MRK INSTITUTE OF TECHNOLOGY

AN AUTONOMOUSINSTITUTION

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

KATTUMANNARKOIL- 608 301, CUDDALORE DISTRICT, TAMILNADU, INDIA

CHOICEBASEDCREDITSYSTEM

Programme: B.Tech., Artificial Intelligence and Data Science **Regulations:**2026

Abbreviations:

HUM –Humanities(Languages, Management,Heritage, and others)

BS–BasicScience(Mathematics,Physics,Chemistry)

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

SD–SkillDevelopment

SL–SelfLearning

CDP–CapstoneDesignProject

OE–OpenElective

L–LaboratoryCourse

T–Theory

LIT–Laboratory IntegratedTheory

PW–Project Work

IPW–InternshipcumProjectWork

DIC–DepartmentIntroductoryCourse

TCP–TotalContactPeriod(s)

Program Outcomes

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyze complex problems using research and sustainability principles.
3. **Design Solutions**: Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations**: Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools**: Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment**: Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics**: Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork**: Work effectively as an individual and in multidisciplinary teams.
9. **Communication**: Communicate clearly in reports,presentations,and documentation across diverse groups.
10. **Management & Finance**: Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning**: Engage in continuous learning, adapt to new technologies, and think critically.

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ProgramSpecificOutcomes:

1. Design, develop, and deploy intelligent systems for real-world applications.
2. Utilize modern tools for innovative solutions in the field of AI and Data Science.
3. Demonstrate research aptitude, implement ethical practices and collaborate in multidisciplinary teams.

Semester – I							
S.No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
3 Weeks Compulsory Induction Program							
1	26ENC01	English for Engineers	T	3-0-0	3	3	HUM
2	26MAC01	Applied Calculus and Matrices	T	3-1-0	4	4	BS
3	26EEC01	Basics Electrical and Electronics Engineering	T	3-0-0	3	3	ES(PC)
4	26CSC01	Programming Language: C	T	3-0-0	3	3	ES(PC)
5	26PHC01	Engineering Physics	LIT	3-0-2	5	4	BS
6	26CYC01	Engineering Chemistry	LIT	3-0-2	5	4	BS
7	26MEC02	Maker space Laboratory	L	0-0-4	4	2	SD
8	26CSC02	Programming in C Laboratory	L	0-0-4	4	2	ES(PC)
9	26HSC02	Physical Education	-	-	-	-	HUM
				Total Credits	**31**	**25**	

Semester – II							
S.No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1	26HSC01	தமிழர் மரபும் தொழில் நுட்பமும் / Tamils Heritage and Technologies	T	1-0-0	1	1	HUM
2	26MAC02	Linear Algebra	T	3-1-0	4	4	BS
3	26PHC02	Physics for Information Science	T	3-0-0	3	3	ES(GE)
4	26GEC01	Environmental Science and Sustainability	T	2-0-0	2	2	ES(G)
5	26CSC03	Problem Solving using Python Programming	LIT	3-0-2	5	4	ES(PC)
6	26CSC04	Object Oriented Programming in C++	LIT	3-0-2	5	4	ES(PC)
7	26ENC02	Communicative English Laboratory	L	0-0-4	4	2	HUM
8		NCC / NSS / NSO/ YRC#1		-	-	-	-
				Total Credits	**24**	**20**	

#1 NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

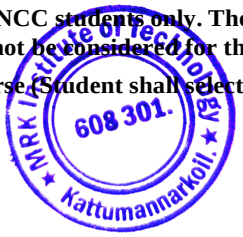
Semester–III							
S.No.	Course Code	CourseName	Course Type	Periods/ Week		Credits	Category
				L-T- P	TCP		
1	26MAC03	Probability and Statistics	T	3-1-0	4	4	BS
2	26CSC05	Digital Principles and Computer Organization	T	3-0-0	3	3	ES(PC)
3	26CSC06	Data Structures using C	T	3-0-0	3	3	ES(PC)
4	26CSC07	Operating Systems	T	3-0-0	3	3	ES(PC)
5	26CSC08	Java Programming	LIT	3-0-2	5	4	ES(PC)
6	26AD301	Exploratory Data Analysis	LIT	3-0-2	5	4	ES (PC)
7	26CSC10	Operating Systems Laboratory	L	0-0-3	3	2	ES(PC)
8	26SDC01	Foundation Aptitude and Verbal ability Skills	-	0-0-2	2	1	SD
9		Mandatory Course - I $	T	1-0-0	1	-	MC
				Total Credits	**29**	**24**	

$ Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC- I)

Semester–IV							
S.No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26MAC07	Discrete Mathematics	T	3-1-0	4	4	BS
2	26CSC11	Database Management Systems	T	3-0-0	3	3	ES(PC)
3	26CSC13	Design and Analysis of Algorithm	T	3-0-0	3	3	ES (PC)
4	26AD402	Artificial Intelligence Essentials and Standards	T	3-0-0	3	3	ES (PC)
5	26AD403	Data Privacy and Security	T	3-0-0	3	3	ES (PC)
6	26CSC09	Foundations of Data Science	LIT	3-0-2	5	4	ES(PC)
7	26CSC17	Database Management Systems Laboratory	L	0-0-3	3	2	ES(PC)
8	26SDC02	Professional and Corporate Communication Skills	L	0-0-2	2	1	SD
9		Mandatory Course - II $	T	1-0-0	1	-	MC
10		NCC / NSS / NSO/ YRC #2	-	-	-	-	-
				Total Credits	**27**	**23**	

#2 NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

$ Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)



Semester–V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1	26CSC15	Computer Network	LIT	3-0-2	5	4	ES(PC)
2	26AMC01	Natural Language Processing	T	3-0-0	3	3	ES (PC)
3	26AD504	Data and Information Security	T	3-0-0	3	3	ES (PC)
4	26ADC05	Machine Learning Techniques	T	3-0-0	3	3	ES (PC)
5		Programme Elective-I	T	3-0-0	3	3	ES (PE)
6		Programme Elective-II	T	3-0-2	3	3	ES (PE)
7	26ADC06	Machine Learning Techniques Laboratory	L	0-0-4	4	2	ES(PC)
8		Mandatory Course - III $	T	1-0-0	1	-	MC
9	26IP501	Summer Internship*	-	-	-	1	IPW
10	26SDC03	Advanced Aptitude and Logical Reasoning Skills	-	0-0-2	2	1	SD
				Total Credits	**27**	**23**	

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

$ Mandatory Course-III is a Non-credit Course (Student shall select one course from the list given under MC-III)

For Honours Degree							
1.		CapstoneDesignProject–Level I	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective–I	T	3-0-0	3	3	
2.		Honours Elective–II	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective–I	T	3-0-0	3	3	
2.		Minor Elective–II	T	3-0-0	3	3	

Semester–VI							
S.No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1	26AD607	Deep Learning Techniques	T	3-0-0	3	3	ES(PC)
2	26CSC19	Full stack Development	T	3-0-0	3	3	ES (PC)
3		Programme Elective – III	T	3-0-0	3	3	ES (PE)
4		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
5		Programme Elective – V	T	3-0-0	3	3	ES (PE)
6		Open Elective -I	T	3-0-0	3	3	ET
7	26AD609	Deep Learning Laboratory	L	0-0-4	4	2	ES (PC)
8	26CSC21	Full Stack Development Laboratory	L	0-0-4	4	2	ES (PC)
9	26SDC04	Technical Interview and Advanced Competitive Examination Skills	---	0-0-2	2	1	SD
10		Mandatory Course - IV $	T	1-0-0	1	-	MC
11		Self-Learning Course	-	-	-	-	SL
12		NCC / NSS / NSO/ YRC #3	-	-	-	-	-
Total Credits					**29**	**23**	

#3 NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

$ Mandatory Course-IV is a Non-credit Course (Student shall select one course from the list given under MC-IV)

For Honours Degree							
1.		Capstone Design Project– Level II	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective–III	T	3-0-0	3	3	
2.		Honours Elective–IV	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective–III	T	3-0-0	3	3	
2.		Minor Elective–IV	T	3-0-0	3	3	

Semester–VII							
S.No.	Course Code	CourseName	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26GEC02	Principles of Management	T	3-0-0	3	3	ES(G)
2		Programme Elective – VI	T	3-0-0	3	3	ES (PE)
		Open Elective -II	T	3-0-0	3	3	ET
3	26AD710	DevOps Engineering	T	3-0-0	3	3	ES(PC)
4	26HSC04	Professional Ethics and Human Values	T	2-0-0	2	2	HUM
5	26IT701	Ethical Hacking and Penetration Testing	LIT	3-0-2	5	4	ES(PC)
6	26SDC05	Professional Employability and Technical Communication Skills	---	0-0-2	2	1	SD
7	26AD701	Mini Project Work	PW	0-0-4	4	2	PW
8		Mandatory Course - V $	T	1-0-0	1	-	MC
9	26IP701	Summer Internship*	-	-	-	1	IPW
				Total Credits	**25**	**22**	

***Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.**

$ Mandatory Course-V is a Non-credit Course (Student shall select one course from the list given under MC- V)

For Honours Degree							
1.		Capstone Design Project-Level III	CDP	0-0-12	12	6	SD
(OR)							
1.		Honours Elective–V	T	3-0-0	3	3	
2.		Honours Elective–VI	T	3-0-0	3	3	
Courses for Minor degree							
1.		Minor Elective–V	T	3-0-0	3	3	
2.		MinorElective–VI	T	3-0-0	3	3	

Semester–VIII							
S. No.	Course Code	CourseName	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD801	Project Work / Internship cum Project Work	PW	0-0-16	16	8	PW
				Total Credits	**16**	**8**	

Total Credits: 168

Programme Electives Courses – Streams

Intelligent Computing	Data Analytics	Robotics	Data Storage & Security	Emerging Technology	IoT & Smart Applications
Reinforcement Learning	Data Curation and Visualization	Robot Operating System	Big Data Frameworks	Quantum Computing	Dynamic Paradigm for IoT
Explainable AI	Stream Data Analytics	Materials Informatics	Cloud Computing	Vibe Coding	Smart IoT Architecture
Computational Neuroscience	Social Network Analytics	Robotics Vision and Sensing	Cyber Security	GPU Programming	Wearable Computing
Generative AI	Bioinformatics	Expert Systems	Cyber Forensics	Real-Time Operating Systems	IoT in 5G Networks
MLOps	Edge AI	Multiagent Systems	Quantum Cryptographic Techniques	Hardware Architectures for AI	IoT and Smart Cities
Deep Reinforcement Learning	Predictive Analytics	Autonomous Robotics	Blockchain and Distributed Ledger Security	Edge Computing	Industrial IoT
Natural Language Understanding	Time Series Analytics	Robot Motion Planning	Network Security and Defense	Digital Twin Technology	IoT Protocols and Standards
Cognitive Computing	Data Mining and Knowledge Discovery	Human-Robot Interaction	Privacy-Preserving Computing	Augmented and Virtual Reality	IoT Edge Intelligence
AI Planning and Reasoning	Data Visualization and Storytelling	Swarm Robotics	Secure Cloud Computing	Neuromorphic Computing	IoT Applications and Services

PROGRAMME ELECTIVE COURSES: VERTICALS

VERTICAL 1: Intelligent Computing

S. No.	Course Code	CourseName	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD101	Reinforcement Learning	T	3-0-0	3	3	ES (PE)
2.	26AD102	Explainable AI	T	3-0-0	3	3	ES (PE)
3.	26AD103	Computational Neuroscience	T	3-0-0	3	3	ES (PE)
4.	26AD104	Generative AI	T	3-0-0	3	3	ES (PE)
5.	26AD105	MLOps	T	3-0-0	3	3	ES (PE)
6.	26AD106	Deep Reinforcement Learning	T	3-0-0	3	3	ES (PE)
7.	26AD107	Natural Language Understanding	T	3-0-0	3	3	ES (PE)
8.	26AD108	Cognitive Computing	T	3-0-0	3	3	ES (PE)
9.	26AD109	AI Planning and Reasoning	T	3-0-0	3	3	ES (PE)

VERTICAL 2: Data Analytics

S. No.	Course Code	Course Name	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD110	Data Curation and Visualization	T	3-0-0	3	3	ES (PE)
2.	26AD111	Stream Data Analytics	T	3-0-0	3	3	ES (PE)
3.	26AD112	Social Network Analytics	T	3-0-0	3	3	ES (PE)
4.	26AD113	Bioinformatics	T	3-0-0	3	3	ES (PE)
5.	26AD114	Edge AI	T	3-0-0	3	3	ES (PE)
6.	26AD115	Predictive Analytics	T	3-0-0	3	3	ES (PE)
7.	26AD116	Time Series Analytics	T	3-0-0	3	3	ES (PE)
8.	26AD117	Data Mining and Knowledge Discovery	T	3-0-0	3	3	ES (PE)
9.	26AD118	Data Visualization and Storytelling	T	3-0-0	3	3	ES (PE)

VERTICAL 3: Robotics

S. No.	Course Code	Course Name	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD119	Robot Operating System	T	3-0-0	3	3	ES (PE)
2.	26AD120	Materials Informatics	T	3-0-0	3	3	ES (PE)
3.	26AD121	Robotics Vision and Sensing	T	3-0-0	3	3	ES (PE)
4.	26AD122	Expert Systems	T	3-0-0	3	3	ES (PE)
5.	26AD123	Multi agent Systems	T	3-0-0	3	3	ES (PE)

6.	26AD124	Autonomous Robotics	T	3-0-0	3	3	ES (PE)
7.	26AD125	Robot Motion Planning	T	3-0-0	3	3	ES (PE)
8.	26AD126	Human-Robot Interaction	T	3-0-0	3	3	ES (PE)
9.	26AD127	Swarm Robotics	T	3-0-0	3	3	ES (PE)

VERTICAL 4: Data Storage and Security

S. No.	Course Code	Course Name	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD128	Big Data Frameworks	T	3-0-0	3	3	ES (PE)
2.	26AD129	Cloud Computing	T	3-0-0	3	3	ES (PE)
3.	26AD130	Cyber Security	T	3-0-0	3	3	ES (PE)
4.	26AD131	Cyber Forensics	T	3-0-0	3	3	ES (PE)
5.	26AD132	Quantum Cryptographic Techniques	T	3-0-0	3	3	ES (PE)
6.	26AD133	Block chain and Distributed Ledger Security	T	3-0-0	3	3	ES (PE)
7.	26AD134	Network Security and Defense	T	3-0-0	3	3	ES (PE)
8.	26AD135	Privacy-Preserving Computing	T	3-0-0	3	3	ES (PE)
9.	26AD136	Secure Cloud Computing	T	3-0-0	3	3	ES (PE)

VERTICAL 5: Emerging Technology

S. No.	Course Code	Course Name	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD137	Quantum Computing	T	3-0-0	3	3	ES (PE)
2.	26AD138	Vibe Coding	T	3-0-0	3	3	ES (PE)
3.	26AD139	GPU Programming	T	3-0-0	3	3	ES (PE)
4.	26AD140	Real-Time Operating Systems	T	3-0-0	3	3	ES (PE)
5.	26AD141	Hardware Architectures for AI	T	3-0-0	3	3	ES (PE)
6.	26AD142	Edge Computing	T	3-0-0	3	3	ES (PE)
7.	26AD143	Digital Twin Technology	T	3-0-0	3	3	ES (PE)
8.	26AD144	Augmented and Virtual Reality	T	3-0-0	3	3	ES (PE)
9.	26AD145	Neuromorphic Computing	T	3-0-0	3	3	ES (PE)

VERTICAL 6: Internet of Things and Smart Applications

S. No.	Course Code	Course Name	Course Type	Periods/ Week		Credits	Category
				L-T-P	TCP		
1.	26AD146	Dynamic Paradigm for IoT	T	3-0-0	3	3	ES (PE)
2.	26AD147	Smart IoT Architecture	T	3-0-0	3	3	ES (PE)
3.	26AD148	Wearable Computing	T	3-0-0	3	3	ES (PE)
4.	26AD149	IoT in 5G Networks	T	3-0-0	3	3	ES (PE)
5.	26AD150	IoT and Smart Cities	T	3-0-0	3	3	ES (PE)
6.	26AD151	Industrial IoT	T	3-0-0	3	3	ES (PE)
7.	26AD152	IoT Protocols and Standards	T	3-0-0	3	3	ES (PE)
8.	26AD153	IoT Edge Intelligence	T	3-0-0	3	3	ES (PE)
9.	26AD154	IoT Applications and Services	T	3-0-0	3	3	ES (PE)

OPEN ELECTIVES
(EMERGING TECHNOLOGIES)

S. No.	Course Code	Course Name	Course Type	Periods /Week		Credits	Category
				L-T- P	TCP		
1	26OE901	AI-Driven Decision Support Systems	T	3-0-0	3	3	OE
2	26OE902	Emerging Technologies for Digital Transformation	T	3-0-0	3	3	OE
3	26OE903	Future Technologies for Intelligent Industries	T	3-0-0	3	3	OE
4	26OE904	Climate Change and Infrastructure Resilience	T	3-0-0	3	3	OE
5	26OE905	Environmental Sustainability and Resource Management	T	3-0-0	3	3	OE
6	26OE906	Green Building Technologies	T	3-0-0	3	3	OE
7	26OE907	Battery Technologies and Management Systems	T	3-0-0	3	3	OE
8	26OE908	Energy Management and Conservation	T	3-0-0	3	3	OE
9	26OE909	Renewable Energy Technologies	T	3-0-0	3	3	OE
10	26OE910	Smart Grid Technologies	T	3-0-0	3	3	OE
11	26OE911	IoT-Enabled Healthcare Technologies	T	3-0-0	3	3	OE
12	26OE912	Wearable Health Technologies	T	3-0-0	3	3	OE
13	26OE913	Biomedical Signal & Image Processing	T	3-0-0	3	3	OE

14	26OE914	Mobile Communication	T	3-0-0	3	3	OE
15	26OE915	Systems on Chip with IoT applications	T	3-0-0	3	3	OE
16	26OE916	Opto Nano Electronics	T	3-0-0	3	3	OE
17	26OE917	Mechatronics and Smart Systems	T	3-0-0	3	3	OE
18	26OE918	Finite Element Analysis for Engineers	T	3-0-0	3	3	OE
19	26OE919	Energy Audit and Energy Management	T	3-0-0	3	3	OE
20	26OE920	Industrial Safety	T	3-0-0	3	3	OE

Mandatory Courses

S.No.	Course Code	Course Title	Course Type	Periods / Week L-T-P	Total Contact Periods	Credits	Category
1	26MCC01	Disaster Management and Safety Awareness	T	3-0-0	3	-	MC
2	26MCC02	Gender Sensitization and Inclusive Society	T	3-0-0	3	-	MC
3	26MCC03	Constitution of India	T	3-0-0	3	-	MC
4	26MCC04	Digital Literacy and Cyber Awareness	T	3-0-0	3	-	MC
5	26MCC05	Research Methodology and Intellectual Property Rights	T	3-0-0	3	-	MC

Semester-wise Credit Distribution

Course Category	Code	I	II	III	IV	V	VI	VII	VIII	Total Credits	% Share
Basic Science	BS	12	4	4	4	–	–	–	–	24	14.29
Humanities	HUM	3	3	–	–	–	–	2	–	8	4.76
Engineering Science (General)	ES(GE)	–	5	–	–	–	–	3	–	8	4.76
Programme Core	PC	8	8	19	18	15	10	7	–	85	50.60
Programme Elective	PE	–	–	–	–	6	9	3	–	18	10.71
Open Elective (Emerging Technology)	ET	–	–	–	–	–	3	3	–	6	3.57
Skill Development	SD	2	–	1	1	1	1	1	–	7	4.17
Internship cum Project Work	IPW	–	–	–	–	1	–	1	–	2	1.19
Project Work	PW	–	–	–	–	–	–	2	8	10	5.95
Self-Learning / Industry-Oriented Course	SL	–	–	–	–	–	–	–	–	0	0.00
Total Credits		**25**	**20**	**24**	**23**	**23**	**23**	**22**	**8**	**168**	**100.00**

SEMESTER-I

26ENC01	English for Engineers	L	T	P	C
		3	0	0	3

Course Objectives:

- Develop vocabulary and grammatical competence by strengthening students' knowledge and appropriate usage in different contexts.
- Facilitate reading and comprehension skills through the effective use in academic and professional texts. Improve oral communication and presentation skills to strengthen content and context.
- Enhance effective listening skills by familiarizing students with different accents, dialects, varieties of English.
- Enable students to write professional correspondence and ethical writing practices.

Unit I	Vocabulary and Grammar	9

Academic Word List (AWL) - Foreign Words - Semantics - synonyms, antonyms, one-word substitution - Phrasal verbs - Phrases and idioms - Misspelt words; Parts of Speech - Subject-verb agreement - Tenses - Articles - Voices - Reported speech – Modals- Sentence structure

Suggested Activities: Gap fills exercises, Cloze Test, Error Detection and Spell Bee.

Unit II	Reading and Comprehension	9

4 Types of Reading Techniques - Scanning, Skimming, Intensive reading, Extensive reading - Fiction and Non-fiction texts - Difference, features, strategies, comprehension - Strategies for reading general and professional content - Identifying transitions in a text - Note making - Interpreting charts and data; Academic reading - PQRST, SQ3R - Critical reading - Effective use of resources - Index, table of contents and glossary

Suggested Activities: Reading - newspaper and digital articles, Reading comprehension, note making and summarizing.

Unit III	Speaking	9

Importance of oral communication - Phonetics - Pronunciation, Stress and Intonation; Speaking in different contexts - verbal and non-verbal behavior; Presentation Skills - Types of Presentations - informative, persuasive, business - effective slide presentation - delivering a presentation; Classroom participation – Group Discussions, Debates, Group activities

Suggested Activities: Just a Minute (JAM) Video recording, Situational role plays, Usage of Apps.

Unit IV	Listening	9

Listening - Types - Purpose - Barriers - Strategies for effective listening in various contexts - Note-taking as a tool for effective listening - Dialects, accents, and slang - Dialectical Varieties - English in India,

Suggested Activities: Listening and Repeating, Note-taking

Unit V	Writing	9

Importance of written communication - Letter writing and e-mail - Reporting/Reports - Introduction to abstracts and articles - Difference between abstract and executive summary; Summarizing - Paraphrasing - Synthesizing - Editing and Proofreading - Plagiarism - Referencing online and offline resources.

Suggested Activities: Picture and poster description, Brainstorming and Mind Mapping.

Total : 45 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).
Text Books:
1. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, New Delhi, 2022. 2. M. Ashraf Rizvi, Effective Technical Communication, 2nd Edition, McGraw Hill Education, New Delhi,2018.

References:
1.Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan, Chennai, 2006. 2.Nitin Bhatnagar and Mamta Bhatnagar, Communicative English for Engineers and Professionals. 3. Pearson Education, 2010. Board of Editors, Vibrant English, Orient Blackswan, Chennai, 2013. 4. William Strunk Jr. & E.B. White, The Elements of Style, 4th Edition, Pearson, 1999. 5. David F. Beer and David McMurrey, Guide to Writing as an Engineer, 5th Edition, John Wiley, New York, 2021.
E-resources:
1. https://learnenglish.britishcouncil.org/ 2. https://www.bbc.co.uk/learningenglish 3. https://learnenglish.britishcouncil.org/skills/speaking 4. https://learnenglish.britishcouncil.org/skills/listening https://owl.purdue.edu/

CO	CO Description	PO	PSO
CO1	Apply appropriate vocabulary and grammatical structures accurately and effectively in academic, professional, and everyday communication.	PO7(2) PO9(3)	PSO2(1) PSO3(2)
CO2	Employ suitable reading strategies to comprehend, analyze,interpret, and critically evaluate general, academic, and professional texts.	PO2(3) PO9(3)	PSO2(1) PSO3(2)
CO3	Demonstrate effective speaking and presentation skills with appropriate pronunciation, stress intonation in individual and group settings.	PO8(3)	PSO1(1) PSO2(1) PSO3(3)
CO4	Demonstrate effective listening skills by identifying key information, understanding different accents and varieties of English.	PO2(2) PO6(1)	PSO2(1) PSO3(2)
CO5	Produce clear, coherent, and professionally appropriate written documents.	PO10(2) PO11(3)	PSO1(1) PSO2(1) PSO3(2)

(1) = Low; (2) = Medium; (3) = High

26MAC01	Applied Calculus and Matrices	L	T	P	C
		3	1	0	4

Course Objectives:

- To provide technical competence of modelling engineering problems using calculus.
- To apply the calculus concepts in solving engineering problems using analytical methods and computational tools.

Unit I	Differential Calculus	12

Functions, graph of functions, Limit of a function, Continuity, Limits at infinity, Derivative as a function, Maxima and Minima of functions of single variable, Mean value theorem.

Suggested Activities: Visualization of the functions, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Unit II	Functions of Several Variables	12

Partial derivatives, Total derivative, Taylor's series formula for functions of two variables, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers.

Suggested Activities: Partial Derivatives with two or three variables, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Unit III	Integral Calculus	12

Fundamental theorem of Calculus, Indefinite integrals and Improper integrals, Evaluation of double integrals, Change of order of integration, Evaluation of triple integrals.

Suggested Activities: Definite and Indefinite Integrals, Determination of double and triple integrals, Solving of Competitive Examination questions (Ex. GATE).

Unit IV	Matrices	12

Eigen values and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigen vectors (without proof) Cayley–Hamilton Theorem, Applications of Cayley–Hamilton Theorem.

Suggested Activities: Compute Eigen values and Eigen vectors, verify the Cayley–Hamilton theorem, and perform matrix computations using open-source software..

Unit V	Orthogonal Transformations and Quadratic Forms	12

Diagonalization of matrices by orthogonal transformation – Quadratic forms – Reduction of a quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

Suggested Activities: Perform orthogonal diagonalization, reduce quadratic forms to canonical form, determine the nature of quadratic forms, and visualize quadratic forms using open-source software

Total : 60 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).

Text Books:

1. Grewal, B. S. (2025). Higher Engineering Mathematics (45th Ed.). Khanna Publishers, New Delhi. .
2. Ramana, B. V. (2024). Higher Engineering Mathematics. McGraw Hill Education (India) Private Limited.

References:

1. Anton, H., Bivens, I. C., & Davis, S. (2021). Calculus: Early transcendentals. John Wiley & Sons.
2. Waner, S., & Costenoble, S. (2024). Applied Calculus (8th Edition). Cengage Learning.
3. Stroud, K. A., & Booth, D. J. (2020). Engineering Mathematics (8th Edition). Red Globe Press.
4. Thomas, G. B., Jr., Weir, M. D., Hass, J., & Heil, C. (2022). Thomas' Calculus: Early Transcendentals (15th Edition). Pearson.
5. Anton, H., Rorres, C., & Kaul, A. (2021). Elementary Linear Algebra: Applications Version (12th Edition). John Wiley & Sons.

E-resources:

1. https://onlinecourses.nptel.ac.in/noc17_hs04
2. https://math.libretexts.org/Bookshelves/Calculus/Map%3A_Calculus___Early_Trans cendentals_(Stewart)/
3. https://openstax.org/books/calculus-volume-1/

CO	CO Description	PO	PSO
CO1	Apply the concepts of limits, continuity and derivatives to analyze functions and solve optimization problems.	PO1(3) PO2(2)	PSO1(2) PSO2(1)
CO2	Analyze functions of several variables using partial derivatives,Taylor's formula and optimization techniques.	PO1(3) PO2(3)	PSO1(2) PSO2(2)
CO3	Apply integration techniques to evaluate single, double and triple integrals.	PO1(3) PO2(2)	PSO1(2) PSO2(1)
CO4	Determine eigenvalues and eigenvectors of matrices and apply the Cayley–Hamilton theorem to solve matrix problems.	PO1(3) PO2(2)	PSO1(2) PSO2(2)
CO5	Analyze matrices and quadratic forms using orthogonal transformations and determine the nature of quadratic forms.	PO1(3) PO2(3) PO5(2)	PSO1(2) PSO2(2) PSO3(1)

(1) = Low; (2) = Medium; (3) = High

26EEC01	Basic Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart foundational knowledge in principles and applications of electrical and electronics engineering.

Unit I	DC Fundamentals	9

Current and Voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Series parallel combination of R, L and C components, Voltage Divider and Current Divider Rules.

Suggested Activities: Virtual Demonstration of electrical laws & circuits, Hands-on Bread boarding, Solving GATE questions.

Unit II	AC Fundamentals	9

Faraday's Laws of Electro-magnetic Induction, Definition of Self and Mutual Inductances, Generation of sinusoidal voltage, Instantaneous & RMS values of sinusoidal signals, Introduction to 3-phase systems, Electrical Safety, Fuses and Earthing.

Suggested Activities: Virtual Demonstration of electromagnetic induction, Measurement of instantaneous and RMS values of AC signals, Solving GATE questions.

Unit III	Electric Machines	9

DC Machines, Transformers, Star and delta Connections, Three phase Induction motors, Synchronous Generators, Single Phase Induction Motors, Stepper Motor, Universal Motor and BLDC motor.

Suggested Activities: Virtual demonstration of step-up and step-down transformers, Virtual working models of Universal and BLDC motors, Solving GATE questions.

Unit IV	Analog and Digital Electronics	9

Semiconductor Devices: PN junction diodes, Zener Diode, Voltage regulator, BJT & FET Transistors, Timers, Operational Amplifiers.Digital Electronics: Boolean algebra, Basic and Universal Gates, adders, multiplexers, de-multiplexers and flip-flops.

Suggested Activities: Virtual demonstration of V-I characteristics of PN junction and Zener diodes using simulation, inverting/non-inverting amplifiers, Online logic gate simulators, Solving GATE questions.

Unit V	Microcontrollers	9

Microcontrollers: Introduction, Architecture, Memory organization, I/O ports, timer, Serial port, Interrupt, Comparison of family 8051, Potential Applications.

Suggested Activities: Physical demonstration of a microcontroller and online simulation of microcontroller.

Total : 45 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%)

Text Books:

1. A textbook of electrical technology, Theraja, B. L. S.Chand & Company,24th edition,2024.
2. Basic Electrical and Electronics Engineering ,D.P. Kothari and I.J. Nagrath, Tata McGraw Hill Education, 2nd edition, 2020.

References:

1. A Textbook of Applied Electronics ,R.S. Sedha, S. Chand & Co. 3 rd edition,2008.
2. Thomas L. Floyd ,Digital Fundamentals , Pearson Education,11 th edition,2025.
3. The 8051 Microcontroller and Embedded Systems ,Muhammad Ali Mazidi, 2 nd edition,2007
4. Basic Electrical and Electronics Engineering by S.K. Bhattacharya published by Pearson India Second Edition published in July 2017.
5. Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku is published by McGraw-Hill Education in 2021.

E-resources:

1. https://archive.nptel.ac.in/courses/108/106/108106172/
2. Circuit Simulator – https://www.falstad.com/circuit/

CO	CO Description	PO	PSO
CO1	Learnt the fundamentals of DC Circuits	PO1(3)	PSO1(3)
CO2	Apply basic and AC circuits calculations in electrical systems.	PO1(3)	PSO1(3)
CO3	Understand the concepts of electrical machines.	PO1(3)	PSO1(3)
CO4	Explain the basic electronics engineering concepts.	PO1(3)	PSO1(3)
CO5	Understand the underlying mechanisms behind the microcontrollers	PO1(3)	PSO1(3)

(1) = Low; (2) = Medium; (3) = CC

26CSC01	Programming Language: C	L	T	P	C
		3	0	0	3

Course Objectives:

- To equip engineering students with the foundational knowledge and practical skills in 'C' programming to analyses and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

Unit I	Introduction to C & Problem Solving	9

Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudo code, program structure, Compilation & Execution process, Interactive and Script mode, Comments, Indentation, Error messages, Primitive data types, Constants, Variables,Reserved words, Operators, Input/output Functions, Built-in Functions.

Suggested Activities:

Solve GATE-style MCQs on algorithms, flowcharts, pseudocode, Interactive and Script mode, Comments, Indentation.

Practice GATE-style questions on data types, variables, operators, input/output, built-in functions, indentation,and error identification.

Unit II	Control Structures & Functions	9

If, if-else, nested if, switch-case, while, do-while, for, nested loops, Jump statements. Function Declaration, Definition and Calling, Function Parameters and Return Types, Call by Value and Call by Reference, Recursive Functions, Scope and Lifetime of Variables, Header files and Modular Programming.

Suggested Activities:

Solve GATE-style MCQs on if, if-else, nested if, switch-case, loops, nested loops, and jump statements with output prediction.

Practice GATE-style questions on parameters, return types, recursion, scope, lifetime and call by value/reference.

Unit III	Arrays, Strings & Pointers	9

One-dimensional and Multi-dimensional Arrays, Array operations and traversals, String Handling: String declaration, input/output, string library functions, Pointer arithmetic, Pointers and Arrays, Pointers to function, Dynamic memory allocation.

Suggested Activities:

Solve GATE-style MCQs on one-dimensional and multi-dimensional arrays, array operations, traversals, and string handling with output prediction.

Practice GATE-style questions on pointer arithmetic, pointers and arrays function pointers, and dynamic memory allocation.

Unit IV	Structures & Unions	9

Defining and using structures, Array of structures, Sorting an array of structures, Difference between structures and unions, Pointers to structures, Unions and their uses, Unions with pointers, Enumerations.

Suggested Activities:

Analyze GATE-style MCQs on structures, arrays of structures, sorting, and pointers to structures.

Attempt GATE-style questions on structures vs. unions, unions with pointers, their applications, and enumerations.

Unit V	File operations & Standard Libraries	9

Open, read, write, close file operations, Binary vs Text files, File pointers, Error handling in file operations.Using standard libraries like stdio.h, stdlib.h, string.h, math.h, Creating and using user-defined header files and libraries.

Suggested Activities:

Interpret GATE-style MCQs on file operations, text and binary files, file pointers, and error handling.

Evaluate GATE-style questions on standard libraries, user-defined header files, libraries, and their

applications.

Total : 45 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).

Text Books:

1. Thareja, R. (2021). Programming in C. Oxford University Press.
2. Balagurusamy, E. (2024). Programming in ANSI C (9th Edition). Tata McGraw Hill.

References:

1. Kanetkar, Y. (2020). Let us C. BPB Publications.
2. Kalicharan, N. (2022). Learn to program with C: An introduction to programming using the C language. A press.
3. Forouzan, B. A., & Afyouni, H. (2023). Computer science: A structured programming approach in C (4th ed.). Cengage.
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

E-resources:

1. Learn-C.org - https://www.learn-c.org/
2. Geeks for Geeks - C Programming - https://www.geeksforgeeks.org/c-programming-language/
3. GNU C Library Documentation https://www.gnu.org/software/libc/manual/"Introduction to C Programming",Swayam MOOC Course,

CO	CO Description	PO	PSO
CO1	Develop algorithms, flowcharts, and basic C programs for problem solving.	PO1 (3) PO2 (2)	PSO1 (3)
CO2	Implement control structures, functions, and modular programming in C.	PO2 (3) PO5 (2)	PSO1 (3)
CO3	Apply arrays, strings, pointers, and dynamic memory allocation in C programming.	PO2 (2) PO3 (3) PO5 (2)	PSO1 (3) PSO2 (2)
CO4	Construct C programs using structures and unions.	PO3 (3) PO5 (3)	PSO1 (3) PSO2 (3)
CO5	Develop C applications using file handling techniques, standard libraries, user-defined libraries and mini projects.	PO3 (3) PO5 (3) PO9 (2)	PSO1 (3) PSO2 (3)

(1) = Low; (2) = Medium; (3) = High

26PHC01	Engineering Physics	L	T	P	C
		3	0	2	4

Course Objectives:

- To impart essential physics concepts and demonstrate their relevance to diverse engineering applications.

Unit I	Fundamental & Properties of Matter	6

Concept – Force, Mass & Weight, Velocity & Acceleration, Momentum & Impulse, Elasticity – Cantilever-Young's modulus (non-uniform bending), Viscosity- Stokes method - Surface tension - Drop weight method –bimetallic Strip-Thermal Stress-Expansion joints and examples

Suggested Activities: Virtual demonstration of thermal stress.

Unit II	Thermodynamics	6

Thermal conductivity – Modes of heat transfer- Conductivity of bad conductor Lee's disc method – Conductivity of good conductor Forb's Method-Conductivity of semiconductor- laws of Thermodynamics – Entropy- Carnot's cycle as heat engine and refrigerator.

Suggested Activities: Virtual demonstration of four stoke engine

Unit III	Optics	6

Fiber Optics: Structure of fiber, fiber optics, communication fiber sensor, Displacement sensor, and pressure sensor & temperature sensor- Interference: constructive and destructive interference -Air Wedge-Determination of thin wire. Michelson's Interferometer - Determination of thin film

Suggested Activities: Demonstration of optical fiber communication and study of fiber optic sensors

Unit IV	Quantum Physics	6

Concept – DE Broglie wave equation – Dual nature of mater waves - Properties of mater waves, Schrodinger. Time dependent wave equation and Time independent wave equation, Particle in one dimensional box, Photo electric effect. -Experimental verification of photo electric effect.

Suggested Activities: Demonstration and analysis of the photoelectric effect and quantum phenomena

Unit V	Laser and its Application	6

Properties- Einstein Co-Efficient A and B, Ratio of stimulated and spontaneous emission construction, working. Solid laser (Nd-YAG Laser), Gas laser (CO_2), Dye laser, Diode laser (hetero junction and homo junction laser)- Advantage industrial and medical application.

Suggested Activities: Demonstration of laser characteristics and study of industrial and medical applications of lasers.

TOTAL (Theory): 30 PERIODS

List of Experiments:

1.Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia.

2.Non-uniform bending - Determination of Young's modulus.

3.Uniform bending –Determination of young's modulus.

4.Determination of band gap of semiconductor using post office box.

5.Air wedge - Determination of thickness of a thin sheet/wire.

6.Photoelectric effect-verification of electron flow.

7.Laser- Determination of the wavelength of the laser using grating.

TOTAL (Lab.): 15 PERIODS

TOTAL: 45 PERIODS

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Assignments (10%), Quiz (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%).
Text Books:
1. M. N. Avadhanulu and P. G. Kshirsagar, A Textbook of Engineering Physics, 11th Edition, 2019, S.Chand Publishing, New Delhi. 2. R. K. Gaur and S. L. Gupta, Engineering Physics, 8th Edition, 2017, Dhanpat Rai Publications, New Delhi.
References:
1. A. K. Sawhney and Puneet Sawhney, A Course in Mechanical Measurements and Instrumentation, Dhanpat Rai & Co., New Delhi. 2. A. Ghatak and K. Thyagarajan, Optical Electronics and Fibre Optics, Cambridge University Press, Cambridge. 3. Arthur Beiser, Concepts of Modern Physics, 6th Edition, McGraw-Hill Education, New Delhi. 4. S. O. Pillai, Solid State Physics, New Age International Publishers, New Delhi. 5. K. R. Nambiar, Lasers: Principles, Types and Applications, New Age International Publishers, New Delhi.
E-resources:
1.Barrier penetration problem and Quantum tunnelling: https://archive.nptel.ac.in/courses/115/104/115104096/ 2.EM waves and wireless channelling: https://onlinecourses.nptel.ac.in/noc24_ee31/preview 3.Bimetallic Strips _ https://www.youtube.com/watch?v=WZQ8lvxdzDk 4.Cell phone Reception_ https://www.youtube.com/watch?v=1JZG9x_VOwA 5. Dipole Antenna_ https://www.youtube.com/watch?v=4xF1Fq2wB1I

CO	CO Description	PO	PSO
CO1	Explain the fundamental principles of mechanics and the physical properties of materials.	PO1(3), PO2(2), PO3(1).	PSO1 (3)
CO2	Describe the basic concepts of thermodynamics, thermal conductivity and the Carnot cycle.	PO1(3), PO2(2), PO3(2)	PSO1 (3)
CO3	Apply the concepts of fiber optics and optical sensors in engineering applications and analyze interference phenomena.	PO1(3), PO2(3), PO4(2)	PSO1 (3)
CO4	Understand the basic principles of quantum mechanics and relate them to modern technological applications.	PO1(3), PO2(3), PO3(2)	PSO1 (3)
CO5	Analyze the operating principles of lasers and identify their applications in science and engineering.	PO1(3), PO2(2),	PSO1 (3)

(1) = Low; (2) = Medium; (3) = High

26CYC01	Engineering Chemistry	L	T	P	C
		3	0	2	4

Course Objectives:

- Understand the fundamental principles and technological requirements of water treatment.
- Acquire knowledge of the basics of polymers, including their preparation, properties, and applications.
- Gain familiarity with renewable and non-renewable energy resources and various energy storage devices used in engineering applications.
- Understand the mechanisms of metal corrosion and the methods used for its prevention and protection in engineering applications.
- Develop an understanding of nanomaterials, their properties, and their applications.

Unit I	Water Technology	9

Introduction-sources and impurities in water-soft and hard water- water quality parameters. Types of hardness. Determination of hardness by EDTA method. Domestic water treatment. Boiler feed water – requisites, scale and sludge formation in boilers-caustic embrittlement- boiler corrosion- treatment of boiler feed water. Internal conditioning (carbonate, phosphate, and calgon conditioning), external conditioning – ion exchange process, zeolite process Brackish water –water purification by reverse osmosis.

Suggested Activities: Coagulation of water sample using Alum.

Unit II	Polymer Chemistry	9

Introduction - occurrence, definitions – functionality - degree of polymerization-, molecular weight - number and weight average method. Types of polymerizations - addition, condensation and copolymerization.Mechanism of polymerization (Free radical). Preparation, properties and applications of nylon 66, Poly Urethane, poly isoprene and Vulcanization of rubber, TEFLON, PET.

Suggested Activities: Preparation of Biodegradable Polymer/Polymer Demonstration.

Unit III	Energy Resources and Storage Devices	9

Nonrenewable energy - nuclear energy, nuclear reaction and its types; Nuclear power plant and its working (light water nuclear power plant & breeder reactor).Renewable energy and its sources - photo voltaic cells-working of photovoltaic cell, recent advances in solar cell materials; Geothermal Energy and Different type of geothermal power plants Batteries and fuel cells: types of batteries - lead storage battery, lithium battery, fuel cell - H_2-O_2 fuel cell-applications.

Suggested Activities: Performance Study of a Solar Cell.

Unit IV	Corrosion and its Control	9

Introduction, types of corrosion - chemical and electrochemical corrosion, mechanism, pilling - bedworth rule, types of electrochemical corrosion – galvanic corrosion, pitting corrosion, crevice corrosion, corrosion on wire fence and pipeline corrosion, factors influencing rate of corrosion. Corrosion control methods – sacrificial anode and impressed cathodic current. Protective coatings – paints: constituents and functions.

Suggested Activities: Demonstration of Corrosion and Its Prevention

Unit V	Nano Chemistry	9

Basics- distinction between molecules, nanoparticles and bulk materials; size dependent properties. Nanoparticles: nanocluster, nanorod, nanotube (CNT) and nanowires. Synthesis: Top down process-chemical vapour deposition, electro deposition. Electro spinning method. Bottom up process-precipitation, sol-gel, solvothermal -properties and applications of nanomaterials in Various fields.

Suggested Activities: Synthesis/Demonstration of Nanomaterials

Total : 45 Periods

List of Experiments:

1. Determination of Total, Temporary and Permanent hardness of water by EDTA Method.
2. Estimation of Alkalinity in water sample.
3. Determination of HCl using NaOH by pH metry.
4. Estimation of Ferrous iron by Potentiometric titration.
5. Estimation of HCl using NaOH by Conduct metric titration.
6. Estimation of Dissolved Oxygen content in water by Winkler's method.
7. Determination of Chloride in water by Argentometric method.
8. Estimation of copper content of the given solution by Iodometry.
9. Estimation of TDS of a water sample by gravimetric.
10. Determination of strength of acids in a mixture of acids using conductivity meter.

Total : 30 Periods

Total: 75 Periods

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Assignments (10%), Quiz (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%).

Text Books:

1. Dr.S.Mageswari, Dr.K.Balachandran, Dr.G.Vijayakumar, "Engineering Chemistry" Tata Mc Graw Hill Pvt. Ltd., First Edition-2024.
2. O.G.Palanna, "Engineering Chemistry" Tata Mc Graw Hill Pvt. Ltd., Second Edition -2017

References:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel'sTextbook of Quantitative Chemical Analysis (2009).
2. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company Pvt. Ltd., 2018.
3. Arun Bahl, B.S. Bahl, G.D. Tuli, "Essentials of Physical Chemistry" Published by S. Chand & Company Ltd., 2014
3. Sashi Chawla, Dhanpat Rai & Co. Pvt. Ltd., "Engineering Chemistry" Fifth Edition - 2017.
4. Dr.S.Vairam, Dr.Suba Ramesh, "Engineering Chemistry" First Edition, Wiley Publication, Reprint-2016.

E-resources:

1. https://nptel.ac.in/courses/
2. https://swayam.gov.in/
3. https://www.chemguide.co.uk/

CO	CO Description	PO	PSO
CO1	Explain the principles of water technology, water treatment methods, and boiler feed water conditioning for industrial applications.	PO3(3)	PSO1(2)
CO2	Apply the concepts of polymer chemistry to classify polymers and relate their preparation, properties, and engineering applications.	PO3(3), PO6(2)	PSO2(3)
CO3	Analyze renewable and non-renewable energy resources, energy storage devices, and fuel cells for sustainable energy applications.	PO6(3)	PSO1(3)
CO4	Analyze the mechanisms of corrosion and suitable corrosion prevention and protective techniques for engineering systems.	PO2(2), PO3(2), PO6(2)	PSO2(3)
CO5	Evaluate the synthesis methods, properties, and applications of nanomaterials in medical and electronic devices.	PO2(3)	PSO1(3) PSO2(2)

(1) = Low; (2) = Medium; (3) = High

26MEC02	Makerspace Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

- To impart practical skills in the assembly, disassembly, and welding of components using appropriate tools and techniques.
- To provide hands-on training in electrical wiring practices, and the use of electronic components, sensors, and actuators.

List of Suggested Activities

(A) Dis-assembly & Assembly Practices

i. Tools and its handling techniques.
ii. Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.
iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.
iv. Dis-assembly and assembly of a Bicycle.

(B) Welding Practices

i. Welding Procedure, Selection & Safety Measures.
ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.
iii. Hands-on session of preparing base material & Joint groove for welding.
iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Steel plates / pipes, for fabrication of a simple part.

(C) Electrical Wiring Practices

i. Electrical Installation tools, equipment & safety measures.
ii. Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box.
iii. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.
iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(D) Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.
ii. Dis-assembly and assembly of Computers.
iii. Hands-on session of Soldering Practices in a Printed Circuit Board.
iv. Hands-on session of Bridge Rectifier, Op-Amp and Trans impedance amplifier.
v. Hands-on session of integration of sensors and actuators with a Microcontroller.
vi. Demonstration of Programmable Logic Control Circuit.

(E) Contemporary Systems

i. Demonstration of Solid Modelling of components.
ii. Demonstration of Assembly Modelling of components.
iii. Fabrication of simple components/ parts using 3D Printers. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

TOTAL : 60 PERIODS

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Observation and Record (20%), Practical (30%), Internal Examinations (50%)

Text Books:

1. S. K. Hajra Choudhury, A. K. Hajra Choudhury and S. K. Bhattacharya, Elements of Workshop Technology – Volume I: Manufacturing Processes, 17th Revised & Enlarged Edition, Media Promoters & Publishers, Mumbai.
2.R. S. Khurmi and J. K. Gupta, A Textbook of Workshop Technology – Manufacturing Processes, 16th Edition, 2019. S. Chand Publishing, New Delhi.

References:

1. P. N. Rao, Manufacturing Technology: Foundry, Forming and Welding, 4th Edition, McGraw Hill Education, New Delhi.
2. S. Kalpakjian and S. R. Schmid, Manufacturing Engineering and Technology, 7th Edition, Pearson Education, New Delhi.
3.B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology – Volume I, S. Chand Publishing, New Delhi.
4.David P. Leach, Electrical and Electronic Technology, McGraw Hill Education, New Delhi.
5.Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, New Delhi.

E-resources:

1.Additive Manufacturing](https://www.nptel.ac.in/courses/112103306
2.https://elearn.nptel.ac.in/shop/iit-workshops/completed/additive-manufacturing-technologies-for-practicing-engineers
3. https://www.autodesk.com/learn/ondemand/collection/intro-to-cad

CO	CO Description	PO	PSO
CO1	Demonstrate proper use and handling of tools and perform disassembly and assembly of mechanical systems, home appliances and bicycles.	PO1(3), PO5(3), PO8(2).	PSO1(3)
CO2	Perform welding and fabrication of simple components using suitable welding processes, materials, tools and safety practices.	PO1(3), PO3(3), PO5(3), PO7(3).	PSO1(3), PSO2(3)
CO3	Carry out basic electrical wiring and connections for domestic and industrial applications using appropriate electrical equipment and safety procedures.	PO1(3), PO5(3), PO7(3).	PSO2(2), PSO3(2)
CO4	Demonstrate electronic assembly, soldering, circuit implementation and integration of sensors, actuators and microcontrollers for practical applications.	PO1(3), PO2(3), PO5(3), PO8(3), PO11(3).	PSO2(3), PSO3(3)
CO5	Apply contemporary engineering tools for solid and assembly modelling, 3D printing and laser cutting to develop simple components.	PO3(3), PO5(3), PO11(3).	PSO1(3), PSO2(3), PSO3(2)

(1) = Low; (2) = Medium; (3) = High

26CSC02	Programming in C Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

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

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. Create Problem Analysis Charts, Flowcharts and Pseudo code for simple C programs
2. I/O statements, operators, expressions.
3. Decision-making constructs: if-else, go to, switch-case, break-continue.
4. Loops: for, while, do-while.
5. Arrays: 1D and 2D, Multi-dimensional arrays, traversal.
6. Strings: operations.
7. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
8. Recursion.
9. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
10. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
11. Files: reading and writing data in text and binary files, File pointers, file operations, random access and processor directives.
12. Use of standard and user-defined libraries in solving problems.

TOTAL : 60 PERIODS

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Observation and Record (20%), Practical (30%), Internal Examinations (50%)

Text Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall.
2. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, New Delhi.

References:

1.Thareja, R. (2021). Programming in C . Oxford University Press.
2.Balagurusamy, E. (2019). Programming in ANSI C. McGraw Hill Education.
3.Kanetkar, Y. (2020). Let us C. BPB Publications.
4.Kalicharan, N. (2022). Learn to program with C: An introduction to programming using the C language. Apress.
5. Forouzan, B. A., & Afyouni, H. (2023). Computer science: A structured programming approach in C (4th Edition). Cengage.

E-resources:
1. Learn-C.org - https://www.learn-c.org/ 2. Geeks for Geeks - C Programming - https://www.geeksforgeeks.org/c-programming-language/ 3. GNU C Library Documentation - https://www.gnu.org/software/libc/manual/ 4. "Introduction to C Programming", Swayam MOOC Course, https://onlinecourses.swayam2.ac.in /imb25_mg71/

CO	CO Description	PO	PSO
CO1	Develop algorithms, flowcharts, and basic C programs for problem solving.	PO1 (3) PO2 (2)	PSO1 (3)
CO2	Implement control structures, functions, and modular programming in C.	PO2 (3) PO5 (2)	PSO1 (3)
CO3	Apply arrays, strings, pointers, and dynamic memory allocation in C programming.	PO2 (2) PO3 (3) PO5 (2)	PSO1 (3) PSO2 (2)
CO4	Construct C programs using structures and unions.	PO3 (3) PO5 (3)	PSO1 (3) PSO2 (3)
CO5	Develop C applications using file handling techniques, standard libraries, user-defined libraries and mini projects.	PO3 (3) PO5 (3) PO9 (2)	PSO1 (3) PSO2 (3)

(1) = Low; (2) = Medium; (3) = High

26HSC02	**Physical Education**	L	T	P	C
		-	-	-	-

Course Objectives:

- To impart the fundamentals of physical education for the development of students' physical, mental, and social well-being.
- To instil a lifelong appreciation for physical activity, develop a positive attitude, and foster the values of teamwork and sportsmanship.

Introduction to physical education: Exercise for good posture – conditioning and calisthenics before starting physical activities – jogging, bending, twisting, standing, sitting, and relaxation exercises – training in basic first-aid practices.

Participation of athletic events: Rules and regulations of important athletic events – sprints, jumps, throws, and hurdles.

Skill development in any one of the following outdoor games: Basket Ball, Volley Ball, Ball Badminton, Football, Hockey, Kho-Kho, Kabaddi, Cricket, Hand ball and Tennis.

Skill development in any one of the following indoor games: Shuttle Badminton, Chess and Table Tennis.

TOTAL: 30 PERIODS

References:

1. Ajmer Singh, Essentials of physical education. Kalyani Publishers, 7th Revised Edition, 2025.
2. Kamlesh,M.L.(2006).Psychology in physical education and sport(3rd Edition). Metropolitan Book Co.
3. S.K. Mangal & Shubhra Mangal: Sports Psychology: Concepts and Applications, 1st Edition, "Psychology of Sports Performance" 2024, Routledge India.

E-resources:

1. https://www.who.int/health-topics/physical-activity

CO	CO Description	PO	PSO
CO1	Demonstrate appropriate physical exercises, conditioning, calisthenics, posture, relaxation techniques and basic first-aid practices for maintaining physical fitness and safety.	PO1(2), PO4(2), PO7(3)	PSO3(2)
CO2	Demonstrate knowledge of rules and regulations and apply fundamental skills in athletic events including sprints, jumps, throws and hurdles.	PO7(2), PO8(3)	PSO3(2)
CO3	Develop and demonstrate fundamental skills, techniques and game strategies in a selected outdoor game through regular practice and teamwork.	PO2(2), PO3(2), PO5(2), PO7(2), PO8(3)	PSO3(3)
CO4	Develop and demonstrate fundamental skills, techniques and strategies in a selected indoor game with emphasis on concentration, discipline and fair play.	PO2(2) PO7(3), PO9(2)	PSO3(2)
CO5	Apply physical fitness, sports skills, teamwork, discipline, ethical values and safety practices to promote a healthy and active lifestyle.	PO6(3), PO7(3), PO8(3) PO11(3)	PSO3(3)

(1) = Low; (2) = Medium; (3) = High

SEMESTER-II

26HSC01	தமிழர் மரபும் தொழில் நுட்பமும்	L	T	P	C
		1	0	0	1

Course Objectives:

- தமிழ்மொழி, திராவிட மொழிகள், சங்க இலக்கியம் மற்றும் தமிழர்களின் பண்பாட்டு மரபுகளை அறிந்து விளக்குதல்.
- தமிழர்களின் நாட்டுப்புறக் கலைகள், விளையாட்டுகள், தெய்வ வழிபாடு மற்றும் கைவினை மரபுகளை அறிந்து அவற்றின் முக்கியத்துவத்தை விளக்குதல்.
- தமிழர்களின் பாரம்பரிய கட்டிடக்கலை, சிற்பக்கலை மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிந்து அவற்றின் சிறப்புகளை விளக்குதல்.
- பண்டைய தமிழர்களின் கப்பல் கட்டுதல், உலோகத் தொழில்நுட்பம், மணிகள் தயாரித்தல் மற்றும் வாணிபத் தொழில்நுட்பங்களை அறிந்து விளக்குதல்.
- தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள், கால்நடைப் பராமரிப்பு மற்றும் கடல்சார் அறிவியல் தொழில்நுட்பங்களை அறிந்து அவற்றின் முக்கியத்துவத்தை விளக்குதல்.

அலகு I	**மொழி மற்றும் இலக்கிய மரபுகள்**	**3**

இந்திய மொழிக் குடும்பங்கள், திராவிட மொழி வகைகள், முத்தமிழ் வரலாறு, சங்க இலக்கியத்தில் அறச்சிந்தனைகள், சங்க இலக்கியமும் பண்பாட்டு மரபுகளும், தமிழ் ஒரு செம்மொழி, திருக்குறளில் மேலாண்மைக் கருத்துகள், சங்ககாலத்தில் கல்வி, சங்ககால நகரங்களும் துறைமுகங்களும், பெரியபுராணம், நாயன்மார்கள் மற்றும் ஆழ்வார்களின் பக்திநெறி

அலகு II	**நாட்டுப்புறக் கலைகளின் மரபுகள்**	**3**

நாட்டுப்புறக் கலையின் தோற்றம் மற்றும் வளர்ச்சி, தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், புலியாட்டம், தமிழர்களின் விளையாட்டுகள், நாட்டுப்புறத் தெய்வங்களின் வகைகள், சிற்பக்கலை, நடுகல் வழிபாடு, கைவினைப் பொருட்கள், இசைக்கருவிகளின் வகைகள்.

அலகு III	**தமிழர்களின் கட்டிடத் தொழில்நுட்பம்**	**3**

சங்க காலத்தில் நெசவு மற்றும் பானைத் தொழில்நுட்பம், சங்ககாலத்தில் கட்டுமானங்கள், வீட்டு பொருட்களின் வடிவமைப்பு, சங்ககாலத்தில் கட்டுமான பொருட்கள், சிலப்பதிகாரத்தில் மேடை அமைப்பு, மாமல்லபுரம் சிற்பங்களும் கோவில்களும் சோழர் கால பெருங்கோயில்கள், வழிபாட்டுத்தலங்கள்,மீனாட்சி அம்மன் ஆலயம்,செட்டிநாட்டு கட்டிடக் கலை, திருமலை நாயக்கர் மஹால்.

அலகு IV	**உற்பத்தித் தொழில்நுட்பம்**	**3**

கப்பல் கட்டும் கலை, இரும்பு தொழிற்சாலை, செம்பு மற்றும் தங்க நாணயங்கள் அச்சடித்தல், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள் , கல்மணிகள் சிலப்பதிகாரத்தில் மணிகளின் வகைகள், ,தொல்லியல் சான்றுகள்,சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி.

அலகு V	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்**	**3**

அணை ஏரி குளங்கள் மதகு அமைப்பு சோழர் கால குமுழி தூம்பின்

முக்கியத்துவம், கால்நடை பராமரிப்பு, வேளாண்மை சார்ந்த செயல்பாடுகள், பெருங்கடல் குறித்த பண்டைய அறிவு , முத்துக்குளித்தல், அறிவுசார் சமூகம், கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி. அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழ் வளர்ச்சி.
TOTAL : 15 PERIODS
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.
Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).
Text Books:
1. மா. இராசமாணிக்கனார், தமிழர் நாகரிகமும் பண்பாடும், சைவசித்தாந்த நூற்பதிப்புக் கழகம், சென்னை. 2. கே. கே. பிள்ளை, தமிழக வரலாறு – மக்களும் பண்பாடும், உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை.
References:
1. ந. சுப்பிரமணியன், தமிழக வரலாறு, தமிழ்நாட்டுப் பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், சென்னை. 2. இரா. நாகசாமி, தமிழகத் தொல்லியல், தமிழ்நாடு அரசு தொல்லியல் துறை, சென்னை. 3. குடவாயில் பாலசுப்ரமணியன், தமிழர் கட்டிடக்கலை, தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர். 4. கா. சிவத்தம்பி, தமிழின் சமூக வரலாறு, நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை. 5. தமிழ்ப் பல்கலைக்கழகம், தமிழர் தொழில்நுட்பம், தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்.
E-resources:
1. https://www.tamilvu.org/ 2. https://www.projectmadurai.org/ 3. https://www.tnarch.gov.in/

CO	CO Description	PO	PSO
CO1	தமிழ்மொழி, திராவிட மொழிகள், சங்க இலக்கியம் மற்றும் தமிழர்களின் பண்பாட்டு மரபுகளை அறிந்து விளக்குதல்.	PO1(2) PO2(2)	PSO3(2)
CO2	தமிழர்களின் நாட்டுப்புறக் கலைகள், விளையாட்டுகள், தெய்வ வழிபாடு மற்றும் கைவினை மரபுகளை அறிந்து அவற்றின் முக்கியத்துவத்தை விளக்குதல்.	PO1 (2), PO7 (3), PO8 (3)	PSO1(1), PSO3 (2)
CO3	தமிழர்களின் பாரம்பரிய கட்டிடக்கலை, சிற்பக்கலை மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிந்து அவற்றின் சிறப்புகளை விளக்குதல்.	PO1 (3), PO2 (3)	PSO2 (2), PSO3 (2)
CO4	பண்டைய தமிழர்களின் கப்பல் கட்டுதல், உலோகத் தொழில்நுட்பம், மணிகள் தயாரித்தல் மற்றும் வாணிபத்	PO1 (2), PO2 (2), PO3 (2), PO7 (3)	PSO2 (2), PSO3 (2)

	தொழில்நுட்பங்களை அறிந்து விளக்குதல்.		
CO5	தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள், கால்நடைப் பராமரிப்பு மற்றும் கடல்சார் அறிவியல் தொழில்நுட்பங்களை அறிந்து அவற்றின் முக்கியத்துவத்தை விளக்குதல்.	PO2 (3), PO5 (3), PO6 (3)	PSO1 (2), PSO2 (2), PSO3 (3)

(1) = Low; (2) = Medium; (3) = High

26HSC01	Tamil Heritage and Technologies	L	T	P	C
		1	0	0	1

Course Objectives:

- Identify and explain the Tamil language, Dravidian languages, Sangam literature, and cultural heritage of the Tamils.
- Identify and explain the importance of folk arts, traditional games, folk deities, and handicraft traditions of the Tamils.
- Study and explain the significance of traditional architecture, sculpture, and construction technologies of the Tamils.
- Explain the shipbuilding, metallurgical, bead-making, and trade technologies practiced by the ancient Tamils.
- Explain the importance of agriculture, irrigation systems, animal husbandry, and maritime knowledge and technologies of the Tamils.

Unit I	Language and Literary Heritage	3

Indian language families, varieties of Dravidian languages, history of Muthamizh, ethical thoughts in Sangam literature, Sangam literature and cultural traditions, Tamil as a classical language, management concepts in Thirukkural, education during the Sangam period, Sangam-age cities and ports, Periyapuranam, and the devotional traditions of Nayanmars and Alvars.

Unit II	Traditions of Folk Arts	3

Origin and development of folk arts, Therukoothu, Karagattam, Villupattu, Kaniyan Koothu,Oyilattam, Tholpavai Koothu, Silambattam, Puliyattam, traditional games of the Tamils, types of folk deities, sculpture, hero-stone worship, handicrafts, and types of musical instruments.

Unit III	Architectural Technology of The Tamils	3

Weaving and pottery technology during the Sangam period, construction practices during the Sangam period, design of household articles, construction materials used during the Sangam period, stage arrangement described in Silappathikaram, sculptures and temples of Mamallapuram, great temples of the Chola period, places of worship, Meenakshi Amman Temple, Chettinad architecture, and Thirumalai Nayak Palace.

Unit IV	Manufacturing Technology	3

Shipbuilding technology, iron industry, production and minting of copper and gold coins, glass beads, terracotta beads, conch-shell beads, stone beads, varieties of beads mentioned in Silappathikaram, archaeological evidences, and export and import during the Sangam period.

Unit V	Agriculture and Irrigation Technology	3

Dams, lakes and ponds, sluice structures, significance of the *Kumizhi Thoompu* during the Chola period, animal husbandry, agriculture-related activities, ancient knowledge of the ocean, pearl diving, knowledge-based society, achievements of the Cholas in overseas countries, development of scientific Tamil, and development of computational Tamil.

Total : 15 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).
Text Books:
1. K. K. Pillay, A Social History of the Tamils, University of Madras, Chennai. 2. R. Nagaswamy, Tamil Nadu: An Archaeological Perspective, Tamil Nadu State Department of Archaeology, Chennai.
References:
1. K. A. Nilakanta Sastri, A History of South India: From Prehistoric Times to the Fall of Vijayanagar, Oxford University Press, New Delhi. 2. N. Subrahmanian, Social and Cultural History of Tamilnadu, Koodal Publishers, Madurai. 3. S. R. Balasubrahmanyam, Early Chola Art, Asia Publishing House, Bombay. 4. C. Sivaramamurti, South Indian Bronzes, Lalit Kala Akademi, New Delhi. 5. Noboru Karashima, A Concise History of South India: Issues and Interpretations, Oxford University Press, New Delhi.
E-resources:
1. https://www.tamilvu.org/ 2. https://www.projectmadurai.org/ 3. https://www.tnarch.gov.in/

CO	CO Description	PO	PSO
CO1	Identify and explain the Tamil language, Dravidian languages, Sangam literature, and cultural heritage of the Tamils.	PO1 (2) PO2 (2)	PSO3 (2)
CO2	Identify and explain the importance of folk arts, traditional games, folk deities, and handicraft traditions of the Tamils.	PO1 (2), PO7 (3), PO8 (3)	PSO1 (1), PSO3 (2)
CO3	Study and explain the significance of traditional architecture, sculpture, and construction technologies of the Tamils.	PO1 (3), PO2 (3)	PSO2 (2), PSO3 (2)
CO4	Explain the shipbuilding, metallurgical, bead-making, and trade technologies practiced by the ancient Tamils.	PO1 (2), PO2 (2), PO3 (2), PO7 (3)	PSO2 (2), PSO3 (2)
CO5	Explain the importance of agriculture, irrigation systems, animal husbandry, and maritime knowledge and technologies of the Tamils.	PO2 (3), PO5 (3), PO6 (3)	PSO1 (2), PSO2 (2), PSO3 (3)

(1) = Low; (2) = Medium; (3) = High

26MAC02	Linear Algebra	L	T	P	C
		3	1	0	4

Course Objectives:

- To impart foundational knowledge in linear algebra essential for analyzing and solving problems in engineering applications.
- The Objectives of the course are to equip students with the ability to formulate and solve various types of Ordinary Differential Equations for solving differential equations encountered in engineering problems.

Unit I	Vector Spaces	12

Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension.

Suggested Activities: Open-Source software, exercises to test linear dependence and independence using rank,solving Competitive Examination questions

Unit II	Inner Product Spaces	12

Inner product, Norms, Cauchy, Schwarz inequality, Gram Schmidt orthogonalization, Simple problems (up to R^3).

Suggested Activities: Open-Source software, exercises to compute inner products and vector norms, solving Competitive Examination questions.

Unit III	Matrix Decomposition	12

QR decomposition (Gram- Schmidt method and House holder method), Singular Value Decomposition (SVD), Least squares solutions, simple problems (up to 3×3 *matrices*).

Suggested Activities: Open-Source software, exercises to check if a matrix is positive definite, solving Competitive Examination questions.

Unit IV	First order Ordinary Differential Equations	12

Basic concepts of ordinary differential equations, Formation of first order differential equations from physical problems, First order and first-degree ODE: Variables separable, Exact equations, Leibnitz's equation, Bernoulli's equation.

Suggested Activities: Application and Visualization of the first order ODE using open-source software and solving Competitive Examination questions.

Unit V	Higher order Ordinary Differential Equations	12

Formation of second order differential equations from physical problems Linear equations of second and higher order with constant coefficients, Euler's linear equations, Method of variation of parameters.

Suggested Activities: solving ordinary differential equations using open-source software and solving of Competitive Examination questions.

Total : 60 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).

Text Books:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). Linear algebra. Pearson.
2. Boyce, W. E., DiPrima, R. C., & Meade, D. B. (2022). Elementary differential equations and boundary value problems (12th ed.). Wiley.

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2026.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). Linear algebra and its applications with MATLAB. Pearson.
3. Bronson, R., Costa, G. B., Saccoman, J. T., & Gross. D (2023). Linear algebra: Algorithms, applications, and techniques (4th Edition).
4. Lay, D. C., Lay, S. R., & McDonald, J. J. (2021). Linear algebra and its applications (6th

Edition). Pearson
5. Kreyszig, E. (2025). Advanced engineering mathematics (11th Edition). Wiley.

E-resources:

1.https://math.libretexts.org/Bookshelves/Linear_Algebra/Book%3A_Linear_Algebra_(Schilling_Nachtergaele_ and_Lankham)/09%3A_Inner_product_spaces
2.https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
3.https://archive.nptel.ac.in/content/syllabus_pdf/111107063.pdf

CO	CO Description	PO	PSO
CO1	Explain the fundamental concepts of Linear Algebra.	PO1(3)	PSO1(2)
CO2	Compute inner products and vector norms, validate the Cauchy-Schwarz inequality	PO1(3)	PSO1(2)
CO3	Factorize matrices using QR decomposition to solve physical least-squares approximation problems.	PO1 (3)	PSO1(1)
CO4	Explain first and higher-order ODEs using appropriate analytical and numerical techniques.	PO1 (2) PO2 (2)	PSO3(1)
CO5	Solve higher-order ODEs using classical and finite difference methods.	PO1(3) PO5(3)	PSO1(2)

(1) = Low; (2) = Medium; (3) = High

26PHC02	Physics for Information Science	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide a comprehensive understanding of physics concepts in computer science and engineering applications.

Unit I	Semiconductor Physics	9

Semiconductors - Intrinsic and Extrinsic –Energy level diagram- Carrier Concentration Intrinsic and Extrinsic Semiconductors. (N type – P type). Variation of Carrier Concentration with temperature. Drift and diffusion current – Hall effect- experiment to find hall effect- Schottky diode.

Suggested Activities:: Experimental study of Hall effect in a semiconductor.

Unit II	Properties of Magnetic Material	9

Classification –Dia, para, and Ferro. Bohr magnetron – origin of ferromagnetism – Domain theory – Antiferro – Ferri magnetism – Properties, Hard and soft magnetic material-principles of magnetic recording- Magnetic hard disc (GMR Sensor). Quantum interference devices.

Suggested Activities: Measurement of magnetic susceptibility using Quincke's method.

Unit III	Logical GATE in Data Process	9

Conversion binary to decimal -decimal to binary-binary coded- decimal coded- logical gate OR, AND, NOR, NOT and EX-OR gate-simplification based on Boolean function- sum of product and product of sum, Boolean function -Expression simplification based on karnangh map.

Suggested Activities: Verification of basic logic gates using a digital logic kit.

Unit IV	Nano Technology	9

Nano particle- Fermi level of Nano material and bulk material- Quantum confinement –Quantum structure -Quantum well, Quantum wire, and Quantum dot, Tunneling principle- coulomb blocked effect –single electron transistor-principle- construction and advantage. -carbon nanotube –types, properties and application.

Suggested Activities: Study of nanomaterials and their applications using models.

Unit V	Quantum Computing	9

Quantum states-Classical bit-quantum bit-Bloch sphere - Quantum gates (Pauli-X,Y AND Z gate)- Hadamard gate, phase gate, T gate- CNOT gate,-single and multiple qubits- advantage of quantum computing over classical computing.

Suggested Activities: Simulation of basic quantum gates using a quantum computing platform.

Total:45 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: : Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).

Text Books:

1.Jasprit Singh, *Semiconductor Devices: Basic Principles*, Wiley.
2.Charles Kittel, *Introduction to Solid State Physics*, Wiley. — 8th Edition.

References:

1. S. O. Kasap, *Principles of Electronic Materials and Devices*, McGraw-Hill Education. — 4th Edition**.**
2. Ben Rogers, Jesse Adams & Sumita Pennathur**,** *Nanotechnology: Understanding Small Systems*, CRC Press. — 3rd Edition**.**
3. Parag K. Lala**,** *Quantum Computing: A Beginner's Introduction*, McGraw-Hill Education. **—** 1st Edition**;**
4. D. A. Neamen, *Semiconductor Physics and Devices*, 4th ed., McGraw-Hill Education, 2021.
5. B. G. Streetman and S. Banerjee, *Solid State Electronic Devices*, 7th ed., Pearson Education, 2015.

E-resources:

1. Semiconductor:https://www.youtube.com/@nptelhrd?utm_source=chatgpt.com
2. Magnetic Susceptibility – https://em-amrt.vlabs.ac.in/exp/quinckes-method
3. Logical gate:https://www.youtube.com/watch?v=jo5_A8_jxlY&utm_source=chatgpt.com

CO	CO Description	PO	PSO
CO1	Understand the core principle of semiconductor physics	PO1(3), PO2(3), PO4(2)	PSO1(3)
CO2	Analyze magnetic material properties, domain theory and application in data storage	PO1(3), PO2(2), PO4(2), PO5(2)	PSO1(3)
CO3	Apply binary-decimal conversion and simplify Boolean expression using logic gate and karnaugh map	PO1(3), PO2(3), PO3(2)	PSO1(3)
CO4	Explain Nano-scale, quantum confinement and unique properties of carbon nanotube	PO1(3), PO2(3), PO4(2)	PSO1(3)
CO5	Evaluate the principles of quantum computing and their advantage over classical computing	PO1(3), PO3(2), PO4(2), PO5(3)	PSO1(3)

26GEC01	Environmental Science and Sustainability	L	T	P	C
		2	0	0	2

Course Objectives:

- To understand environment, ecosystems, biodiversity, and conservation.
- To understand sustainability, SDGs, and environmental issues.
- To learn sustainable practices, circular economy, and green engineering.
- To understand pollution, prevention, control, and waste management.
- To learn energy conservation and renewable energy sources

Unit I	Environment and Biodiversity	6

Nature and scope of environmental education, natural resources, Ecosystem Structure, characteristics and functions of ecosystem. Biodiversity, definition, conservation of biodiversity (in-situ and Ex-situ).

Suggested Activities: Know Your Campus Biodiversity & Campus Biodiversity Survey.

Unit II	Social Issues and Sustainability	6

Sustainability, Definition, Sustainable development Goals, Environmental issues - global warming and Ozone depletion ,Climate change, Acid rain, Carbon foot print-Possible solutions to Environmental issues.

Suggested Activities: Sustainability Action Challenge & Sustainability Action Plan.

Unit III	Sustainability Practices	6

Zero waste and R-concept-circular economy, material life cycle assessment, Sustainable habitat – Sustainable transports, Sustainable urbanization, Green Engineering, Green buildings, Green materials- GRIHA- IGBC Green & Net Zero Buildings Rating System.

Suggested Activities: Unsustainable Campus Challenge – "From Waste to Resource Green Campus" solution.

Unit IV	Environmental Pollution and Its Control	6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Environmental protection, Environmental protection acts.

Suggested Activities: Environmental Pollution Audit and Control Plan, Prepare a Pollution Control Chart.

Unit V	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. Concept, origin and power plants of geothermal energy.

Suggested Activities: Comparative Study of Renewable Energy Sources, Design a Renewable Energy Syllabus.

Total : 30 Periods

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology:

Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%)

Text Books:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
2. G. Tyler Miller and Scott E. Spoolman, Environmental Science, 15th Edition, Cengage Learning, Boston.

References:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 3rd Edition,

Pearson Education, 2023.
3. P. Meenakshi – Elements of Environmental Science and Engineering, 2nd Edition, latest print 2023, PHI Learning
4. Jay H. Withgott & Matthew Laposata – Essential Environment: The Science Behind the Stories, 7th Edition, Pearson.
5. Cunnighum and cooper-"Environmental Science, Jaico", The current Cunningham environmental-science text is 16th Edition, 2026, McGraw Hill

E-resources:

1. https://nptel.ac.in/courses/103107215
2. https://nptel.ac.in/courses/103107216
3. https://nptel.ac.in/courses/103107218

CO	CO Description	PO	PSO
CO1	Explain environmental concepts, ecosystems, biodiversity, and conservation.	PO6(3)	PSO3(3)
CO2	Describe sustainability, SDGs, environmental issues, and solutions.	PO7(3)	PSO2(3)
CO3	Apply sustainable practices, circular economy, green engineering, and green buildings.	PO6(3), PO7(3)	PSO1(3)
CO4	Identify pollution causes, effects, control measures, and waste management practices.	PO3(3), PO6(3)	PSO2(3)
CO5	Explain energy conservation and emerging renewable energy sources.	PO6(3)	PSO1(3) PSO2(2)

(1) = Low; (2) = Medium; (3) = High

26CSC03	Problem Solving using Python Programming	L	T	P	C
		3	0	2	4

Course Objectives:

- To equip engineering students with the foundational knowledge and practical skills in Python programming to analyse and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

Unit I	Introduction to Python Programming	9

Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, Interactive and Script Mode, Indentation, Comments, Error Messages, Variables, Reserved Words, Data Types, Arithmetic Operators and Expressions, Built-in Functions, Importing from Packages.

Suggested Activities:

- Interpret GATE-style MCQs on pseudocode, interactive/script mode, indentation, comments, errors, variables, reserved words, and data types.
- Evaluate GATE-style questions on arithmetic operators, expressions and importing functions from packages.

Unit II	Control Structures and Functions	9

If, if-else, Nested if, Multi-way if-elif Statements, while Loop, for Loop, Nested Loops, pass Statements. Functions: Hiding Redundancy and Complexity, Parameters, Arguments and Return Values, Formal and Actual Arguments, Named Arguments, Recursive Functions, Lambda Functions.

Suggested Activities:

- Practice GATE-style MCQs on Control Statements, while, for, nested loops, and pass statements.
- Analyze GATE-style questions on parameters, arguments, return values, formal/actual and named arguments, recursion, and lambda functions.

Unit III	Strings and Collections	9

String Comparison, Formatting, Slicing, Splitting, Stripping. Collections: Lists, Tuples, Sets and Dictionaries,Basic List Operators, Searching and Sorting Lists, Dictionary Literals, Adding and Removing Keys, Accessing and Replacing Values.

Suggested Activities:

- Evaluate GATE-style MCQs on string comparison, formatting, slicing, splitting, stripping, lists, tuples, sets, and dictionaries.
- Interpret GATE-style questions on list operators, searching, sorting, dictionary operations, keys, and value manipulation.

Unit IV	File Operations and Data Processing	9

Creating, Opening, Reading, Writing, Appending and Closing Files, Manipulating Directories, OS and Sys Modules, Reading and Writing Text and Numbers, Creating and Reading Formatted Files such as CSV and Tab-Separated Files.

Suggested Activities:

- Examine GATE-style MCQs on creating, opening, reading, writing, appending, closing files, directories, and OS/Sys modules.
- Interpret GATE-style questions on reading/writing text, numbers, CSV files, and tab-separated files.

Unit V	Python Modules, Packages and Project	9

Packages: Built-in Modules, User-Defined Modules, NumPy, SciPy, Pandas and Scikit-learn.

Suggested Activities:

- Assess GATE-style MCQs on built-in modules, user-defined modules, and their

applications.
- Examine GATE-style questions on NumPy, SciPy, Pandas, and Scikit-learn.

Total : 45 Periods

List of Experiments:

1. Problem Analysis Chart, Flowchart and Pseudocode Practices. (Minimum Three)
2. Usage of Conditional Logics in Programs. (Minimum Three)
3. Usage of Functions in Programs. (Minimum Three)
4. String Manipulation and Operations on Lists, Tuples, Sets and Dictionaries. (Minimum Three)
5. Opening, Closing, Reading and Writing Formatted Files and Sorting Data. (Minimum Three)
6. Usage of Modules and Packages to Solve Engineering Problems. (Minimum Three)
7. Project: Development of Python-based applications using appropriate programming concepts, modules and packages. (Minimum Two Projects)

Total : 30 Periods
Total: 75 Periods

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology:
Quiz (10%), Assignment (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%)

Text Books:

1.Thareja, R. (2023). Python Programming: Using Problem Solving Approach (2nd edition). Oxford University Press.
2.Liang, Y. D. (2017). Introduction to Programming Using Python (1st edition). Pearson Education.

References:

1. Matthes, E.(2019). Python crash course: A hands-on, project-based introduction to programming (2nd ed.). No Starch Press.
2. Brown, M. C. (2018). Python: The complete reference (4th ed.). McGraw Hill Publishers.
3. Guttag, J. V. (2016). Introduction to computation and programming using Python: With applications to understanding data (2nd ed.). MIT Press.
4. McKinney, W. (2017). Python for data analysis: Data wrangling with pandas, NumPy, and IPython. Shroff/O'Reilly.
5. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media,2016.

E-resources:

1. Official Python Documentation – https://docs.python.org/3/
2. Python Tutorials – https://www.w3schools.com/python/
3. NumPy – https://numpy.org/doc/
4. SciPy – https://scipy.org/
5. Google's Python class – https://developers.google.com/edu/python/

CO	CO Description	PO	PSO
CO1	Apply problem-solving techniques, algorithms, flowcharts, and Python programming fundamentals to develop simple programs.	PO1 (3), PO2 (3)	PSO1 (3), PSO2 (2)
CO2	Implement conditional, looping, and function construct to develop modular Python programs.	PO1 (3), PO2 (3), PO5 (2)	PSO1 (3), PSO2 (3), PSO3 (2)
CO3	Develop Python programs using strings, lists, tuples, sets, and dictionaries for data manipulation.	PO1 (3), PO2 (3), PO3 (2), PO5 (2)	PSO1 (3), PSO2 (3), PSO3 (2)
CO4	Implement file and directory operations to store, retrieve, process, and organize data in formatted files.	PO2 (3), PO5 (3)	PSO1 (2), PSO2 (3), PSO3 (2)
CO5	Develop problem-solving applications using Python modules and packages such as NumPy, SciPy, Pandas, and Scikit-learn.	PO2 (3), PO3 (3), PO5 (3), PO11 (2)	PSO1 (3), PSO2 (3), PSO3 (3)

(1) = Low; (2) = Medium; (3) = High

26CSC04	Object Oriented Programming in C++	L	T	P	C
		3	0	2	4

Course Objectives:

- To impart the principles of object-oriented programming and their advantages over procedural programming.
- To develop problem-solving skills by creating real-world application using OOP features.

Unit I	Principles of Object-Oriented Programming	9

Introduction: Characteristics of object-oriented languages– C++ Program structure– Procedure Oriented Programming vs Object Oriented Programming– C++ constructs and syntax– tokens– variables– data-types– type conversion– operators– Expressions– Namespace– flow Control and decision making statements.

Suggested Activities:

- Solve GATE-based MCQs on C++ constructs, data types, operators, expressions, and type conversion.
- Practice GATE previous-year questions on OOP concepts, namespaces, and flow-control statements.

Unit II	Classes and Objects Templates and Exception Handling	9

Classes and Objects Templates and Exception Handling: Abstraction mechanism: Classes, Objects, member data, member functions - Constructors and types - destructors, inline function, friend function - array of objects, objects as function arguments - memory allocation for objects, static members static data and static function. Class Templates - Function Templates – Overloading of Template Functions - String, iterators, hashes, IO streams; Exception Handling.

Suggested Activities:

- Analyze GATE-based questions on classes, objects, constructors, destructors, static members, friend functions, and object memory allocation.
- Apply GATE concepts through problems on templates, function overloading, iterators, IO streams, strings, hashes, and exception handling.

Unit III	Time Polymorphism Inheritance	9

Time Polymorphism Inheritance: Derived Classes – Single inheritance – Multilevel Inheritance – Multiple Inheritance - Hierarchical inheritance – Hybrid inheritance. Operator Overloading: Compile time Polymorphism – Overloading Functions, Overloading Operators, Overloading Unary Operators – Overloading Binary Operators – Operator Overloading with Friend Functions.

Suggested Activities:

- Evaluate GATE-oriented problems on time polymorphism, derived classes, and different types of inheritance.
- Demonstrate GATE concepts through questions on function overloading, operator overloading, unary and binary operators, and friend functions.

Unit IV	Pointers and Runtime Polymorphism	9

Pointers and Runtime Polymorphism: Pointers with arithmetic operations - this pointer – Pointers to Derived classes and Base classes - Compile time Versus Runtime Polymorphism - Virtual functions - Late Binding - Abstract classes- Pure virtual functions and Virtual Destructors - Virtual base class.

Suggested Activities:

1. **Evaluate** GATE-oriented problems on pointers, pointer arithmetic, base and derived class pointers, and runtime polymorphism.
2. **Illustrate** GATE concepts through questions on virtual functions, late binding, abstract classes, pure virtual functions, virtual destructors, and virtual base classes.

Unit V	**I/O Systems and File I/O**	**9**

I/O Systems and File I/O: C++ Streams - Formatted and Unformatted I/O –File stream classes – File modes - File operations, Sequential Read / Write operations – Binary and ASCII Files - Error handling in file I/O with member function.

Suggested Activities:

- **Analyze** GATE-oriented questions on C++ streams, formatted and unformatted I/O, file stream classes, and file modes.
- **Apply** GATE concepts through problems on sequential file operations, binary and ASCII files, and file I/O error handling

Total:45 Periods

List of Experiments:

1. Simple programs to using Operators, and type conversion.
2. Programs using Conditional and Loop statements and loops.
3. Programs using in-line and friend functions.
4. Programs using constructors and destructors Inheritance and Compile
5. Programs for inheritance and its types.
6. Programs using friend function and operator overloading.
7. Programs for pointer manipulation.
8. Programs for virtual functions.
9. Programs using function and class templates.
10. Programs using exception handling.
11. Programs for error handling in file and I/O management
12. Develop applications using OOP features.

Total:30 Periods

Weightage: Continuous Assessment:50%, End Semester Examinations: 50%.

Assessment Methodology: Quiz (10%), Assignment (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%).

Total:75 Periods

Text Books:

1.Deitel, P., & Deitel, H. (2024). *C++ How to Program: An Objects-Natural Approach* (11th ed.). Pearson Education.
2.Bronson, G. (2011). *A First Book of C++*. Course Technology Inc.

References:

1.Balagurusamy, E. (2026). *Object Oriented Programming with C++* (9th ed.). McGraw Hill Education (India).

2. Stroustrup, B. (2024). *Programming: Principles and Practice Using C++* (3rd ed.). Addison-Wesley. Bjarne Stroustrup

3.Savitch, W., & Mock, K. (2022). ***Problem Solving with C++*** (10th ed.). Pearson Education. Pearson

4.Thareja, R. (2025). ***Object Oriented Programming with C++*** (2nd ed.). Oxford University Press.

E-resources:

1.https://en.cppreference.com/w/cpp

2. https://youtu.be/M-mKgBHaMb0?si=1I-pEiAFgwwBA8IC

3. https://www.cet.edu.in/noticefiles/285_OOPS%20lecture%20notes%20Complete.pdf

CO	CO Description	PO	PSO
CO1	Explain the fundamental principles, features, constructs, and syntax of object-oriented programming using C++.	--	--
CO2	Apply classes, objects, constructors, destructors, templates, and exception handling to develop C++ programs..	PO1 (3)	PSO1 (3)
CO3	Analyze and implement inheritance and compile-time polymorphism using function and operator overloading.	PO3 (2)	PSO2 (2)
CO4	Apply pointers and runtime polymorphism concepts using virtual functions, abstract classes, and late binding.	PO2 (1)	PSO1 (3)
CO5	Develop C++ programs using streams and file handling techniques for formatted, unformatted, sequential, binary, and ASCII file operations.	PO11 (2)	---

26ENC02	Communicative English Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

- To make students proficient and confident communicators in English across a variety of contexts. To enable learners to comprehend both spoken English in diverse settings.
- To develop students' ability in the nuances Reading English.
- To enhance the ability of different formal and technical writings.
- To prepare learners to tackle situations and seek employment with assurance in the modern globalized world.

List of Suggested Activities

LISTENING SKILL

a) Listening Comprehension
b) Listening Native Speakers and Repeat
c) Listening to Pod casts
d) Experiencing Listening Technical Reports
e) Listening Barriers

SPEAKING SKILL

a) Phonetics
b) Pronunciation
c) Accent
d) Intonation
e) Stress
f) Pause
g) Nuances

READING SKILL

a) General and Technical Comprehension
b) Experiencing Intensive reading,
c) Extensive reading
d) Skimming and Scanning
e) Practice on Terminologies
f) Synonyms and Antonyms from technical subjects

WRITING SKILL

a) Common Errors
b) Paragraphs and Essays
c) Writing Technical Reports
d) Business Letters, Emails, Notices
e) Agenda and Minutes of Meeting

PERSONALITY DEVELOPMENT

a) SWOT Analysis
b) Digital Presentation
c) Role Play
d) Dialogue and Conversation
e) TED Talks – Extempore

Total : 60 Periods

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%.

Assessment Methodology:
Observation and Record (20%), Practical (30%), Internal Examinations (50%).

Text Books:

1. Dutt, Kiranmai, et al. A Course in Communication Skills. Cambridge University Press, 2008.
2. Green, David. Contemporary English Grammar: Structures & Composition. Trinity Press, 2018.

References:

1. Narayanaswami, V. R. Strengthen Your Writing. Orient Blackswan, 2009.
2. Nicholls, Anne. Mastering Public Speaking. Jaico Publication, 1999.
3. Raman, Meenakshi. Principles and Practice in Technical Communication. Oxford University Thomson,
4. A.J. and A.V. Martinet. A Practical English Grammar. Oxford University Press.
5. Murphy, Raymond. Essential English Grammar. 3rd ed., Cambridge University Press, 2004.

E-resources:

1. https://www.shortform.com/summaries
2. https://www.skillsyouneed.com/rhubarb.html
3. Sway am-NPTEL Business English Communication Portal

CO	CO Description	PO	PSO
CO1	Demonstrate effective interpersonal and intrapersonal communication skills in all the contexts.	PO7(2) PO8(3) PO9(3)	PSO3(3)
CO2	Apply appropriate listening and speaking strategies to comprehend technical information.	PO8(2) PO9(3) PO10(2) PO11(2)	PSO2(2) PSO3(2)
CO3	Employ reading strategies to comprehend and interpret general and technical texts and acquire relevant technical vocabulary.	PO2(2) PO9(3) PO11(2)	PSO2(2) PSO3(2)
CO4	Produce clear and accurate written communication to use in appropriate grammar and professional conventions.	PO2(1) PO8(2) PO9(3)	PSO2(2) PSO3(3)
CO5	Develop personality and professional competencies for career development.	PO3(1) PO7(3) PO8(3)	PSO2(2) PSO3(3)

(1) = Low; (2) = Medium; (3) = High

SEMESTER-III

26 MAC03	Probability and Statistics	L	T	P	C
		3	1	0	4

Course Objectives:

The Objectives of the course are to introduce data collection methods, classification techniques, and graphical representation of data using charts and plots, to explain the fundamental concepts of descriptive statistics, probability theory, random variables, and hypothesis testing for analyzing data and to demonstrate the application of statistical techniques such as experimental design and process control using R/Python for data-driven decision-making.

Unit I	Descriptive Statistics	12

Measures of Central Tendency: Arithmetic Mean, Median and Mode, Measures of Variation: Range, Quartile Deviation - Standard Deviation and Coefficient of Variation, Five Number Summary, Box Plot Technique.

Suggested Activities: Application of descriptive statistics and data presentation methods using R/ Python programming and Analysing data using Box Plots using R/ Python programming.

Unit II	Probability	12

Introduction, sample space and events Axioms of probability, Conditional probability, Total probability, Baye's theorem–problems, Random variable, Distribution function, Probability mass function, Probability density function.

Suggested Activities*:* Application of various distributions using R/ Python programming.

Unit III	Probability distributions	12

Moments, Standard Distributions, Binomial, Poisson and Normal Distributions-Problems, Uniform Distribution and Exponential Distribution (Simple Problems), Correlation and regression (for discrete data only), Central limit theorem (Statement only).

Suggested Activities: Applications of Correlation and Regression using R/ Python programming

Unit IV	Testing of Hypothesis	12

Large sample tests for single mean and difference of means, Small samples tests based on t and F distributions (single mean, difference of means, paired t- test and variance ratio test), Chi-square test for independence of attributes and goodness of fit.

Suggested Activities: Application of Student – t test, F test ,Chi - square test using R/ Python programming.

Unit V	Design of Experiments	12

Analysis of Variance (ANOVA), Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD)

Suggested Activities: Application and visualization of One-way ANOVA and Two-way ANOVA using R/ Python programming.

TOTAL : 60 PERIODS

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class (10%), Internal Examinations (40%).

Text Books:

1. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2024.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2021

References:

1. Johnson R. A., Miller & Freund's, "Probability and Statistics for Engineers", 9th Edition, Pearson Education, Delhi, 2020.
2. Charles Henry Brase and Corrinne Pellillo Brase, "Understandable Statistics: Concepts and Methods", Cengage Learning, 12th Edition, 2018.
3. Montgomery, D. C. and Runger, G. C., Applied Statistics and Probability for Engineers, 7th Edition,John Wiley & Sons, 2018.
4. Navidi, W., Statistics for Engineers and Scientists, 5th Edition, McGraw-Hill Education, 2020.
5. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 7th E dition, Wiley, 2018.

E-resources:

1. NPTEL – Descriptive Statistics with R Software - https://onlinecourses.nptel.ac.in/noc22_mg87/preview
2. MIT OCW – Introduction to Probability and Statistics (18.05, Spring 2022) - https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/
3. MIT OCW – Statistics for Applications (18.650, Fall 2016) - https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/

CO	CO Description	PO	PSO
CO1	Apply descriptive statistical measures such as mean, median, mode, range, quartile deviation, standard deviation and coefficient of variation to summarize and interpret data.	PO1(3) PO2(3) PO5(3)	PSO1(3) PSO2(2) PSO3(3)
CO2	Apply the concepts of probability, conditional probability, Bayes' theorem, random variables and standard probability distributions to solve real-world problems.	PO1(3) PO2(3) PO5(3)	PSO1(3) PSO3(3)
CO3	Analyze data using correlation, regression, and probability models.	PO1(3) PO4(3) PO5(3)	PSO1(3) PSO3(3)
CO4	Perform statistical hypothesis testing using large-sample tests, t-tests, F-tests and chi-square tests, and interpret the results for decision-making.	PO1(3) PO2(3) PO5(3)	PSO1(3) PSO3(3)
CO5	Utilize hypothesis testing, ANOVA for data-driven decision-making.	PO1(3) PO2(3) PO5(3)	PSO1(3) PSO2(2)

26CSC05	Digital Principles and Computer Organization	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on digital logic and provide functional concepts of computer systems with necessary illustrations.

Unit I	Digital Logic	9

Digital Systems, Integer Arithmetic, Addition and Subtraction of Signed Numbers, Boolean Algebra, Theorems and Postulates, Functions, Truth Table, Canonical and Standard Forms, Simplification using K-Maps, Digital Logic Gates, Universal gates, Implementation of Logic Gates, Integrated Circuits.

Suggested Activities:

- Assignment on Karnaugh Map.
- Build logic circuits.
- Virtual demonstration of logical gates.

Unit II	Computer System	9

Basic structure of a computer, Classes of Computer, Functional units - Interconnection of components, Von Neumann architecture and Harvard architecture - Instruction execution cycle, Performance metrics: MIPS, MFLOPS, CPI, throughput.

Suggested Activities:

- MIPS, MFLOPS, and CPI calculations.
- Preparations of report on comparison of two CPU from different manufacturing.

Unit III	Arithmetic and Logic Unit	9

Combinational Circuits: Adders, Binary Adder, Binary Parallel Adder, Subtractor, Multiplexers, Decoders, Design of Fast Adder, Multiplication of Signed and Unsigned Numbers, Fast Multiplication - Integer Division, Floating Point Numbers and Operations, Booth's algorithm for signed multiplication, Sequential Circuits: Flip-Flops, Registers, Counters.

Suggested Activities:

- Virtual demonstration on Binary adder.
- Build a parallel order.

Unit IV	Processing and Pipelining	9

Instruction Set Architecture: RISC vs CISC, Addressing modes, Hardwired control and Micro programmed control unit, Concepts of Pipelining, Pipeline stages and Timing diagram, Hazards: Structural, Data and Control Hazards, Instruction-level parallelism, Parallel processing concepts: SIMD, MIMD, Superscalar processors, Vector and Array Processor.

Suggested Activities:

- Comparison of RISC-V and x86 ISAs; present findings on their relevance to AI accelerators.
- Spot and resolve different types of pipeline hazards in given scenarios.

Unit V	Memory And I/O Systems	9

Memory hierarchy: Registers, Cache, Main Memory- RAM- ROM: PROM, EPROM, EEPROM-Secondary storage, HDD, SSD, Cache Organization, Cache replacement policies, NUMA- DMA- ECC. I/O Techniques: Programmed, Interrupt-Driven, DMA, I/O Devices and Interface Standards: PCI, USB, SATA, Interrupt Types and Priority Handling, Buses and Bus Arbitration, Peripheral Communication.

Suggested Activities:

- Virtual demonstration of DMA.
- I/O in Real AI Systems.

TOTAL : 45 PERIODS

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class (10%), Internal Examinations (40%).

Text Books:

1. M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson.
2. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson.

References:

1. Mano, M. M., & Ciletti, M. D. (2021). Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson.
2. Patterson, D. A., & Hennessy, J. L. (2020). Computer Organization and Design: The Hardware/Software Interface, 6th Edition, Morgan Kaufmann.
3. Stallings, W. (2021). Computer Organization and Architecture: Designing for Performance, 11th Edition, Pearson.
4. Hamacher, C., Vranesic, Z., Zaky, S., & Manjikian, N. (2023). Computer Organization and Embedded Systems, 6th Edition, McGraw-Hill.
5. Morris Mano, M. M., & Ciletti, M. D. (2021). Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson.SafwatZaky&ZvonkoVranesic– Computer OrganizationandEmbeddedSystems, McGraw-Hill.

E-resources:

1.NPTEL Courses (Indian MOOCs – Free & Government Certified): Computer Architecture: Computer Architecture - Course
2.Digital Circuit Simulator: CircuitVerse - Online Digital Logic Circuit Simulator Cloud environment: https://www.cloudbus.org/cloudsim/
3.https://www.google.com/search?q=2.+Digital+Circuit+Simulator%3A+CircuitVerse+-+Online+Digital+Logic+Circuit+Simulator+Cloud+environment%3A+https%3A%2F%2Fwww.cloud

CO	CO Description	PO	PSO
CO1	Identify basic digital components and their functions in a computer system	---	---
CO2	Apply Boolean algebra and number systems to design simple digital circuits and simulate them using tools	PO1(3)	PSO1(3)
CO3	Analyze instruction sets, arithmetic units, and performance metrics to evaluate processor design	PO2(2)	PSO2(3) PSO3(1)
CO4	Engage in continuous learning to update with advancements through evolving computing trends.	PO11(1)	PSO3(3)
CO5	Explain the organization and characteristics of computer memory hierarchy, including registers, cache, RAM, ROM, and secondary storage.	PO1(3)	PSO1(3)

(1) = Low; (2) = Medium; (3) = High

26CSC06	Data Structures Using C	L	T	P	C
		3	0	0	3

Course Objectives:

This course presents various data structures and their importance to provide a comprehensive view about problem solving skills.

Unit I	Linear Data Structures	9

Abstract Data Types- Internal Representation of Primitive Data Structures-One Dimensional and Multi-Dimensional Arrays-linear lists-Singly, doubly, Circular linked lists- Applications-Polynomial ADT.

Suggested Activities:

- Students work in groups to construct Singly, Doubly, and Circular Linked Lists using cards or diagrams.
- Perform insertion, deletion, searching, and traversal operations.

Unit II	Stacks and Queues	9

Stack: Representations–Operations–Implementations–Applications. Queue: Representations – Operations – Implementations– Types -Applications.

Suggested Activities:

- Use books or cards to demonstrate Stack operations.
- Demonstrate Enqueue, Dequeue, Front, and Rear operations.

Unit III	Trees	9

Representations – Types**:** Binary Search Trees (BSTs) - AVL Tree **–** Operations: Search, Traversals, Rotations - Balanced BSTs- Splay trees- B-trees- Binary Heaps.

Suggested Activities:

- Provide a set of integer values and ask students to construct a Binary Search Tree.
- Students balance the tree using LL, RR, LR, and RL rotations.

Unit IV	Sorting, Searching & Hashing Techniques	9

Linear and Binary Search-Bubble Sort-Insertion Sort- Merge Sort- Bucket Sort- Quick Sort- Heap sort- Hashing techniques- Dictionaries- Hash function- Collision - Separate chaining- open addressing.

Suggested Activities:

- Divide students into groups and give the same set of numbers to each group.
- Students insert the keys using a suitable hash function.

Unit V	Graphs	9

Representation-Types–Operations-Prim’s, Kruskal’s algorithms -Dijikstra’s algorithm – Connected and Bi-Connected Components.

Suggested Activities:

- Give students a real-world network such as cities and roads or a social network.
- Find the Minimum Spanning Tree using Prim's Algorithm and Kruskal's Algorithm.

TOTAL : 45 PERIODS

Weightage: Continuous Assessment: 40%, End Semester Theory Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class (10%), Internal Examinations (40%).

Text Books:

1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
2.Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007.

References:

1. Langsam, Y., Augenstein, M. J., & Tenenbaum, A. M., Data Structures Using C and C++, 2nd Edition, Prentice Hall/Pearson.
2. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C., Introduction to Algorithms, 4th Edition, MIT Press, 2022.
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D., Data Structures and Algorithms, Addison-Wesley.
4. Kruse, R. L., Tondo, C. L., Leung, B. P., & Mogalla, S., Data Structures and Program Design in C, 2nd Edition, Pearson.
5. Tremblay, J.-P., & Sorenson, P. G., An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw-Hill.

E-resources:

1.https://www.nptel.ac.in/courses/106102064
2.https://www.nptel.ac.in/courses/106106133
3.https://www.geeksforgeeks.org/data-structures/

CO	CO Description	PO	PSO
CO1	Explain the fundamental concepts of data structures and analyze the operations of linear data structures such as arrays, linked lists, stacks and queues.	PO1(3) PO2 (3)	PSO1 (3)
CO2	Explain tree structures and analyze various tree operations, traversals and applications.	PO1(3) PO2(3) PO5 (2)	PSO1 (3) PSO2 (2)
CO3	Apply graph representations and traversal techniques to analyze graph-based problems and algorithms.	PO1(3) PO2(3) PO3(2) PO5 (2)	PSO1 (3) PSO2 (3)
CO4	Analyze and compare different sorting techniques based on their operations, performance and time complexity.	PO1(3) PO2(3) PO4(2) PO5 (2)	PSO1 (3) PSO2 (2)
CO5	Analyze searching and hashing techniques and select suitable methods for efficient data organization and retrieval.	PO1(3) PO2(3) PO3(2) PO5 (3)	PSO1 (3) PSO2 (3)

(1) = Low; (2) = Medium; (3) = High

26CSC07	Operating Systems	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide a strong foundation in operating system concepts, architecture, process management, resource scheduling, memory management, file systems, and I/O management.
- To develop skills in analyzing process and thread behavior, CPU scheduling, synchronization, deadlock handling, memory allocation, virtual memory, and disk scheduling techniques.
- To introduce students to modern operating system architectures, virtualization, containerization, Unix/Linux environments, and emerging operating system technologies.
- To enable students to apply operating system concepts and algorithms to real-world computing problems.

Unit I	Foundations Of Modern Operating System Architecture	9

History and Evolution of Operating Systems – Types of Operating Systems – Batch Systems – Time-Sharing Systems – Distributed Operating Systems – Real-Time Operating Systems – OS Structures – Functions of Operating Systems – Operating System Challenges – Introduction to Unix and Linux – Modern Operating System Architectures.

Suggested Activities: Install and configure a Linux operating system. Practice basic Linux commands and develop introductory shell scripts to perform file, directory, process, and system-related operations.

Unit II	Process Management And Thread Dynamics	9

System Calls – Process Concepts – Process States and Lifecycle – Process Control Block (PCB) – Context Switching – Process Creation and Termination – Parent and Child Processes – Threads – Process vs. Thread – Threading Models – Multithreading – Process Synchronization Basics.

Suggested Activities: Implement process creation and management using fork(), exec(), and wait() system calls. Develop simple multithreaded programs using POSIX threads and demonstrate thread creation, execution, and termination.

Unit III	Resource Scheduling And Concurrency Control	9

Scheduling Criteria and Objectives – CPU Scheduling Algorithms – First Come First Serve (FCFS) – Shortest Job First (SJF) – Round Robin – Priority Scheduling – Multilevel Queue Scheduling – Concurrency Issues – Critical Section Problem – Process Synchronization – Mutex – Semaphores – Classical Synchronization Problems – Producer-Consumer Problem – Readers-Writers Problem – Deadlock – Necessary Conditions – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Deadlock Recovery.

Suggested Activities: Develop and analyze Gantt charts for different CPU scheduling algorithms and calculate waiting time, turnaround time, and response time. Implement Producer-Consumer and Readers-Writers synchronization problems using appropriate synchronization mechanisms. Demonstrate deadlock avoidance using suitable algorithms.

Unit IV	Memory Architecture And Virtualization	9

Memory Management – Contiguous Memory Allocation – Paging – Segmentation – Virtual Memory – Demand Paging – Page Faults – Page Replacement Algorithms – FIFO – LRU – Optimal Page Replacement – Thrashing – Memory Allocation Strategies – Dynamic Memory Allocation.

Suggested Activities: Implement FIFO, LRU, and Optimal page replacement algorithms for a given page-

reference string and calculate page faults. Develop programs demonstrating dynamic memory allocation and analyze different memory management techniques.

Unit V	**Permanent Storage, I/O Subsystems and Containerization**	**9**

File System Concepts – File Attributes and Operations – Directory Structures – File Access Methods – File Protection and Access Control – I/O Management – I/O Devices – Device Management – Buffering – Caching – Disk Scheduling – FCFS – SSTF – SCAN – C-SCAN – Emerging Trends in Operating Systems – Virtual Machines – Virtualization – Containerization – Introduction to Containers and Modern Deployment Environments.

Suggested Activities: Implement file operations and buffering simulations. Develop programs to simulate disk scheduling algorithms and compare their performance. Explore basic virtual machine and containerization concepts through a simple practical demonstration.

TOTAL : 45 PERIODS

Weightage: Continuous Assessment: 40%, End Semester Theory Examinations: 60%.

Assessment Methodology: Assignments (20%), Quiz (10%), Competitive Examinations (20%), Flipped Class (10%), Internal Examinations (40%).

Text Books:

1. Silberschatz, A., Galvin, P. B., & Gagne, G. (2018). Operating System Concepts, 10th Edition, Wiley.
2. Tanenbaum, A. S., & Bos, H. (2022). Modern Operating Systems, 5th Edition, Pearson.

References:

1. Silberschatz, A., Galvin, P. B., and Gagne, G., Operating System Concepts, 10th Edition, Wiley.
2. Stallings, W., Operating Systems: Internals and Design Principles, 9th Edition, Pearson.
3. Tanenbaum, A. S., and Bos, H., Modern Operating Systems, 5th Edition, Pearson.
4. Bach, M. J., The Design of the UNIX Operating System, Prentice Hall.
5. Dhamdhere, D. M., Operating Systems: A Concept-Based Approach, 3rd Edition, McGraw-Hill Education.

E-resources:

1.Operating Systems – NPTEL (Video)
2.Operating Systems and System Software – NPTEL (Video)
3.Operating Systems – MIT OpenCourseWare (Video/Lecture Materials)

CO	CO Description	PO	PSO
CO1	Describe operating system concepts, architectures, functions, and mechanisms used to manage computer hardware and software resources.	PO1 (3), PO2 (2)	PSO1 (3)
CO2	Analyze processes, threads, system calls, process states, and file system components for efficient operating system management..	PO1 (3), PO2 (3), PO5 (2)	PSO1 (3)
CO3	Apply propositional and predicate logic, logical equivalences, quantifiers and rules of inference to establish the validity of arguments.	PO1 (3), PO2 (3), PO3 (2)	PSO2 (3)
CO4	Design suitable memory management, virtual memory, page replacement, and resource management solutions for real-world computing scenarios.	PO2 (3), PO3 (3), PO5 (2)	PSO1 (3), PSO2 (3)
CO5	Develop and apply operating system solutions involving file systems, I/O management, disk scheduling, virtualization, and containerization while adapting to emerging technologies .	PO3 (3), PO5 (3), PO11 (2)	PSO2 (3)

(1) = Low; (2) = Medium; (3) = High

26CSC08	Java Programming	L	T	P	C
		3	0	2	4

Course Objectives:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

Unit I	Introduction To Oop And Java	9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays Operators – Control Statements – Programming Structures in Java – Defining classes in Java Constructors-Methods -Access specifiers - Static members- JavaDoc comments.

Suggested Activities:

- Implement constructors and methods to display student details.
- Give students a set of problems involving if-else, switch, for, while, and do-while.

Unit II	Inheritance, Packages And Interfaces	9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch – Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access – Importing Packages – Interfaces.

Suggested Activities:

- Create a base class Employee and derived classes such as Manager, Developer, and Tester.
- Create a user-defined package containing related classes.

Unit III	Exception Handling And Multithreading	9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication-Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

Suggested Activities:

- Develop a simple calculator or banking application.
- Create one user-defined exception, such as Insufficient Balance Exception.

Unit IV	I/O, Generics, String Handling	9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

Activities:

- Create a Java program to write student details into a text file.
- Create a generic class or generic method to process different types of data.

Unit V	Javafx Event Handling, Controls And Components	9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

Suggested Activities:

- Handle button-click and mouse events.
- Develop a simple application with MenuBar, Menu, and MenuItem.

TOTAL (Theory): 45 PERIODS

List of Experiments:

1.Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)

2.Develop stack and queue data structures using classes and objects.

3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of (i)BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employee with their gross and net salary.

4.Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.

5.Solve the above problem using an interface.

6.Implement exception handling and creation of user defined exceptions.

7.Write a java program that implements a multi-threaded application that has three threads.

(i)First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

8.Write a program to perform file operations.

9.Develop applications to demonstrate the features of generics classes.

10.Develop applications using JavaFX controls, layouts and menus. Develop a mini project for any application using Java concepts.

TOTAL (Lab.) :30 PERIODS

TOTAL :75 PERIODS

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.
Assessment Methodology: Assignments (10%), Quiz (10%), Competitive Examinations (10%), Flipped Class (10%), Practical (20%), Internal Examinations (40%).
Text Books:
1. Schildt, H., & Coward, D., Java: The Complete Reference, 13th Edition, McGraw-Hill, 2024. 2. Deitel, P. J., & Deitel, H. M., Java How to Program: An Objects-Natural Approach, 12th Edition, Pearson, 2025.
References:
1. Balagurusamy, E., Programming with Java, 7th Edition, McGraw-Hill, 2024. 2. Schildt, H., Schildt's Java: A Beginner's Guide, 9th Edition, McGraw-Hill. 3. Bloch, J., Effective Java, 3rd Edition, Addison-Wesley Professional, 2018. 4. Gosling, J., Joy, B., Steele, G., Bracha, G., Buckley, A., & Smith, D., The Java Language Specification, Java SE 27 Edition, Oracle, 2026. 5. Eckel, B., Thinking in Java, 4th Edition, Prentice Hall.
E-resources:
1.Oracle Java Tutorials – Java programming concepts, OOP, exceptions, collections, etc. https://docs.oracle.com/javase/tutorial/ 2.Dev.java – Learn Java – Java basics, JDK setup, classes, applications and modern Java topics. https://dev.java/learn/ 3.Oracle Java SE Documentation – Java API documentation, developer guides and specifications. https://docs.oracle.com/en/java/javase/

CO	CO Description	PO	PSO
CO1	Explain the fundamental concepts of Object-Oriented Programming and Java, including data types, arrays, operators, control statements, classes and objects.	PO1 (3), PO2(2), PO5 (2)	PSO1 (3)
CO2	Apply inheritance, method overloading and overriding, packages, abstract classes and interfaces to develop object-oriented Java applications.	PO1 (3), PO2 (3), PO3 (2), PO5 (3)	PSO1 (3), PSO2 (2)
CO3	Implement exception handling and multithreading concepts to develop robust and concurrent Java applications.	PO2 (3), PO3 (2), PO4 (2), PO5 (3)	PSO1 (3), PSO2 (3)
CO4	Develop Java applications using I/O streams, file processing, generic classes and methods, and string handling.	PO2 (3), PO3 (2), PO4 (2), PO5 (3)	PSO1 (3), PSO2 (3)
CO5	Develop interactive applications using JavaFX controls, event handling, layouts and menus, and apply Java programming concepts to real-world applications.	PO3 (3), PO4 (2), PO5 (3), PO9 (2), PO11 (2)	PSO1 (3), PSO2 (3), PSO3 (2)

(1) = Low; (2) = Medium; (3) = High

26AD301	Exploratory Data Analysis	L	T	P	C
		3	0	2	4

Course Objectives:

This course aims to provide in-depth knowledge and practical skills in performing Exploratory Data Analysis (EDA), using statistical and graphical techniques.

UNIT I	INTRODUCTION TO EXPLORATORY DATA ANALYSIS	15

Introduction: Purpose and Goals of EDA – Mindset for Effective Data Exploration – Significance of EDA in the Data Science Lifecycle – Types of Data and Quality Issues – EDA vs. Classical and Bayesian Approaches – Tools and Libraries for EDA – Visual Techniques for Initial Insights.

Suggested Activities:

1. **Data Cleaning Activity:** Identify and handle missing values, duplicate records, inconsistent data, and outliers in a real-world dataset.
2. **Data Visualization Activity:** Use Python, Pandas, Matplotlib, and Seaborn to create **bar charts, histograms, box plots, and scatter plots** and identify initial insights from the data.

UNIT II	DATA WRANGLING	15

Data Wrangling: Importing, Loading and Cleaning Datasets – Merging – Reshaping – Pivoting Data – Handling Missing Values and Outliers – Renaming – Deduplication – Discretization and Binning – Permutation and Random Sampling – Challenges in Real-World Data Preprocessing.

Suggested Activities:

1. **Data Wrangling Activity:** Import and clean a real-world dataset by handling **missing values, outliers, duplicate records, and inconsistent data**.
2. **Data Transformation Activity:** Perform **merging, reshaping, pivoting, discretization, and binning** operations on a dataset using Python/Pandas.

UN IT-III	Multivariate Analysis, Relationship Exploration and Causal Inference	15

Multivariate Analysis, Relationship Exploration and Causal Inference: Univariate, Bivariate and Multivariate Analysis – Interpreting Relationships and Simpson‘s Paradox – Multicollinearity and Correlation Pitfalls – Visualizing Multivariate Data using Pair Plots and Heatmaps – Causal Inference in Data Science – Correlation vs. Causation – Confounding Variables.

Suggested Activities:

1. **Multivariate Visualization Activity:** Use Python to create **pair plots and heatmaps** and interpret relationships among multiple variables.
2. **Correlation vs. Causation Activity:** Analyze a real-world case study to identify **correlation, causation, and confounding variables**, including an example of **Simpson’s Paradox**.

UNIT-IV	Time-Oriented Data Exploration and Statistical Testing	15

Time-Oriented Data Exploration

Time-Series Data – Time-Based Indexing and Date-Time Conversion in Pandas – Seasonal Patterns – Resampling (Up/Down) – Aggregations – Line Plots – Rolling Statistics – Anomaly Spotting.

Statistical Testing for Insights

Hypothesis Testing – Null vs. Alternative Hypothesis – Type I and Type II Errors – Statistical Tests – t-Tests – p-Values using SciPy and Statsmodels – Interpreting Test Results in the Context of EDA.

Suggested Activities:

1. **Time-Series Analysis Activity:** Use Python/Pandas to analyze a real-world time-series dataset by performing **date-time conversion, resampling, rolling statistics, line plots, and anomaly detection**.
2. **Hypothesis Testing Activity:** Use **SciPy/Statsmodels** to perform a **t-test**, formulate null and alternative hypotheses, calculate **p-values**, and interpret the statistical results in the context of EDA.

UNIT V	From EDA to Model Deployment	15

From EDA to Model Deployment: Supervised vs. Unsupervised Models – Simple and Multiple Linear Regression – Train/Test Split – Cross-Validation – Evaluation Metrics: MAE, RMSE, R^2, Accuracy and F1-Score – Saving Models using Pickle or Joblib – Basic Deployment using Flask for Local Predictions.

Suggested Activities:

1. **Model Building Activity:** Use Python to implement **simple and multiple linear regression**, perform **train/test split and cross-validation**, and evaluate the model using **MAE, RMSE and R^2**.
2. **Model Deployment Activity:** Train a machine learning model, **save it using Pickle/Joblib**, and create a basic **Flask application** with a /predict endpoint for making local predictions.

Total :45 Periods

List of Experiments

1. Load a real-world dataset (CSV/JSON) into a Pandas DataFrame and inspect its structure using .head(), .info(), .shape and .describe().
2. Choose one dataset and create a **data story** using 3 to 5 visualizations that highlight trends, patterns or anomalies.
3. Load a messy dataset with missing values, duplicates and incorrect data types. Identify and handle missing values using Pandas functions, applying mean or median for numeric data and mode for categorical data. Remove duplicates and verify data consistency.
4. Rename ambiguous column names to meaningful ones and convert improperly inferred data types to suitable formats. Apply binning using equal-width/equal-frequency methods on a continuous column such as age or income. Display the new binned column and analyze its utility.
5. Create and analyze a detailed correlation matrix. Identify and explain variable pairs with high correlation coefficients ($r > 0.8$ or $r < -0.8$).
6. Construct a sns.pairplot() for 4–6 numerical columns with an additional categorical hue to observe grouped patterns across variables.
7. Perform both down-sampling (e.g., daily to monthly) and up-sampling using resample() and aggregate meaningful summaries.
8. Compute rolling mean and standard deviation for a chosen variable, such as a 7-day moving average. Use plots to identify anomalies or trend shifts.
9. Perform t-tests or other appropriate statistical tests using scipy.stats. Record t-values, p-values and significance-level conclusions.
10. Interpret test results in layman terms. Report whether the difference is statistically significant and what it implies for decision-making.
11. Load a dataset and select suitable independent and dependent variables for simple linear regression. Split the dataset into training and testing sets. Train a linear regression model using sklearn and evaluate it with MAE, RMSE and R^2.

12. Save the trained model using pickle or joblib. Build a minimal Flask application with a /predict route that takes input and returns a prediction. Test locally

Total(Lab) :30 Periods
Total :75 Periods

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Assignments (10%), Quiz (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%).

Text Book:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms*, **4th Edition**, The MIT Press, 2022.
2. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, *Computer Algorithms/C++*, **2nd Edition (Updated/VTU Print)**, Universities Press / Orient Blackswan, 2019.

References:

1. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, **3rd Edition (Pearson India Reprint)**, Pearson Education, 2017
2. Steven S. Skiena, *The Algorithm Design Manual*, **3rd Edition**, Springer, 2020.

E-Resources :

1. *Design and Analysis of Algorithms*, Swayam-NPTEL Platform, 2026.
2. MIT OpenCourseWare, Spring 2020.
3. *Data Structures and Algorithms (DSA) Learning Path*, GeeksforGeeks All-in-One Portal, 2026.

CO	Description of CO	PO	PSO
CO1	Describe the importance of Exploratory Data Analysis in understanding and summarizing datasets.	**--**	**--**
CO2	Analyze datasets to identify patterns, trends, anomalies, and relationships among variables.	**PO1 (3)**	**PSO1 (3)**
CO3	Evaluate data quality and extract meaningful insights for decision-making.	**PO3 (2)**	**PSO2 (2)**
CO4	Design effective Exploratory Data Analysis workflows for real-world datasets.	**PO2 (1)**	**PSO1 (3)**
CO5	Recognize the importance of continuous learning by adapting to emerging tools and evolving data-driven practices.	**PO11 (2)**	---

(1) = Low; (2) = Medium; (3) = High

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26CSC10	Operating Systems Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

- To learn UNIX commands and shell programming.
- To understand and use UNIX system calls.
- To implement process creation and inter-process communication.
- To implement CPU scheduling algorithms.
- To understand process synchronization using semaphores.
- To implement deadlock avoidance and detection.
- To understand memory management and page replacement.
- To implement file organization and allocation techniques.

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. Write programs using fork, exec, getpid, exit, wait, close, stat, opendir and readdir.
2. Write programs using open, read, write, seek, close, etc.
3. Write C programs to simulate commands such as ls, cp, grep, etc.
4. Given processes with CPU burst time and arrival time:
    a. Generate the Gantt chart.
    b. Calculate average waiting time.
    c. Calculate average turnaround time.
5. Implement:
    a.Priority Scheduling
    b.Round Robin Scheduling Calculate average waiting time and turnaround time.
6. Develop applications using:
    a.Shared memory
    b.Pipes
    c.Message queues
7. Implement the Producer–Consumer problem using semaphores.
8. Implement Banker's Algorithm.
9. Implement an algorithm for Deadlock Detection.
10. Implement threads and synchronization applications.
11. Implement: a.First Fit b.Worst Fit c.Best Fit
12. Implement the Paging technique of memory management.

TOTAL : 45 PERIODS

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Observation and Record (20%), Practical (30%), Internal Examinations (50%)

References:

1. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, 5th Edition, Pearson, 2023.
2. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson.
3. Dhananjay M. Dhamdhere, Operating Systems: A Concept-Based Approach, 2nd Edition, McGraw-Hill, 2007.
4. Maurice J. Bach, The Design of the UNIX Operating System, 1st Edition, Prentice Hall, 1986.
5. Michael Kerrisk, The Linux Programming Interface: A Linux and UNIX System Programming Handbook, 1st Edition, No Starch Press, 2010.

E-resources:

1.https://pages.cs.wisc.edu/~remzi/OSTEP/
2.https://michaelkerrisk.com/tlpi/
3.https://www.kernel.org/doc/man-pages/

CO	CO Description	PO	PSO
CO1	Implement UNIX commands, shell programs and basic system calls for process management.	PO1 (3) PO2 (3) PO5 (2)	PSO1 (2) PSO2 (2)
CO2	Implement and analyze CPU scheduling algorithms and inter-process communication techniques.	PO1 (3) PO2 (3) PO4 (2) PO5 (2)	PSO1 (3) PSO2 (2)
CO3	Implement process synchronization, threading and deadlock avoidance and detection algorithms.	PO1 (3) PO2 (3) PO3 (2) PO5 (3)	PSO1 (3) PSO2 (3)
CO4	Implement paging, page replacement algorithms and various memory allocation techniques.	PO1 (3) PO2 (3) PO3 (2) PO5 (3)	PSO1 (3) PSO2 (3)
CO5	Implement file organization, file allocation and disk scheduling strategies using suitable programming techniques.	PO2 (3) PO3 (2) PO4 (2) PO5 (3) PO9 (2)	PSO1 (3) PSO2 (3) PSO3 (2)

(1) = Low; (2) = Medium; (3) = High

26SDC01	Foundation Aptitude and Verbal ability Skills	L	T	P	C
		0	0	2	1

Course Objectives:

- To Solve quantitative aptitude problems through practical exercises.
- To Apply logical and analytical reasoning techniques.
- To Improve grammar and vocabulary through practice-oriented activities.
- To Demonstrate effective reading, listening and speaking skills.
- To Demonstrate professional communication skills required for placement activities.

List of Activities:

1. Number System, Simplification, Percentage and Ratio.
2. Average, Profit and Loss, Simple and Compound Interest.
3. Time, Work, Speed, Distance and Data Interpretation.
4. Number Series, Analogy, Coding-Decoding and Logical Patterns.
5. Blood Relations, Direction Sense, Ranking, Syllogism and Data Sufficiency.
6. Grammar, Sentence Correction and Error Spotting.
7. Vocabulary, Synonyms, Antonyms, Idioms and Sentence Completion.
8. Reading Comprehension, Para Jumbles and Listening Skills.
9. Speaking Skills, Group Discussion and Presentation Skills.
10. Resume Preparation, Interview Skills and Mock Placement Activities.

TOTAL : 30 PERIODS

Weightage: Continuous Assessment: 100%

Assessment Methodology: Observation and Record (20%), Practical (30%), Internal Examinations (50%)

References:

1. R. S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishing.
2. R. S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand Publishing.
3. Wren & Martin, High School English Grammar and Composition, S. Chand Publishing.
4. Arun Sharma, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGraw Hill Education.

E-resources:

1. https://nptel.ac.in/courses/109104030

CO	CO Description	PO	PSO
CO1	Solve quantitative aptitude problems using appropriate numerical and arithmetic techniques.	PO1(3) PO2(2)	PSO2(1)
CO2	Apply logical and analytical reasoning techniques to solve aptitude problems.	PO2(3) PO4(2)	PSO2(2) PSO3(1)
CO3	Apply grammar and vocabulary skills to solve verbal ability exercises.	PO1(2) PO10(3)	PSO3(2)
CO4	Demonstrate effective reading, listening, speaking, group discussion and presentation skills.	PO8(3) PO9(3) PO10(3)	PSO3(3)
CO5	Demonstrate professional communication skills through resume preparation, interviews and mock placement activities.	PO6(2) PO8(3) PO9(3)	PSO1(1) PSO2(2) PSO3(3)

(1) = Low; (2) = Medium; (3) = High

SEMESTER-IV

26MAC07	Discrete Mathematics	L	T	P	C
		3	1	0	4

Course Objective:

- The Objectives of the course are to Introduce foundational concepts of set theory, relations, functions, and recurrence relations relevant to modeling data and algorithmic structures and to explain principles of propositional and predicate logic, Boolean algebra, and lattice theory for reasoning and decision-making in AI systems and to present core ideas of graph theory and its applications to analyze and optimize networks, data structures, and intelligent systems.

Unit I	Set Theory	12

Set theory, Inductive definition of sets and proof by induction, Peano postulates, Relations, equivalence relations and partitions, Principle of inclusion and exclusion.

Suggested Activities: Create and present Venn diagrams to illustrate union, intersection.

Unit II	Relations and Functions	12

Functions, Type of functions: Injective, surjective and bijective functions, Composition of functions, Inverse functions, Permutation functions, Recurrence relations, Solving linear recurrence relations.

Suggested Activities: Categorize real-world mappings such as student-to-email ID User name-to-password an injective, surjective, or bijective using role-play or sorting tasks.

Unit III	Logic	12

Propositions, Logical operators, Normal forms, Rules of inference, Consistency and inconsistency, Propositional logic, Proofs , Predicates, Quantifiers, Universe of discourse, Logical equivalences and implications for quantified statements, Rules of specification and generalization, Validity of arguments.

Suggested Activities: Conduct a truth table building competition for compound propositions using logical operators.

Unit IV	Boolean Algebra and Lattice Theory	12

Partial ordering, Posets, Lattices as Posets, Properties of lattices, Lattices as algebraic systems, Sub lattices, Direct product and homomorphism, Some special lattices, Boolean algebra, Sub Boolean Algebra, Boolean Homomorphism.

Suggested Activities: Draw Hasse diagrams for lattices from a given set and identify sub lattices and lattice operations**.**

Unit V	Graph Theory	12

Graphs, Types of graphs, Matrix representation of graphs, Graph isomorphism, Walk, Path , Cycles, Eulerian graphs, Hamiltonian graphs, Planar graph, Euler formula, Shortest path algorithm: Dijkstra‘s algorithm.

Suggested Activities: Implement Dijkstra‘s algorithm to find the shortest path in a weighted AI decision graph.

Weightage: Continuous Assessment:40%, End Semester Examinations:60%

Assessment Methodology: Assignments - 20%, Quiz- 10%, Competitive Examinations - 20%, Flipped Class - 10%, Internal Examinations - 40%

Total Hours:45

Text Book:

1. **Rosen, K.H.,** *Discrete Mathematics and Its Applications***, 8th Edition, Tata McGraw-Hill Education, New Delhi, Special Indian Edition, 2021.**
2. Tremblay J.P., Manohar R., “Discrete Mathematical Structures with applications to Computer Science”, Tata McGraw-Hill, International Edition, 2017**.**

References:

1. Kenneth H. Rosen, "Discrete Mathematics and its applications: With Combinatorics and Graph Theory (9^{th} Edition)", Tata McGraw-Hill, 2025.
2. **Johnsonbaugh, R.,** *Discrete Mathematics***, 8th Edition,** Pearson Education**, 2026 Global Edition**.
3. Liu, C. L. and D. P. Mohapatra, *Elements of Discrete Mathematics: A Computer Oriented Approach*, 4th Edition, McGraw Hill Education, 2017.
4. Grimaldi, R. P., *Discrete and Combinatorial Mathematics (Classic Version), Global Edition*, 5th Edition, Pearson**,** 2026.
5. **Epp, S.S.,** *Discrete Mathematics with Applications***, 5th Edition, Cengage Learning India, 2021**

E-resources:

1. E-Book - "Mathematics for Computer Science" – Eric Lehman, MIT: https://courses.csail.mit.edu/6.042/spring17/mcs.pdf
2. NPTEL – Discrete Mathematics (IIT Ropar) - https://nptel.ac.in/courses/106106183

   MIT OpenCourseWare – Mathematics for Computer Science (6.042J) - https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2005/

CO	CO Description	PO	PSO
CO1	Apply the concepts of set theory, mathematical induction, relations and equivalence relations to solve discrete mathematical problems.	PO1 (3) PO2 (2)	PSO1(2)
CO2	Analyze functions, permutations and recurrence relations and solve linear recurrence relations.	PO1 (3) PO2 (3)	PSO1(2)
CO3	Apply propositional and predicate logic, logical equivalences, quantifiers and rules of inference to establish the validity of arguments.	PO1 (3) PO2 (3) PO4 (2)	PSO1(2) PSO2(2)
CO4	Analyze posets, lattices and Boolean algebra and apply their properties to solve discrete mathematical problems.	PO1 (3) PO2 (3)	PSO1(2) PSO2(2)
CO5	Apply graph theory concepts, graph representations, Euler/ Hamiltonian graphs, planar graphs and Dijkstra's algorithm to solve real-world problems.	PO1 (3) PO2 (3) PO5(2)	PSO1(2) PSO2(3)

26CSC11	Database Management Systems	L	T	P	C
		3	0	0	3

Course objectives: This course provides a comprehensive foundation in database system concepts, including architecture, data modeling, and query languages. The course discusses the concepts of transaction management, concurrency control and query optimization.

Unit I	DBMS and Data Modeling	9

Purpose-architecture and types of DBMS-Data models:traditional, hierarchical, network, relational, object-oriented-DBMS architecture-Database users and languages (DDL, DML, DCL) – basic SQL queries.

Suggested Activities:

- **DBMS Architecture & User Role Activity** – Students draw the three-level DBMS architecture and identify the roles of DBA, database designer, programmer, and end users.
- **SQL Hands-on Activity** – Students create tables and perform basic DDL, DML, DCL, and SELECT queries using a sample student database.

Unit II	Data Modeling and Relational Design	9

Entity Types, Entity Sets-Attributes-Keys: Candidate, Primary, Foreign-RelationshipTypes&Roles-Constraints:Participation,Degree-WeakEntities & Keys - Converting ER Diagrams to Relations-Handling M:N relationships, ISA hierarchies-EER Extensions: Specialization/Generalization.

Suggested Activities:

- **ER Diagram Design Activity** – Students identify entities, attributes, keys, relationships, roles, and constraints, then draw an ER diagram for a college/library management system.
- **ER-to-Relational Mapping Activity** – Students convert given ER diagrams into relational tables, including primary keys, foreign keys, weak entities, and M:N relationships.

Unit III	SQL Commands	9

Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries,correlatedsub-Queries:Useofgroupby,having,orderby,joinanditstypes,Exist,Any, All, view and its types. Transaction control commands.

Suggested Activities:

- **SQL Constraints & Functions Activity** – Students create tables using Primary Key, Foreign Key, UNIQUE, NOT NULL, CHECK constraints and practice IN, numeric, date, string, and aggregate functions.
- **Advanced SQL Query Activity** – Students solve queries using GROUP BY, HAVING, ORDER BY, joins, set operations, sub-queries, correlated sub-queries, EXISTS, ANY, and ALL.

Unit IV	Query Processing and Indexing	9

Parsing, Validation, Query Trees-Query Execution Plans - Cost Estimation-Physical Plan Strategies-Heuristics and Cost-Based Optimization - Disk Storage, RAID-File Organization-B+-Tree Indexes-Hash-Based Indexing: Static & Dynamic-NoSQL.

Suggested Activities:

- **Query Optimization Activity** – Students construct query trees, generate different query execution plans, and compare them using heuristic and cost-based optimization.

- **NoSQL Database Activity** – Students design a simple NoSQL database and perform basic data insertion, retrieval, and update operations using a suitable NoSQL data model.

Unit V	**Transactions,Concurrency and Recovery**	**9**

ACID Properties-Transaction States (active, committed, aborted)-System and User Transactions - Serializability-Locking Protocols (2PL), TimestampOrdering,Deadlocks-IsolationLevels-Log-BasedRecovery:Write-AheadLogging-Checkpoints-ARIES-Shadow Paging.

Suggested Activities:

- **ransaction & Serializability Activity** – Students analyze ACID properties, transaction states, system/user transactions, and serializability using sample transaction schedules.
- **Concurrency Control Activity** – Students simulate Two-Phase Locking (2PL), Timestamp Ordering, isolation levels, and deadlock detection using transaction scenarios.

Weightage: Continuous Assessment:40%, End Semester Examinations:60%.

Assessment Methodology: Assignments - 20%, Quiz- 10%, Competitive Examinations - 20%, Flipped Class - 10%, Internal Examinations - 40%.

Total :45 Periods

Text Book:

1. **1. AbrahamSilberschatz,HenryF.Korth,S.Sudarshan,**DatabaseSystemConcepts, McGraw-HillEducation,**2021**.
2. **Carlos Coronel,Steven Morris,** Database Systems:Design,Implementation,and Management, Cengage Learning, **2024**.

References:

1.Elmasri, Ramez, and Shamkant B. Navathe. ***Fundamentals of Database Systems***. 8th ed., Pearson, 2024.

Eresources/Ematerials:

1. **Link:https://nptel.ac.in/courses/106105175**
2. **Link:https://nptel.ac.in/courses/106106095**
3. **Link:https://ocw.mit.edu/courses/6-5830-database-systems-fall-2010/**
4. **Link:https://online.stanford.edu/courses/soe-ydatabases0005-databases-relational-databases-and-sql**
5. **.Link :http//university.mongodb.com**

CO	CO Description	PO	PSO
CO1	Describe the fundamental concepts,of database management systems and data models.	--	--
CO2	Analyze database methods to ensure efficient data organization and retrieval.	PO1(3)	PSO1(3)
CO3	Evaluate database design approaches in maintaining data integrity	PO3(2)	PSO2(2)
CO4	Design database solutions for real-world applications.	PO2(1)	PSO1(3)
CO5	Develop the ability to apply emerging topics through continuous self-learning.	PO11(2)	--

26CSC13	Design And Analysis Of Algorithm	L	T	P	C
		3	0	0	3

Course Objectives:

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

Unit I	Introduction	9

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm -Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort.

Suggested Activity: Implement linear search, binary search, interpolation search, insertion sort and heap sort. Analyze and compare their time and space complexities for different input sizes.

Unit II	Graph Algorithms	9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path:Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.

Suggested Activity: Represent a graph using adjacency matrix and adjacency list. Implement DFS and BFS, and apply Prim's, Kruskal's and Dijkstra's algorithms to solve graph problems.

Unit III	Algorithm Design Technique	9

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

Suggested Activity: Implement merge sort and quick sort using divide and conquer. Solve matrix-chain multiplication and activity selection problems using dynamic programming and greedy techniques.

Unit IV	State Space Search Algorithms	9

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

Suggested Activity: Implement backtracking solutions for the N-Queens, subset sum and graph colouring problems. Apply branch and bound to solve the assignment and knapsack problems.

Unit V	NP-Complete And Approximation Algorithm	9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP–3-CNFproblem.ApproximationAlgorithms:TSP-Randomized Algorithms:conceptand application - primality testing - randomized quick sort - Finding k^{th} smallest number

Suggested Activity: Identify NP-hard and NP-complete problems and demonstrate problem reduction using TSP and 3-CNF. Implement randomized quick sort and an approximation algorithm for TSP.

Weightage: Continuous Assessment:40%, End Semester Examinations:60%.

Assessment Methodology: Assignments - 20%, Quiz- 10%, Competitive Examinations - 20%, Flipped Class - 10%, Internal Examinations - 40%.

Total :45 Periods

Text Book:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms*, **4th Edition**, The MIT Press, 2022.
2. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, *Computer Algorithms/C++*, **2nd Edition (Updated/VTU Print)**, Universities Press / Orient Blackswan, 2019.

References:

1. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, **3rd Edition (Pearson India Reprint)**, Pearson Education, 2017
2. Steven S. Skiena, *The Algorithm Design Manual*, **3rd Edition**, Springer, 2020.

E-Resources :

1. *Design and Analysis of Algorithms*, Swayam-NPTEL Platform, 2026.
2. MIT OpenCourseWare, Spring 2020.
3. *Data Structures and Algorithms (DSA) Learning Path*, GeeksforGeeks All-in-One Portal, 2026.

CO	CO Description	PO	PSO
CO1	Analyze algorithms using time and space complexity**, a**symptotic notations, recurrence relations, and lower-bound analysis**,** and apply efficient searching, pattern matching, and sorting techniques.	PO1(3) PO2(3) PO3(3)	PSO1(3) PSO2(3) PSO3(2)
CO2	Apply graph algorithms such as DFS, BFS, minimum spanning tree, shortest path, network flow, and bipartite matching algorithms to solve computational problems.	PO1(3) PO2(3) PO3(3)	PSO1(3) PSO2(3) PSO3(2)
CO3	Design and analyze algorithms using Divide and Conquer, Dynamic Programming, and Greedy techniques for optimization and problem-solving.	PO1(3) PO2(3) PO3(3)	PSO1(3) PSO2(3) PSO3(3)
CO4	Develop solutions using Backtracking and Branch and Bound techniques for state-space search problems such as N-Queens, Knapsack, TSP, Assignment, and 15-Puzzle.	PO1(3) PO2(3) PO3(3)	PSO1(3) PSO2(3) PSO3(2)
CO5	Analyze tractable, intractable, NP-hard and NP-complete problems, and apply reduction, approximation, and randomized algorithm techniques to solve computationally difficult problems.	PO1(3) PO2(3) PO3(3)	PSO1(2) PSO2(3) PSO3(3)

26AD402	Artificial Intelligence Essentials and Standards	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to introduce the essential concepts of Artificial Intelligence, covering key areas such as search strategies, knowledge representation, planning, learning and communication.

UNIT I	Introduction	9

Artificial Intelligence (AI) – Applications and Future - Intelligent Agents: Agents and Environments – Characteristics - Task Environments & their properties – Types – Architecture – Problem solving approach to AI problems.

Activities

- Assignment: Impact of AI in the next 10 years.
  Quiz: Agents and Environments.

UNIT II	Search Strategies	9

Uninformed Search: Breadth First Search (BFS) – Depth First Search (DFS) - Depth-Limited Search (DLS) - Informed Search: Greedy Best First Search – A* Search – Iterative Deepening A* Search (IDA*). Local Search Algorithms and Optimization Problems: Hill Climbing - Simulated Annealing – Genetic Algorithms – Beam Search – Local Beam Search - Constraint Satisfaction Problems (CSPs) - Adversarial Search.

Activities:

- Project based learning:
  - Solve a CSP like Sudoku.
  - Develop a Tic-Tac-Toe AI.

UNIT III	Knowledge Representation in Logic	9

Propositional Logic Vs Predicate Logic - First Order Predicate Logic: Syntax - Semantics – Usage - Knowledge Representation. Inference in First Order Logic: Unification - Resolution – Forward Chaining - Backward Chaining - Simple Logic programming using Prolog for Unification, Resolution, Forward and Backward Chaining.

Activities:

- Review of GATE Questions.
- Assignment: Building a Simple Rule based expert system

UNIT IV	Semantic Modeling and Planning	9

Knowledge Representation: Ontological Engineering - Categories and Objects – Events - Mental Events and Mental Objects. Reasoning Systems for Categories - Reasoning with Default Information. Planning in AI: Problems – Algorithms – Forward State Space Search – Backward State Space Search – Heuristics – Graphs.

Activities:

- Flipped Class Room: For a given scenario, identify the different objects, events, categories and their relationships
- Quiz: Planning problems.

UNIT V	Learning and Communication And Standards	9

Learning in AI: Supervised Learning – Unsupervised Learning – Reinforcement Learning. Agent communication – Criteria for evaluation – Conceptual Foundations – Traditional Software Engineering Approaches – Agent Communication Languages (ACL) – Commitment Protocols – Modelling Communications.

Introduction to AI Standards-AI Governance and Risk Management-Responsible and Ethical AI-AI Safety, Security and Reliability-Data and Privacy Standards--AI Lifecycle Standards-Important AI Standards and Frameworks.

Activities:

- Assignment: Real world applications of different learning models.
- Quiz: Agent Communication.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.
Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).
TOTAL: 45 PERIODS

Text Books:

1. Artificial Intelligence: A Modern Approach — Stuart Russell and Peter Norvig
2. Artificial Intelligence: Foundations of Computational Agents — David L. Poole and Alan K. Mackworth
3. Artificial Intelligence — Elaine Rich and Kevin Knight

References:

1. Russell and P. Norvig, —Artificial Intelligence: A Modern Approach‖, Pearson, Fourth Edition, 2020.
2. Gerhard Weiss, —Multiagent Systems‖, Second Edition, MIT Press, 2016.
3. Chandramouli Subramanian and Asha A George, Artificial Intelligence: Principles & Application, Universities Press India Pvt. Ltd. 1st Edition, 2026.
4. Bratko, —Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison Wesley Educational Publishers Inc.,
5. M. Tim Jones, —Artificial Intelligence: A Systems Approach (Computer Science)‖, Jones and Bartlett Learning, Second Edition, 2019.

E-resources:

1. NPTEL - Artificial Intelligence: Knowledge Representation and Reasoning by Prof. Deepak Khemani, IIT Madras https://onlinecourses.nptel.ac.in/noc23_cs09/preview
2. NPTEL - Fundamentals Of Artificial Intelligence by Prof. Shyamanta M. Hazarika, IIT Guwahati https://onlinecourses.nptel.ac.in/noc24_ge47/preview
3. https://www.nist.gov/artificial-intelligence/nist-information-technology-laboratory-itl-ai-program.

CO	CO Description	PO	PSO
CO1	Describe Artificial Intelligence for solving real-world problems.	----	----
CO2	Analyze Artificial Intelligence algorithms for effective design of search techniques and knowledge representation methods.	PO1(3)	PSO1(3)
CO3	Evaluate suitability of Artificial Intelligence models for different problem scenarios.	PO3 (2)	PSO2(2)
CO4	Design appropriate Artificial Intelligence-based solutions using learning and reasoning techniques.	PO2 (1)	PSO1(3)
CO5	Develop the ability to apply emerging Artificial Intelligence tools through continuous self-learning.	PO11(2)	----

(1) = Low; (2) = Medium; (3) = High

26AD403	Data Privacy and Security	L	T	P	C
		3	0	0	3

Course Objectives:

To develop knowledge of data privacy and security principles, apply protection mechanisms and cryptographic techniques, and design secure systems that ensure data confidentiality, integrity, and compliance with regulations.

UNIT I	Data Privacy and Risk Models	9

Data Privacy and Risk Models covers the fundamental concepts of data privacy and security, including the CIA Triad—Confidentiality, Integrity, and Availability. It also explains the difference between data privacy and data security, various cyber threats such as malware, phishing, Denial-of-Service (DoS), and Man-in-the-Middle (MITM) attacks. The unit further introduces vulnerabilities, threat modeling, and privacy risk categories. Activities include an assignment on mapping threats to CIA violations using current events and a quiz on cyber threats.

Activities

- **Assignment:** Map threats to CIA violations using current events.
- **Quiz:** Cyber threats

UNIT II	Cryptographic Techniques for Data Security	9

Cryptographic Techniques for Data Security introduces various methods used to protect data. It covers symmetric encryption techniques such as AES and DES, public-key cryptography including RSA and ECC, hashing techniques such as SHA and HMAC,Diffie - Hellman key exchange, and digital signatures. The unit also covers block cipher modes, key management protocols, elliptic curve cryptography, number theory, Fermat_s and Euler_s theorems, Chinese Remainder Theorem, algebraic structures, primality testing, and factorization. Activities include implementing RSA and SHA for secure message exchange and secure multicast key distribution using the Chinese Remainder Theorem.

Activities

Project Based Experiential Learning:

- Implementation of RSA and SHA for secure message exchange.
- Secure multicast key distribution using Chinese Remainder Theorem

UNIT III	Secure Data Storage and Communication	9

Secure Data Storage focuses on protecting data during storage, processing, and communication. It covers secure file systems, disk encryption, database encryption, secure API access, cloud data security, and token-based authentication mechanisms such as OAuth and JWT. The unit also introduces application layer security, Transport Layer Security (TLS), and IP Security (IPSec). Activities include reviewing GATE questions related to SSL/TLS and IPSec and completing an assignment on cloud data security.

Activities

- **Review of GATE Questions:** SSL/TLS concepts, IPSec
- **Assignment:** Cloud data security

UNIT IV	Privacy-Preserving Computation and Legal Frameworks	9

Privacy-Preserving Computation and Legal Frameworks covers modern techniques for protecting privacy during data processing, including homomorphic encryption, Secure Multi-Party Computation (SMPC), federated learning, and local differential privacy. It also introduces important data protection laws and regulations such as GDPR, NIS2, the Indian IT Act, CERT-In regulations, DPDP Act 2023, and Aadhaar guidelines.Compliance standards and frameworks including ENISA, eIDAS, and ISO 27001 are also discussed. Activities include a federated learning project using the Flower framework, a flipped classroom on cryptographic foundations, an assignment on a real-world GDPR violation, and

a quiz on Indian regulations.

Activities:

- Project Based Experiential Learning: Federated learning using the Flower framework
- .Flipped Class Room: Cryptographic foundations

UNIT V	Emerging Topics in Privacy	9

Emerging Topics in Privacy focuses on current developments and practical challenges in data privacy. It covers the ethics of data privacy, Privacy Impact Assessment (PIA), privacy in online social media, case studies of privacy violations and their impact, secure data sharing in federated systems, and advances in privacy technologies. Activities include a flipped classroom on privacy in online social media and a quiz on privacy technologies.

Activities:

- **Assignment:** Real-world GDPR violation case and its legal impact.
- **Quiz:** Indian Regulations.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Quiz (10%), Assignments (20%), Competitive Examinations (20%), Flipped Class(10%), Internal Examinations (40%).

TOTAL: 45 PERIODS

Text Books:

1. Security in Computing — Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies
2. Computer Security: Principles and Practice — William Stallings and Lawrie Brown
3. Privacy in Context: Technology, Policy, and the Integrity of Social Life — Helen Nissenbaum.

References:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson Education, 8th Edition, 2023.
2. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India, 2nd Edition, 2020.
3. Arvind Narayanan et al., A Primer on Differential Privacy, 2017.
4. S. Bose and P.Vijay Kumar, Cryptography and Network Security, Pearson Education, 1st Edition, 2016.

E-resources:

1. NPTEL: Cyber Security and Privacy- Prof. Saji K Mathew ,IIT Madras https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. NPTEL: Privacy and Security in Online Social Media – Prof. P. Kumaraguru, IIT Madras https://onlinecourses.nptel.ac.in/noc23_cs13/preview
3. Coursera: IBM Cybersecurity Analyst Professional Certificate
4. OWASP Foundation – Resources on secure coding, privacy-by-design, and vulnerability testing

CO	CO Description	PO	PSO
CO1	Describe the fundamental concepts of data privacy, information security, and cyber threats in digital systems.	–	–
CO2	Analyze data protection mechanisms and security policies to understand their applicability.	**PO1 (3)**	**PSO1 (3)**
CO3	Evaluate privacy-preserving techniques and security frameworks for diverse application scenarios.	**PO3 (2)**	**PSO2 (2)**
CO4	Design appropriate data privacy and security solutions for real-world systems.	**PO2 (1)**	**PSO1 (3)**
CO5	Develop the ability to apply emerging security practices through continuous self-learning.	**PO11 (2)**	–

26CSC09	Foundations of DataScience	L	T	P	C
		3	0	2	4

CourseObjectives:

- Toprovide astrong foundationin Python programmingand fundamentaldata science concepts.
- Todevelopskillsin NumPy,Pandas, datawrangling,statisticalanalysis, andexploratory data analysis.
- Tointroducemachinelearning, regression,classification,clustering, anddatavisualization techniques.
- Toenablestudentstoapplydatascience,AI,andvisualizationtechniquestoreal-worldproblems responsibly.

UnitI	Python programming and Data Science Fundamentals	9

PythonBasics–Variables,DataTypes,OperatorsandControlFlow– Functions,ModulesandFileHandling– Lists, Tuples, Sets and Dictionaries – Comprehensions – Introduction to Data Science – Benefits and Applications – Types and Facets of Data – Data Science Process – Problem Definition – Data Collection – Data Preparation – Exploratory Data Analysis – Model Building – Data Mining – Data Warehousing – Basic Statistical Concepts.

Activities: Develop Python programs using variables, data types, operators, control flow, functions,collections and file handling. Perform a mini data science process involving problem definition, datacollection, data preparation and basic statistical analysis.

UnitII	Numpyand DescribingData	9

NumPy Arrays – ndarray – Array Creation and Attributes – Indexing and Slicing – Reshaping – Array Operations – Universal Functions – Aggregation – Broadcasting – Boolean Operations and Masks – Fancy Indexing – Random Number Generation – Types of Data and Variables – Tables and Graphs – Measures of Central Tendency – Measures of Variability – Normal Distribution – Standard (z) Scores.

Activities: Create and manipulate NumPy arrays using indexing, slicing, reshaping, broadcasting, universal functions, aggregation, Boolean masking and random number generation. Calculate measures of central tendency and variability for a given dataset.

UnitIII	Pandas and Data Wrangling	9

Pandas Series and DataFrames – Data Loading and Inspection – Indexing and Selection – Data Cleaning – Missing Data – Data Transformation – String Operations – Hierarchical Indexing – Combining and Merging Datasets –GroupByand Aggregation – Pivot Tables – Reading and Writing CSV,JSONand Database Data – APIs – Basic Data Preprocessing.

Activity: PerformdatawranglingusingPandasbycreatingDataFrames,loadingdatasets,handlingmissing data,transformingdata, mergingdatasets, applyingGroupBy operationsand creatingpivot tables.

UnitIV	Relationships, Eda and Machine Learning	9

Exploratory Data Analysis – Correlation – Scatter Plots – Correlation Coefficient – Regression – Regression Line – Least Squares Regression – Standard Error of Estimate – Coefficient of Determination – Multiple Regression – Regression Towards the Mean – Introduction to Machine Learning – Supervised and Unsupervised Learning–Classification–Regression–Clustering–TrainingandTesting–BasicModel Evaluation–Introduction toArtificialIntelligence andGenerative AI.

Activity: Conduct exploratory data analysis using correlation, scatter plots and regression. Develop a basic machine learning model using training and testing datasets and evaluate its performance.

Unit V	Data Visualization and Data Science Applications	9

Matplotlib – Line, Bar and Scatter Plots – Histograms – Box Plots – Density and Contour Plots – Subplots – Colors, Legends and Annotations – Three-Dimensional Visualization – Seaborn – Statistical and Multivariate Visualization–Heatmaps–Time-SeriesVisualization–GeographicVisualization–InteractiveDashboards–DataStorytelling – DataScienceApplications–Data PrivacyandEthics–Responsible AI.

Activity: Create data visualizations using Matplotlib and Seaborn, including line plots, bar charts, histograms, box plots and heatmaps. Develop a simple data storytelling/dashboard activity and discuss data privacy, ethics and responsible AI

TOTAL:45PERIODS

List ofExperiments:

1. WorkingwithPandasdata frame.
2. BasicPlotsusing Matplotlib.
3. Frequencydistributors,Averages,Variability
4. NormalCurves,Correlationandscatterplots,Correlationcoefficient
5. Regression
6. Z-test
7. T-test
8. Anova
9. Buildingandvalidatinglinearmodels
10. Buildingandvalidatinglogistic models
11. Timeseries analysis

TOTAL:30PERIODS
TOTAL:75PERIODS

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Assignments (10%), Quiz (10%), Competitive Examinations (10%), Flipped Class(10%), Practical (20%), Internal Examinations (40%).

TextBooks:

1.JakeVanderPlas,PythonDataScienceHandbook:EssentialToolsforWorkingwithData,2nd Edition, O'Reilly Media, 2022.

2. WesMcKinney, PythonforData Analysis:Data WranglingwithPandas, NumPy,andJupyter,3rd Edition,O'ReillyMedia,2022.

References:

1. Bruce, P., Bruce, A., & Gedeck, P., Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, 3rd Edition, O'Reilly Media, 2025.

2.Wickham, H., Çetinkaya-Rundel, M., & Grolemund, G., R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, 2nd Edition, O'Reilly Media, 2023.

3.VanderPlas, J., Python Data Science Handbook: Essential Tools for Working with Data, 2nd Edition, O'Reilly Media, 2022.

4. McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly Media, 2022.

5. Grus, J., Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media,

2019.
E-resources: 1. Pythonfor DataScience (Video) – NPTEL 2. DataSciencefor Engineers(Video) – NPTEL 3. PythonforData Science,AI &Development (Video)– Coursera

CO	CODescription	PO	PSO
CO1	Apply Python programming concepts, data science fundamentals, data types, control structures, functions, file handling,andbasicstatisticaltechniquestosolvedata-oriented	PO1 (3) PO2 (2) PO5 (3)	PSO1(3) PSO2(2)
CO2	Apply NumPyarrays, arrayoperations, statistical measures, data manipulation, and numerical computing techniques for describing and analyzing data.	PO1(3) PO2(3) PO5 (3)	PSO1(3) PSO2(2)
CO3	Perform data loading, cleaning, transformation, integration, preprocessing, and analysis using Pandas and other appropriate data handling tools.	PO1(3) PO2(3) PO3(2) PO5(3)	PSO1(3) PSO2(3)
CO4	Analyze datasets using exploratory data analysis, correlation, regression, and basic machine learning techniquesforclassification,regression,andclustering problems.	PO1(3) PO2(3) PO3(3) PO5(3)	PSO1(3) PSO2(3)
CO5	Develop effective data visualizations and communicate data driven insights using Matplotlib and Seaborn while considering data privacy, ethics, and responsible AI practices.	PO1(2) PO3(3) PO5(3) PO8(3) PO10 (3)	PSO1(3) PSO2(3)


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26CSC17	Database Management System Laboratory	L	T	P
		0	0	3

Course Objectives:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions,procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

1.Create a database table,add constraints (primary key,unique,check,Notnull),insert rows, update and delete rows using SQL DDL and DML commands.

2.Create a set of tables,add foreign key constraints and incorporate referential integrity.

3.Query the database tables using different 'where' clause conditions and also implement aggregate functions.

4.Query the database tables and explore sub queries and simple join operations.

5.Query the database tables and explore natural,equi and outerjoins.

6.Write user defined functions and stored procedures in SQL.

7.Execute complex transactions and realize DCL and TCL commands.

8.Write SQL Triggers for insert,delete,and update operations in a database table.

9.Create View and index for database tables with a large number of records.

10.Create an XML database and validate it using XML schema.

11.Create Document, column and graph based data using NOSQL database tools.

12.Develop a simple GUI based database application and incorporate all the above- mentioned features

13.Case Study using any of the real life database applications from the following list

a) Inventory Management for a EM art Grocery Shop
b) Society Financial Management
c) Cop FriendlyApp–Eseva
d) Property Management–eMall
e) Star Small and Medium Banking and Finance

- Build Entity Model diagram.The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views,triggers(for auditing purposes),functions for enabling enterprise grade features.
- Build PLSQL/Stored Procedures for Complex Functionalities,ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

- Ability to show case ACID Properties with sample queries with appropriate settings

Total :45 Periods

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Observation and Record (20%), Practical (30%), Internal Examinations (50%)

CO	CO Description	PO	PSO
CO1	Create databases with different types of key constraints	PO1(3), PO2(3), PO4(3),	PSO1(2), PSO2(3), PSO3(2)
CO2	Construct simple and complex SQL queries using DML and DCL commands	PO1(2),PO 2(2), PO4(3),	PSO1(2), PSO2(1), PSO3(2
CO3	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development	PO1(3),PO 2(3), PO4(2),	PSO1(2), PSO2(3), PSO3(3)
CO4	Create an XML database and validate with meta-data(XML schema).	PO1(1), PO2(3), PO4(3),	PSO1(3), PSO2(1), PSO3(3)
CO5	Create and manipulate data using NOSQL database.	PO1(3),PO 2(2), PO4(1),	PSO1(3), PSO2(1), PSO3(2)

26SDC02	Professional and Corporate Communication Skills	L	T	P	C
		0	0	2	1

Course Objectives:

To develop effective verbal and professional communication skills.
To enhance grammar, vocabulary, reading and listening abilities.
To demonstrate effective speaking, presentation and group discussion skills.
To prepare students for corporate communication and workplace interactions.
To develop professional skills required for interviews, placements and corporate environments.

List of Activities

1. Professional Communication Fundamentals and Workplace Etiquette
2. Verbal Ability, Grammar and Vocabulary Enhancement
3. Reading Comprehension and Critical Verbal Reasoning
4. Listening Skills and Effective Workplace Conversations
5. Professional Speaking, Pronunciation and Presentation Skills
6. Group Discussion, Team Communication and Negotiation Skills
7. Corporate Email, Business Writing and Digital Communication
8. Resume Writing, Self-Introduction and Personal Branding
9. Interview Skills, Corporate Etiquette and Workplace Interaction
10. Mock Corporate Communication, Presentation and Placement Simulation

TOTAL : 30 PERIODS

Assessment Methodology: Observation and Record - 20%, Practical - 30%
Internal Examinations- 50%.

References:

1. Meenakshi Raman & Sangeeta Sharma – Technical Communication: Principles and Practice, Oxford University Press.
2. M. Ashraf Rizvi – Effective Technical Communication, McGraw Hill.
3. Rajendra Pal & H. S. Korlahalli – Essentials of Business Communication, Sultan Chand.
Norman Lewis – Word Power Made Easy, Penguin.
4. John Seely – The Oxford Guide to Writing and Speaking, Oxford University Press.
5. Michael Swan – Practical English Usage, Oxford University Press.

E-resources:

1. https://nptel.ac.in/courses/112107291

CO	CO Description	PO	PSO
CO1	Apply verbal and professional communication techniques in workplace situations.	PO1 (3)	PSO1 (3)
CO2	Demonstrate effective reading, listening, speaking and presentation skills.	PO2 (1) PO3 (3)	PSO1 (3) PSO2 (2)
CO3	Construct professional emails, business documents and other forms of corporate communication.	PO1 (3) PO3 (3)	PSO1 (3) PSO2 (3)
CO4	Demonstrate effective participation in group discussions, interviews and professional interactions.	PO3 (3) PO5 (3)	PSO1 (3) PSO2 (3)
CO5	Develop professional communication profiles through resume preparation, personal branding and placement-oriented activities.	PO1 (3) PO2 (2) PO3 (3)	PSO1 (3) PSO2 (3)

(1) = Low; (2) = Medium; (3) = High

MANDATORY COURSES

26MCC01	Disaster Management and Safety Awareness	L	T	P	C
		1	0	0	-

Course Objectives:
To provide students with fundamental knowledge of natural and man-made disasters, disaster preparedness, risk reduction, emergency response, industrial safety and personal/community safety, enabling them to respond effectively during emergency situations

Unit I	Fundamentals of Disaster Management	3

Disaster, hazard, vulnerability and risk; types of disasters; disaster management cycle; prevention, mitigation, preparedness, response and recovery; disaster risk reduction and early warning systems.

Unit II	Natural Disasters	3

Earthquakes, tsunamis, floods, landslides, cyclones, thunderstorms, droughts and heat waves; causes and impacts; preparedness, mitigation, evacuation and emergency response.

Unit III	Industrial and Man-Made Disasters	3

Industrial hazards and accidents; fire and explosion; chemical leakage; electrical and machinery hazards; biological and transportation disasters; personal protective equipment; hazard identification and risk assessment.

Unit IV	Emergency Response and First Aid	3

Emergency action and evacuation plans; fire prevention and fire extinguishers; basic first aid; bleeding, burns, fractures, electric shock and heat-related emergencies; basic CPR awareness; emergency communication and rescue procedures.

Unit V	Safety and Community Resilience	3

Occupational, laboratory, workshop, road and electrical safety; disaster recovery and rehabilitation; community resilience; role of government agencies, NGOs and volunteers; disaster risk mapping, safety audit, emergency drills and institutional disaster management planning.

TOTAL : 15 PERIODS

Text Books:

1. R. B. Singh, Disaster Management, Rawat Publications, Jaipur, 2015
2. S. K. Singh, Disaster Management, A.K. Publications, New Delhi, 2017.

References:

1. M. M. S. Maheshwari, Disaster Management, Pointer Publishers, Jaipur, 2011.
2. B. K. Khanna, All You Wanted to Know About Disasters, New India Publishing Agency, New Delhi, 2005.
3. National Disaster Management Authority (NDMA), National Disaster Management Guidelines, Government of India.
4. Ministry of Home Affairs, National Disaster Management Plan, Government of India.
5. S. K. Sharma, Disaster Management and Preparedness, CBS Publishers & Distributors, New Delhi.

CO	CO Description	PO	PSO
CO1	Explain the concepts, types and phases of disaster management.	PO9 (2) PO11 (2)	PSO3 (3)
CO2	Identify disaster hazards, vulnerabilities and associated risks.	PO7 (3) PO9 (2)	PSO3 (3)
CO3	Apply appropriate preparedness and mitigation measures for different disasters.	PO9 (2) PO11 (2)	PSO3 (3)
CO4	Demonstrate basic emergency response, first aid, fire safety and evacuation procedures.	PO9 (3) PO10 (2)	PSO3 (3)
CO5	Develop awareness of industrial, occupational, environmental and community safety practices	PO9 (3) PO11 (3)	PSO3 (3)

(1) = Low; (2) = Medium; (3) = High

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