Sri SAI RAM ENGINEERING COLLEGE
An Autonomous Institution
West Tambaram, Chennai - 44
www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

AUTONOMOUS

CURRICULUM AND

SYLLABUS I - V

SEMESTERS

REGULATIONS 2024

Academic Year 2024-25 onwards

SRI SAIRAM ENGINEERING COLLEGE

VISION

To emerge as a ”Centre of excellence “ offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instil high levels of discipline and strive to set global standards, making our students technologically superior and ethically stronger, who in turn shall contribute to the advancement of society and humankind.

MISSION

We dedicate and commit ourselves to achieve, sustain and foster unmatched excellence in Technical Education. To this end, we will pursue continuous development of infra-structure and enhance state-of-the-art equipment to provide our students a technologically up-to date and intellectually inspiring environment of learning, research, creativity, innovation and professional activity and inculcate in them ethical and moral values.

Educational Organization Management System (EOMS) Policy

We at Sri Sai Ram Engineering College are committed to empower our students not only to excel academically but also imbibe essential values, enabling them to become exemplary global citizens. We build a better nation by fostering excellence and innovative practices in Engineering, Technology and Management Education. We are dedicated to consistently enhancing our systems, infrastructure and services to meet the needs and expectations of all our stakeholders for sustainable growth

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

VISION

To emerge as a “Centre of Excellence” in the field of Cybersecurity, providing cutting-edge skill sets, deep domain expertise, and industry collaborations to nurture students into highly skilled, ethical professionals who contribute to safeguarding digital ecosystems and inspire them to become responsible members of society.

MISSION

M1. To facilitate a high-quality learning environment with excellent teaching and adequate infrastructure.

M2. To attain excellence and nurture growth in the field of computer science, emphasizing cybersecurity.

M3. Collaborate with industries to create opportunities for advanced real-time projects and internships, connecting academic learning with practical application.

M4. Promote moral and ethical values within the curriculum to enhance interpersonal skills and social awareness.

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA101	Matrices and Calculus	3	1	0	4	4
2	24HSEN101	Communicative English	3	0	0	3	3
3	24BSPH101	Engineering Physics	3	0	0	3	3
4	24BSCY101	Engineering Chemistry	3	0	0	3	3
5	24ESCS101	Problem Solving and Programming in C	3	0	0	3	3
6	24ESGE101	Engineering Graphics	1	2	0	3	3
7	24HSTA101	Heritage of Tamils	1	0	0	1	1
		PRACTICALS					
1	24BSPL101	Physics and Chemistry Laboratory	0	0	4	4	2
2	24ESPL101	Programming in C Laboratory	0	0	2	2	1
		VALUE ADDITIONS - I					
1	24ESID101	Idea Engineering Lab -I	0	0	2	2	1
2	24ENTP101	Functional Life Skills	1	0	1	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BOS					
					Total	**30**	**25**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA201	Discrete Structures	3	1	0	4	4
2	24HSEN201	Professional English	2	0	0	2	2
3	24BSPH203	Physics for Information Science	3	0	0	3	3
4	24BSCY201	Chemistry for Environment and Sustainability	3	0	0	3	3
5	24HSTA201	Tamils and Technology	1	0	0	1	1
6	24HSNC201	NCC Course Level 1*	2	0	0	2	0
		PRACTICALS					
1	24ESGE102	Engineering Practices Laboratory	0	0	4	4	2
2	24ITPT201	OOPS Using Java Laboratory with Theory	1	0	4	5	3
		VALUE ADDITIONS - II					
1	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
2	24ENTP201	Digital Dynamics	1	0	1	2	0
		ONLINE SUPPLEMENTARY					
1	24ESMC201	MS Office (Mandatory - NC)	0	0	0	0	0
					Total	**28**	**19**

*only for NCC cadets

Approved by
Academic Council Meeting
No. 05 Dated: 27/4/25

Chairman
Board of Studies
Department of Computer Science and Engineering (Cyber Security)

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA306	Linear Algebra and Number Theory	3	1	0	4	4
2	24SCPC301	Cyber Security Essentials	3	0	0	3	3
3	24SCPC302	Computer Networks	3	0	0	3	3
4	24ITPC301	Data Structures and Algorithms	3	0	0	3	3
5	24ITPW301	Database Management Systems with lab	3	0	2	5	4
6	24HSMC301	Universal Human Values- II Understanding Harmony	3	0	0	3	3
7	24HSNC301	NCC course Level 2*	3	0	0	0	0
		PRACTICALS					
1	24CIPT301	Digital Design and Computer Organization Laboratory with Theory	1	0	4	5	3
2	24ITPL301	Data structures and Algorithms Laboratory	0	0	4	4	2
		VALUE ADDITIONS - III					
1	24SCTP301	Aptitude Skills - I	0	0	2	4	1
2	24SCID301	Innovative Design Lab - I	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
1	24ESMC301	Joy of Computing using Python (Mandatory - NC)	2	0	0	0	0
				Total		**36**	**27**

*only for NCC cadets

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA406	Probability and Statistics with R Programming	3	1	0	4	4
2	24SCPC401	Cryptography and Information Security	3	0	0	3	3
3	24SCPC402	Machine Learning Essentials for Cyber Security	3	0	0	3	3
4	24SCPC403	Software Development and Design Thinking	3	0	0	3	3
5	24xxOE9xx	Open Elective - I #	3	0	0	3	3
6	24HSNC401	NCC course Level 3*	3	0	0	0	0
		PRACTICALS					
1	24SCPL401	Cryptography and Cyber Security Lab	0	0	2	2	1
2	24SCPT401	Operating System in Kali Linux lab with Theory	1	0	4	5	3
		VALUE ADDITIONS - IV					
1	24SCTP401	Aptitude Skills - II	0	0	2	2	0
2	24SCID401	Innovative Design Lab - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
				Total		**27**	**21**

Logistics Information System

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SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CP	C	PREREQUISITE COURSES
		THEORY						
1	24SCPC501	Theoretical Computer Science	3	0	2	5	4	24BSMA201, 24ESCS101 24ITPC301
2	24SCPC502	Secure Coding	3	0	0	3	3	24SCPC302, 24ITPW301
3	24xxEL5XX	Professional Elective-I	3	0	0	3	3	-
4	24xxEL5YY	Professional Elective-II	3	0	0	3	3	-
5	24xxOE9xx	Open Elective-II	3	0	0	3	3	-
6	24MGMC501	Constitution of India	2	0	0	2	0	-
		PRACTICALS						
1	24SCPL501	Secure Coding Laboratory	0	0	4	4	2	-
2	24SCPT502	Cloud Security Laboratory with Theory	1	0	4	5	3	24SCPC301, 24SCPC401
		VALUE ADDITIONS						
1	24SCTP501	Skill Enhancement	0	0	2	2	1	-
2	24SCID501	Prototype Development Laboratory-I	0	0	2	2	1	24SCID301, 24SCID401
		ONLINE SUPPLEMENTARY						
		As recommended by BoS						
		Total				32	23	

Design of Internet of Things

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24SCPC601	Penetration Testing and Ethical Hacking	3	0	0	3	3
2	24xxEL6vv	Professional Elective - III	3	0	0	3	3
3	24xxEL6ww	Professional Elective - IV	3	0	0	3	3
4	24xxEL6xx	Professional Elective - V	3	0	0	3	3
5	24xxOE9xx	Open Elective - III	3	0	0	3	3
6	24HSMG601	Principles of Engineering Management	3	0	0	3	3
		PRACTICALS					
1	24SCPL601	Penetration Testing and Ethical Hacking Lab	0	0	4	4	2
		VALUE ADDITIONS - VI					
1	24SCTP601	Technical Skill	0	0	2	2	0
2	24SCID601	Prototype Development Laboratory - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
		Total				26	21

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SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24SCPC701	Cyber Forensics	3	0	2	5	4
2	24xxEL7xx	Professional Elective - VI	3	0	0	3	3
3	24xxOL7xx	Open Elective - IV	3	0	0	3	3
4	24MGEL703	Creative Innovation Entrepreneurship	3	0	0	3	3
		PRACTICALS					
1	24SCPL701	Cyber Forensics Laboratory	0	0	4	4	2
2	24SCPJ701	Project Work- Phase I	0	0	8	8	4
		VALUE ADDITIONS - VII					
1	24SCTP701	Company Specific Skills	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
		Total				31	20

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	TOTAL CONTACT HOURS	CREDITS
		THEORY					
1	24xxEL8xx	Professional Elective - VII	3	0	0	3	3
		PRACTICALS					
1	24SCPJ801	Project Work- Phase II	0	0	12	12	6
		VALUE ADDITIONS - VIII					
1	24SCIN801	Internship	0	0	9	9	3
		Total				24	12

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PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL501	Exploratory Data Analysis with R Software	3	Artificial Intelligence	24BSMA406
2	24AIEL502	Artificial Intelligence Fundamentals And Applications	3	Artificial Intelligence	24SCPC402
3	24AIEL503	Human Computer Interaction	3	Artificial Intelligence	
4	24ITPC401	User Interface / User Experience (UI/UX) Designing Skills	3	Web and App Development	24SCPC302
5	24CSEL501	Introduction To Mobile Technologies	3	Web and App Development	24SCPC302
6	24CSEL502	No SQL Databases	3	Web and App Development	24ITPW301, 24ITPT201
7	24SCEL501	Fundamentals of Quantum computing	3	Quantum Computing	24BSMA201, 24ESCS101, 24BSMA101
8	24SCEL502	Quantum Tools And Applications	3	Quantum Computing	24BSMA201, 24BSMA306
9	24SCEL503	Quantum Information Theory	3	Quantum Computing	24BSPH203, 24ECPC303
10	24SCEL504	Applied Fintech for Business	3	Fintech and Blockchain	
11	24SCEL505	Payments, Crypto-Currencies & Alternative Finance	3	Fintech and Blockchain	24SCPC401
12	24SCEL506	Blockchain for Fintech Applications	3	Fintech and Blockchain	24SCPC401

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL504	Business Intelligence	3	Artificial Intelligence	
2	24AIEL505	Machine Learning Essentials	3	Artificial Intelligence	24SCPC402
3	24AIEL506	Decision Support Systems	3	Artificial Intelligence	
4	24CSEL511	Usability Designing of Software Application	3	Web and App Development	24SCPC403
5	24CSEL509	Web Design	3	Web and App Development	24SCPC302
6	24CSEL510	Mobile Application Development	3	Web and App Development	24SCPC302
7	24SCEL507	Introduction to Quantum Programming	3	Quantum Computing	24BSMA201, 24BSMA306
8	24SCEL508	Quantum Algorithms	3	Quantum Computing	24BSMA201, 24ITPC301, 24SCPC501
9	24SCEL509	Quantum-Classical Systems of Computing	3	Quantum Computing	24BSMA201, 24ITPC301
10	24SCEL510	Financial and Corporate Accounting	3	Fintech and Block Chain	24SCPC402
11	24SCEL511	Banktech, Insurtech & Regtech	3	Fintech and Block Chain	
12	24SCEL512	Fintech For Capital Markets	3	Fintech and Block Chain	24MGOE904

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PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL601	Introduction To Large Language Models	3	Artificial Intelligence	
2	24AIEL602	Information Retrieval Systems	3	Artificial Intelligence	
3	24AIEL603	Knowledge Representation And Reasoning	3	Artificial Intelligence	24BSMA306
4	24CSEL601	JEE Framework	3	Web and App Development	
5	24CSEL602	Modern web Applications (CSBS)	3	Web and App Development	
6	24CSEL603	Cloud and DevOps	3	Web and App Development	
7	24SCEL601	Secure Computing in the Quantum Era	3	Quantum Computing	
8	24SCEL602	Quantum Network Security	3	Quantum Computing	
9	24SCEL603	Cryptographic Protocols in Quantum Networks	3	Quantum Computing	
10	24SCEL604	Blockchain - Based Financial Systems	3	Fintech and Block Chain	
11	24SCEL605	Identify and Access Management Systems	3	Fintech and Block Chain	
12	24SCEL606	Financial Technology Security	3	Fintech and Block Chain	

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL604	Conversational Systems	3	Artificial Intelligence	
2	24AIEL605	AI For Computer Vision	3	Artificial Intelligence	24SCPC402
3	24AIEL606	Time Series Analysis	3	Artificial Intelligence	
4	24CSEL610	Micro services Architecture	3	Web and App Development	
5	24CSEL611	RESTful APIs & GraphQL	3	Web and App Development	
6	24CSEL612	Back-End frameworks and API	3	Web and App Development	
7	24SCEL607	Quantum Artificial Intelligence (Quantum AI)	3	Quantum Computing	
8	24SCEL608	Quantum Machine Learning (QML) Fundamentals	3	Quantum Computing	
9	24SCEL609	Quantum Computing for Data Science	3	Quantum Computing	
10	24SCEL610	FinTech Risk Management	3	Fintech and Block Chain	
11	24SCEL611	Financial Compliance and Financial Compliance and Governance	3	Fintech and Block Chain	
12	24SCEL612	Regulatory Technology (Reg Tech)	3	Fintech and Block Chain	

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PROFESSIONAL ELECTIVES - V

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL607	Social Network Analysis	3	Artificial Intelligence	
2	24AIEL608	Fundamentals of Agent Based Intelligent System	3	Artificial Intelligence	
3	24AIEL609	Introduction to Deep Learning	3	Artificial Intelligence	24BSMA201
4	24CSEL619	MERN stack development	3	Web and App Development	
5	24CSEL620	Multitier web Architecture	3	Web and App Development	
6	24CSEL621	Front End framework Engineering	3	Web and App Development	
7	24SCEL613	Quantum System Engineering	3	Quantum Computing	
8	24SCEL614	Quantum System Architecture	3	Quantum Computing	
9	24SCEL615	Quantum Cloud Computing	3	Quantum Computing	
10	24SCEL616	Insurance Technology (InsurTech)	3	Fintech and Block Chain	
11	24SCEL617	Tokenized Financial Systems	3	Fintech and Block Chain	
12	24SCEL618	Blockchain Governance Models	3	Fintech and Block Chain	

PROFESSIONAL ELECTIVES - VI

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL610	Generative AI Essentials	3	Artificial Intelligence	
2	24AIEL611	Modern Machine Learning Techniques	3	Artificial Intelligence	
3	24AIEL612	Introduction to Reinforcement Learning	3	Artificial Intelligence	
4	24CSEL701	Kotlin Programming	3	Web and App Development	
5	24CSEL702	Full Stack Software Development	3	Web and App Development	
6	24CSEL703	Building Web Services with Java Network Programming	3	Web and App Development	
7	24SCEL701	Post-Quantum Cryptography	3	Quantum Computing	
8	24SCEL702	Quantum Optimization Techniques	3	Quantum Computing	
9	24SCEL703	Quantum-Enhanced Deep Learning	3	Quantum Computing	
10	24SCEL704	Decentralized Finance (DeFi) Systems	3	Fintech and Block Chain	
11	24SCEL705	Decentralized Autonomous Organizations (DAOs)	3	Fintech and Block Chain	
12	24SCEL706	Blockchain Attack Vectors and Defense Mechanisms	3	Fintech and Block Chain	

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PROFESSIONAL ELECTIVES - VII

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL704	Expert Systems and Applications	3	Artificial Intelligence	
2	24AIEL705	Cognitive Computing	3	Artificial Intelligence	
3	24AIEL706	Problem Solving using Intelligent Agents	3	Artificial Intelligence	
4	24CSEL707	Web Security	3	Web and App Development	
5	24CSEL708	Game Design and Development	3	Web and App Development	
6	24CSEL709	Mobile Forensics	3	Web and App Development	
7	24SCEL707	Quantum-Enabled IoT Security	3	Quantum Computing	
8	24SCEL708	Quantum Software Testing	3	Quantum Computing	
9	24SCEL709	Quantum Computation & Quantum Information	3	Quantum Computing	
10	24SCEL710	Blockchain Scalability and Performance	3	Fintech and Block Chain	
11	24SCEL711	FinTech Regulatory Frameworks	3	Fintech and Block Chain	
12	24SCEL712	Adversarial Attack Modeling in Financial Technologies	3	Fintech and Block Chain	

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will thrive globally as cyber security professionals, entrepreneurs, and innovators, delivering secure and impactful digital solutions.

PEO2: Graduates will advance through higher studies, global certifications, and lifelong learning to address emerging cyber threats.

PEO3: Graduates will lead, communicate, and collaborate effectively to build resilient and innovative cyber security solutions.

PEO4: Graduates will uphold ethics, inspire digital trust, and safeguard society in a sustainable, connected world.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 Demonstrate basic knowledge of computer applications and apply standard practices in software project development.

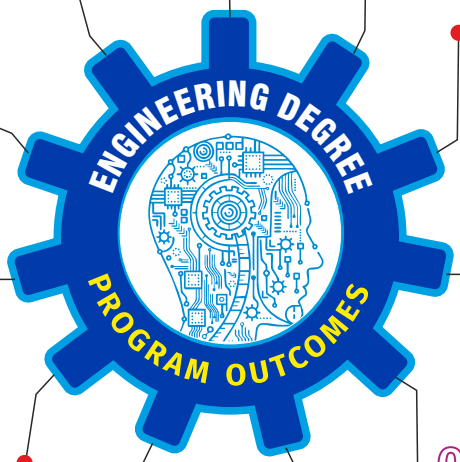
PSO2 Design and develop secure computing systems using cybersecurity frameworks, cryptography, and ethical hacking to address real-world cyber threats.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences (BS)	18	32	30
Engineering Sciences (ES)	5	12	09
Humanities and Social Sciences (HS)	8	13	13
Professional Electives (EL)	15	26	26
Program Core + Program Lab (PC+PL)	22	47	37
Program theory with Lab (PW) / Program Lab With Theory (PT)	11	25	18
Open Elective (OE)	7	12	12
Training & Placement (TP)	2	14	4
Innovation & Development (ID) / Project (PJ)	10	32	16
Internships (IN)	2	9	3
Mandatory Courses (MC)	NA	4	NA
Total		**226**	**168**

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



01 Engineering knowledge
Apply math, science, computing, and engineering knowledge to solve complex engineering problems.

02 Problem Analysis
Identify and analyze complex problems using research to draw valid conclusions.

03 Design / Development of solutions
Design practical and innovative solutions considering safety, cost, culture, and the environment.

04 Investigate complex problems
Use research methods—experiments, modeling, and data analysis—to investigate complex problems.

05 Engineering Tool Usage
Apply modern engineering and IT tools for analysis and problem solving with awareness of their limits.

06 The Engineer and the World
Assess societal, environmental, legal, health, and cultural impacts of engineering solutions.

07 Ethics
Follow professional ethics, human values, diversity, inclusion, and legal responsibilities.

08 Individual & Teamwork
Work effectively as an individual and as a team member or leader in multidisciplinary groups.

09 Communication
Communicate clearly in writing and presentations for diverse technical and non-technical audiences.

10 Project Management and Finance
Apply management and financial principles to plan and execute projects effectively.

11 Life-long learning
Engage in independent lifelong learning and adapt to new technologies with critical thinking.

SEMESTER - I

24BSMA101 - SDG NO. 4	MATRICES AND CALCULUS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To understand and gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives, maxima and minima for functions of several variables.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To provide understanding of double integration, triple integration and their applications.
- To impart the knowledge of Fourier series..

MODULE - I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem (without proof) – Symmetric and orthogonal matrices - Reduce the Quadratic to Canonical form using orthogonal transformation - Nature of Quadratic forms.

MODULE - II FUNCTIONS OF SEVERAL VARIABLES 12

Limits, Continuity - Definitions - Partial derivatives -Taylor's series - Jacobians, Maxima and Minima - Method of Lagrange multipliers.

MODULE - III VECTOR DIFFERENTIATION 4

Scalar and Vector valued functions- Gradient and Directional derivatives – Tangent plane - Divergence and Curl- Irrotational and Solenoidal vector fields - Scalar and Vector Potentials - Vector identities (without proof).

MODULE - IV VECTOR INTEGRATION 8

Line integral over a plane curve - Surface integral - Area of a curved surface - Volume integral - Greens, Gauss divergence and Stoke's theorems -Verification and Application in evaluating line, Surface and Volume integrals. Problems involving Cube and Cuboids.

MODULE - V MULTIPLE INTEGRALS 12

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

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

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Humanities & Science

MODULE - VI FOURIER SERIES **12**

Fourier series – Convergence of Fourier series -Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.

REFERENCES:

1. Higher Engineering Mathematics, B. V. Ramana, 11th reprint, Tata McGraw-Hill, New Delhi, 2010.
2. Engineering Mathematics for first year, T. Veerarajan, Tata McGraw-Hill, New Delhi, 2008.
3. A text-book of Engineering Mathematics, N.P. Bali and Manish Goyal, 9th Edition, Laxmi Publications, Reprint, 2008.
4. Higher Engineering Mathematics, B. S. Grewal, 40th Edition, Khanna Publishers, New Delhi, 2007.

WEB REFERENCES:

1. https://math.mit.edu/~gs/linearalgebra/ila0601.pdf
2. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/
3. https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial derivatives/
4. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/

ONLINE RESOURCES:

1. https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear algebra-introduction-to-eigenvalues-and-eigenvectors
2. https://www.khanacademy.org/math/differential-calculus

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Diagonalize the matrix using orthogonal transformation and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
2. Evaluate the limit, examine the continuity and use derivatives to find extreme values for functions of several variables. (K3)

Recommended by Board of Studies of H&S dept.

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Humanities & Science

3. Compute the derivatives of scalar and vector point functions. (K3)
4. Use the vector point function to establish the relation between line, surface and volume integrals. (K3)
5. Apply double and triple integrals to find the area and the volume of a region. (K3)
6. Compute Fourier series expansion of a function. (K3)

CO-PO Mapping:

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

SEMESTER - I

24HSEN101 - SDG NO. 4	COMMUNICATIVE ENGLISH	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Develop the basic LSRW skills
- Acquire enhanced knowledge of English grammar
- Improve modern and technical vocabulary
- Enhance the communicative and cognitive skills
- Interpret the texts and write reviews critically

MODULE - I COMMUNICATION PROCESS 8

Listening – informal conversations - Speaking – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - Reading comprehension – skimming/ scanning/ predicting – question & answers – objective and descriptive answers - Writing – paragraph writing, personal notes - Language Development – parts of speech, prefix, suffix, word formation

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

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Humanities & Science

MODULE - II LANGUAGE BARRIERS, LEVELS AND CHANNELS 8

Listening –interviews - Speaking – describing a simple process – asking and answering questions - Reading – critical reading – finding key information in a given text – ideation, mind mapping - Writing - dialogue,, instructions – Language Development – regular, irregular verbs, tenses, framing questions,

MODULE - III NARRATION AND SUMMATION 8

Listening - long texts - TED talks - extensive speech on current affairs - Speaking – role plays – asking about routine actions and expressing opinions - Reading- longer texts & making a critical analysis of the given text - Writing – essay (comparative / analytical), jumbled sentences, recommendations - Language Development – writing single sentence definitions, sequence words

MODULE - IV WRITING MECHANICS 7

Listening -debates and discussions – practicing multiple tasks –Speaking - self introduction about friends/ places/ hobbies - Reading -Making inference from the reading passage – Predicting the content of the reading passage - Writing – informal letters, e-mails - accuracy, coherence, brevity – Language Development- single word substitutes, compound words- conditionals

MODULE - V INTERPRETATION SKILLS 7

Listening- popular speeches and presentations - Speaking - impromptu speeches -Reading - articles – magazines - Writing – review writing, channel conversion – bar diagram/ table, poster/ picture interpretation - Language Development – modal verbs, collocations, 21st century vocabulary

MODULE - VI COGENT EXPOSITIONS 7

Listening - Motivational speeches - Speaking - Debates and discussion - Reading - analytical reading - newspapers - Writing - process description - Language Development - voices, sentences expressing purpose, synonyms & antonyms

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. A Course in Technical English, D. Praveen Sam and K.N. Shoba, Cambridge University Press, 2020

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Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narasakrishnan
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Humanities & Science

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al.Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

ONLINE RESOURCES:

1. https://wwPearson.com/english/catalogue/business-english/technical-english.html
2. https://ww.cambridgeenglish.org/learning-english/free-resources/

OUTCOMES:

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

1. Improve understanding and application of listening, speaking, reading, and writing skills (K2)
2. Demonstrate the ability to write personal notes, clear and coherent paragraphs (K2)
3. Apply analytical skills to write essays, rearrange jumbled sentences, and formulate recommendations (K3)
4. Apply skills to develop email etiquette and construct professional emails and informal letters (K3)
5. Analyze and interpret data to write comprehensive and effective reviews (K3)
6. Enhance vocabulary, improve grammatical accuracy, and confidently engage in debates (K2)

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Meeting No. 6 Dated: 31/05/2024

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CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	-	3	-	2	-	-
CO5	-	-	-	-	-	-	-	-	3	-	2	-	-
CO6	-	-	-	-	-	-	-	-	3	-	2	-	-

SEMESTER - I

24BSPH101 - SDG NO. 4,7,9,11	ENGINEERING PHYSICS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basic concepts of mechanics and its use in engineering applications.
- To understand the concept of waves and lasers and its applications.
- To illustrate the various laws of electromagnetic waves and its applications.
- To apply the concepts of quantum mechanics to engineering studies.
- To understand the basics of crystal for engineering applications.
- To identify the basic principles involved in thermal physics and its applications.

MODULE - I PROPERTIES OF MATTER 8

Elasticity – Hooke's law- Poisson's ratio - Stress - strain diagram and its uses - Twisting couple - shaft - Torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders.

MODULE - II MECHANICAL WAVES AND LASERS 7

Waves on a string – standing waves – traveling waves – Energy transfer of a wave – Reflection and refraction of light waves – interference –Theory of air wedge and experiment - Theory of laser – characteristics – Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd-YAG laser, CO_2 laser – Basic applications of lasers in industry.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

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MODULE - III ELECTROMAGNETIC WAVES **8**

The Maxwell's equations – wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field – properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter – polarization – Producing electromagnetic waves – Energy and momentum in EM - Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

MODULE - IV BASIC AND APPLIED QUANTUM MECHANICS **7**

Black body radiation – Planck's derivation – Electrons and matter waves –The Schrodinger equation (Time dependent and time independent forms) – significance of wave function – Normalization –Free particle – particle in a infinite potential well: 1D, 2D and 3D Boxes; - Barrier penetration and quantum tunneling (qualitative) – Scanning Tunneling Microscope.

MODULE - V CRYSTAL PHYSICS **8**

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - X-Ray diffraction - Calculation of number of atoms per unit cell - Atomic radius - Coordination number – packing. factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy. Crystal Growth: Chochralski technique - Molecular beam epitaxy.

MODULE - VI THERMAL PHYSICS **7**

Transfer of heat energy - Conduction, Convection and Radiation - Thermal conductivity, Forbe's method and Lee's disc method - Conduction through compound media - series and parallel methods - Heat exchangers - Refrigerators and Solar water heaters.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattacharya & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu And P.G. Kshirsagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

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Humanities & Sciences

REFERENCES:

1. D. Halliday, Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma," Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.
7. Arthur Beiser. "Concepts of Modern Physics", McGraw-Hill, 6th Edition. 2003.
8. Charles Kittel, "Introduction to Solid State Physics". John Wiely & Sons. 8th Edition, 2005.

OUTCOMES:

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

1. Apply the concepts of stress, torsion, and bending to study the mechanical behavior of structural elements using theoretical and experimental methods. (K3)
2. Analyze wave phenomena and interference to study energy transfer, and evaluate laser principles with their industrial applications. (K4)
3. Examine Maxwell's equations and electromagnetic wave theory to analyze wave propagation, polarization and reflection-transmission phenomena in different media (K4)
4. Utilize the principles of quantum mechanics to explain black body radiation, matter waves, particle confinement in potential wells and tunneling phenomena. (K3)
5. Examine and compare the characteristics of various crystal structures, polymorphic forms, and crystal growth techniques. (K4)
6. Apply the principles of heat transfer to determine the thermal conductivity and explain the role of heat exchangers in refrigerators and solar water heaters. (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2019

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CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

SEMESTER - I

24BSCY101 – SDG NO. 4,7,8,9,11,12,17	ENGINEERING CHEMISTRY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To enumerate the importance, synthesis, and applications of polymers.
- To impart basic knowledge of chemistry and the principles involved in electrochemistry, energy storage devices, and their commercial applications.
- To familiarize the fundamental laws and concepts of important photophysical and photochemical processes, as well as spectroscopy.
- To explore the fundamental concepts, laws, and principles of thermodynamics, and apply its derivations to optimize and innovate engineering processes across various disciplines.
- To comprehend the chemistry of fuels and combustion, and their applications across various engineering and industrial processes.
- To gain an understanding of the emergence and challenges of nanomaterials and nanotechnology across various scientific and technological disciplines.

MODULE - I POLYMER CHEMISTRY 8

Polymers: Definition, Degree of polymerization, Functionality of monomer, Classification of polymer with examples, Types of polymerization, Mechanism of addition polymerization (Free radical mechanism).

Plastics: Definition and Characteristics - Thermoplastics & Thermosets. Preparation, properties and engineering applications of plastics -PVC, Teflon, Kevlar and Bakelite.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 3rd May

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Fibers: Characteristics fibers - Preparation, properties and applications of Nylon and Dacron. Biodegradable polymers & Conducting Polymers: Characteristics, Classification and their applications.

MODULE - II ELECTROCHEMISTRY AND BATTERY TECHNOLOGY 7

Electrochemistry: Types of Cells (Electrochemical and Electrolytic cell) – Redox reaction – Single and Standard electrode potential, Reference electrodes - SHE, Calomel electrode, Measurement of Single Electrode Potential, Nerns't equation (Derivation & Problems), Electrochemical series and its significance.

Batteries: Evolution of batteries – Primary and Secondary battery (Lead acid battery), Next Generation Battery Technology (NGBT) - Solid-state batteries (Lithium-ion), Sodium-ion batteries.

MODULE - III PHOTOCHEMISTRY & SPECTROSCOPY 7

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination-Photo processes - Jablonski diagram (Internal Conversion, Intersystem crossing, Fluorescence, Phosphorescence), Chemiluminescence and Photo-sensitization.

Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and Rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

MODULE - IV CHEMICAL THERMODYNAMICS 8

Terminology of Thermodynamics - Laws of Thermodynamics – I law – Significance – Mathematical formulation and its applications. II law – Need for the II law. Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes, entropy of phase transitions; Clausius inequality. Helmholtz and Gibbs free energy functions, Criteria of spontaneity, Maxwell relations, Gibbs-Helmholtz equation, Van't Hoff Isotherm and Isochore.

MODULE - V FUELS 8

Fuels: Introduction –Classification of fuels – Coal – Analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – Octane number and Cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gas (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of fuels: Introduction – Calorific value – Higher and Lower Calorific values- Theoretical calculation of Calorific value(Dulong formula) – Flue gas analysis (ORSAT Method).

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

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MODULE - VI NANOCHEMISTRY 7

Introduction - Types of nanomaterials - Emergence and challenges in nanotechnology- Synthesis routes for nanomaterials: Bottom-up and top-down approaches - Sol-gel, precipitation, Thermolysis, Laser ablation, Chemical Vapour Deposition (CVD), Electro deposition - Properties of nanomaterials- Mechanical properties, Chemical, Optical, Electrical and Magnetic properties-applications of nanomaterials (Gold nanoparticles as an example). Quantum Dots - concept, properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P)LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 2024.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi,2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
4. Chemistry of Nanomaterials Vol.1 S.S.R Kumar Challa (Ed).
5. Advanced chemistry by Phillip Matthews Vol.1 and Vol.2.
6. Chemistry in Engineering and Technology Vol. 1 & 2, J.C. Kuriacose and J. Rajaram.
7. Applied chemistry - A textbook for Engineers and Technologists by H.D. Gesser.
8. Chemical and Electrochemical Energy Systems, R. Narayanan, B. Viswanathan, University Press India Limited.

OUTCOMES:

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

1. Explain the importance of polymers in science and technology, describe their roles in different applications and discuss their impacts on modern advancements. (K3)

Recommended by
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Meeting No. 6 Dated: 31/08/2025

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2. Recognize the basic principles of electrochemistry and describe their application in battery technologies. (K3)
3. Apply the concepts of key photophysical and photochemical processes, as well as spectroscopy, to develop and optimize various applications. (K3)
4. Describe the principles of the second law of thermodynamics and its derivations to analyze engineering applications across all disciplines. (K3)
5. Categorize the chemistry of fuels and combustion and their applications at various levels. (K3)
6. Demonstrate the knowledge of nanomaterials, including their properties, behavior, interactions and applications across various disciplines of science and technology. (K3)

CO-PO, Mapping:

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

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Humanities & Science

SEMESTER - I

24ESCS101 106105171 SDG NO. 4 & 9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Interpret Mathematical problems using algorithms, flowchart and pseudocode.
- To understand the programming language.
- To develop C Programs using basic Programming Constructs, Loops, Arrays and Strings.
- To develop applications in C using Functions, Pointers and Structures.
- To perform I/O operations and File Handling in C.

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30/05/2024

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Department of Computer Science and Engineering
Sri Sairam Engineering College

MODULE - I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 7

Introduction to Problem Solving through programs- Algorithm-Flowchart–Pseudocode-Memory, Variables, Values, Instructions, Programs-compilation process-Syntax and Semantic Errors- The language of C : Phases of developing a running computer program in C - Character set – Constants – Keywords – Primitive data types –Declaration, Type Conversion.

MODULE - II BASICS OF C PROGRAMMING 7

Sequential- Arithmetic Operators, Relational Operators, Logical Operators, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, selective – If, Else-If, Switch- repetitive structures-for, while, do while, Nested loops, go to, break, continue –Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD and LCM, Prime number generation.

MODULE - III ARRAYS AND STRINGS 8

Introduction to Arrays: Declaration, Initialization – One Dimensional Array – Example Program: Computing Mean, Median and Mode - Two Dimensional Arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String Operations: Length, Compare, Concatenate - Copy – Selection Sort - Linear and Binary Search.

MODULE - IV FUNCTIONS AND POINTERS 9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions - Factorial and Fibonacci Generation - Towers of Hanoi problem - – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

MODULE - V STRUCTURES 7

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

MODULE - VI FILE PROCESSING 7

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers Stored

Recommended by Board of Studies of CSE dept. Meeting No. 7 Dated: 30/05/24

CHAIRMAN Board of Studies Department of Computer Science and Engineering Sri Sairam Engineering College

in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.G. Dromey, "How to solve it by Computers", Reprint, PHI Publishers, 2011.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2018.
3. Kernighan, B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:

1. Yashwant Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
2. Byron Gottfried, "Programming with C", Fourth Edition, Tata McGraw Hill Education, 2018.
3. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication, 2015.
4. Jeri R. Hanly & Elliot B.Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
7. Hanly J R & Koffman E.B, "Problem Solving and Programme design in C", Pearson Education, 2009.

WEB REFERENCES:

1. https://www.learn-c.org/
2. https://codeforwin.org/
3. https://www.cprogramming.com

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programing_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30/05/25

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Sri Sairam Engineering College

OUTCOMES:

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

1. Solve basic problems using algorithms, flowcharts, and pseudo code.(K3)
2. Analyze the various programming constructs for basic computational problems.(K4)
3. Implement simple C programs using arrays and strings. (K3)
4. Use functions, recursion, and pointers to perform calculations, searching, and sorting.(K3)
5. Apply structures and dynamic memory allocation in handling complex programming tasks. (K3)
6. Organize sequential and random file processing techniques to provide solutions for real-world computational problems. (K4)

CO-PO, PSO MAPPING:

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

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Sri Sairam Engineering College

SEMESTER - I

24ESGE101 – SDG NO. 4,6,7,9,12, 14 & 15	ENGINEERING GRAPHICS	L	T	P	CP	C
		1	2	0	3	3

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To visualize the job in three dimensions.
- To have a clear conception and appreciation of the shape, size, proportion and design.
- To expose the student community to existing national standards related to technical drawings.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

MODULE - I PLANE CURVES **6+4**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – Drawing of tangents and normal to the above curves.

MODULE - II PROJECTION OF POINTS, LINES AND PLANES **6+4**

Projection of Points (Concept only). Projection (Elevation and Plan) of straight lines, inclined to both reference planes by rotating line method. Projection of plane surfaces, inclined to one of the reference planes by rotating object method.

MODULE - III PROJECTION OF SOLIDS **6+4**

Projection of regular solids (Prisms, Pyramids, Cylinder and cone) in first quadrant, by rotating object method when the axis is inclined to one of the reference planes.

MODULE - IV ORTHOGRAPHIC PROJECTION **6+4**

Orthographic Projection - Principles of orthographic projections, Orthographic projection of objects from pictorial view.

MODULE - V SECTION AND DEVELOPMENT OF LATERAL SURFACE **6+4**

Projection of sectioned solids (Prisms, Pyramids, Cylinder and cone) and true shape of the sections, when the axis of the solid is perpendicular to HP alone and cutting plane inclined to HP only. Development of lateral surfaces of sectioned regular vertical solids (Prisms, Pyramids, Cylinder and Cone) with cutting plane inclined to HP only.

MODULE - VI ISOMETRIC PROJECTIONS **6+4**

Isometric projection – Principle, isometric scale, Isometric views and Isometric projections of truncated solids - Prisms, Pyramids, Cylinder and Cone in simple vertical positions only.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011.
2. T. Jeyapoovan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University Press, New Delhi, 2015.

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 01.06.2024

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Mechanical Engineering

2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/112/102/112102304/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/104/105104148/
2. https://nptel.ac.in/courses/112/103/112103019/

OUTCOMES:

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

1. Perform free hand drawing of conical sections and cycloids. (K3)
2. Sketch the orthographic projection of lines and plane surfaces of rectangle, square, pentagon and Hexagon. (K3)
3. Draw the orthographic projection of regular solids like prism, pyramids, cylinder and cone using change of position method. (K3)
4. Draw plan, elevation and side views for the 3dimensional isometric drawing by using the concepts of orthographic projection. (K3)
5. Draw the section and development of lateral surfaces for the regular solids like Prism, Pyramid, Cylinder and Cone for the axis perpendicular to HP. (K3)
6. Draw the isometric view, projection for regular and truncated solids like Prism, Pyramid, Cylinder and Cone. (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	-	-	-	3
CO2	3	-	-	-	-	-	-	-	2	-	-	-	3
CO3	3	-	-	-	-	-	-	-	2	-	-	-	3
CO4	3	-	-	-	-	-	-	-	3	-	-	-	3
CO5	3	-	-	-	-	-	-	-	2	-	-	-	3
CO6	3	-	-	-	-	-	-	-	3	-	-	-	3

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

SEMESTER - I

24HSTA101 - SDG NO. 4	HERITAGE OF TAMILS	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Develop interest for classical language and literature to promote Tamil heritage
- Understand the ancient Tamil sculptures, folk and martial arts and contribution of Tamil to the freedom of India

அலகு ஐ மொழி மற்றும் இலக்கியம்

இந்திய மொழிக் குடும்பங்கள் — திராவிட மொழிகள் — தமிழ் ஒரு செம்மொழி — தமிழ் செவ்விலக்கியங்கள் — சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை — சங்க இலக்கியத்தில் பகிர்தல் அறம் — திருக்குறளில் மேலாண்மைக் கருத்துகள்

UNIT I LANGUAGE AND LITERATURE 5

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural

அலகு II இடைகால மற்றும் நவீன இலக்கியங்கள்

தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம் — ஆழ்வார்கள் மற்றும் நாயன்மார்கள் — சிற்றிலக்கியங்கள் — தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி — தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

Unit II MEDIEVAL AND MODERN LITERATURE 5

Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

அலகு III மரபு ஓ பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை

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

UNIT III HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 5

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures> Village deities> Thiruvalluvar Statue at Kanyakumari> Making of musical instruments - Mridhangam> Parai> Veenai> Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

Recommended by Board of Studies of HAS dept. Meeting No. 6 Dated: 31/05/2024

S. Ramakrishnan
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Humanities & Science

அலகு IV நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

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

UNIT IV FOLK AND MARTIAL ARTS 5

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

அலகு V தமிழர்களின் திணைக் கோட்பாடுகள்

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

UNIT V THINAI CONCEPT OF TAMILS 5

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

அலகு VI இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு — இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் — சுயமரியாதை இயக்கம் — இந்தியமருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு — கல்வெட்டுகள், கையெழுத்துப்படிகள் — தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

UNIT VI CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 5

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 30 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு — மக்களும் பண்பாடும் — கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)
2. கணினித் தமிழ் — முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி — வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை — ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2019

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6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian> Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - „Sangam City Civilization on the banks of river Vaigai... (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation> Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

OUTCOMES:

Upon completion of the course, the learners will be able to:

1. மொழிக் குடும்பங்களின் வரலாறு மற்றும் தமிழ் இலக்கியங்களை மதிப்பிடுகிறார்கள் Students evaluate the history of language families and Tamil literatures (K3)
2. பக்தி மரபுகளின் தாக்கம் பெற்ற தமிழ் இலக்கியங்களைப் புரிந்துகொள்கிறார்கள் Students understand Tamil literatures influenced by Philosophical and religious traditions (K3)
3. தமிழகத்தின் பாறை, சிற்பம், ஓவியம்- கலை மரபுகளைப் பகுப்பாய்வு செய்கிறார்கள் Students analyze the artistic traditions of Tamil Nadu such as rock art, sculpture, and painting (K3)
4. தமிழக நாட்டுப்புறக் கலைகள் மற்றும் தற்காப்புக் கலைகளின் மாண்புகளை உணர்ந்து கொள்கிறார்கள் Students realize the significance of Tamil Nadu's folk arts and martial arts (K3)
5. பழந்தமிழரின் திணையியல் வாழ்வியலை மீளாய்வு செய்கிறார்கள் Students re-examine the ecological lifestyle (Thinai-based life) of the ancient Tamils (K3)
6. தேசிய இயக்கம் மற்றும் இந்தியப் பண்பாட்டில் தமிழர்களின் பங்களிப்பினை நினைவுகூர்கிறார்கள் Students recall the contribution of Tamils to the National Movement and Indian culture (K3)

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Meeting No. 6 Dated: 31/05/2024

CO- PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	-	-	-	-	-	-	2	2	2
CO3	2	3	3	-	-	-	-	-	-	-	2	2	2
CO4	2	3	3	-	-	-	-	-	-	-	2	2	2
CO5	2	3	3	-	-	-	-	-	-	-	2	2	2
CO6	2	3	3	-	-	-	-	-	-	-	2	2	2

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Board of Studies of H & S dept.
Meeting No. 6 Dated: 31/05/2024

SEMESTER - I

24BSPL101 - SDG NO. 6,11,12,17	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	CP	C
		0	0	4	4	2

PHYSICS LABORATORY (Any Five Experiments to be conducted)

OBJECTIVES:

- Demonstrate the wave nature of light using diffraction and interference properties.
- Study the thermal conductivity of a bad conductor.
- Verify experimentally the elastic properties of materials.

Sl.No.	Name of the Experiment
1	(a) Determination of wavelength of Laser (b) Determination of numerical aperture and acceptance angle in an optical fiber. (c) Determination of particle size using laser source.
2	Determination of thermal conductivity of a bad conductor – Lee's Disc method.
3	Determination of Young's modulus by non-uniform bending method.

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Meeting No. 6 Dated: 31/05/2024

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4	Determination of the period of oscillation of a given torsional pendulum for a fixed length and find the rigidity modulus of the wire.
5	Find out the thickness of the given wire by air wedge method.
6	Calculation of lattice cell parameter – X-ray diffraction method.
7	Determination of Planck's constant.
8	Determination of wavelength of mercury spectrum – spectrometer grating.
9	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
10	Determination of band gap of a semiconductor.
11	Determination of Hall coefficient by Hall Effect experiment.
12	Determination of solar cell characteristics.

CHEMISTRY LABORATORY (Any Five Experiments to be conducted)

OBJECTIVES:

- To acquaint students with practical knowledge of the basic concepts of chemistry that they will encounter during their studies and in the industry and engineering fields.
- To acquaint students with the determination of the molecular weight of a polymer by viscometry.
- To develop and understand the basic concepts of acidic and basic nature using pH.

Sl.No.	Name of the Experiment
1	Conductometric titration of strong acid vs strong base.
2	Determination of chloride content of water sample by Argentometric method.
3	Determination of strength of acids in a mixture of acids using conductivity meter.
4	Determination of total, temporary & permanent hardness of water by EDTA method.
5	Estimation of iron content of the given solution using potentiometer.
6	Determination of DO content of water sample by Winkler's method.
7	Determination of strength of given hydrochloric acid using pH meter.
8	Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method).

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9 Estimation of Sodium and Potassium in the given sample of water using Flame Photometer.

10 Determination of molecular weights of polymer samples using Ostwald's Viscometer.

11 Synthesis of nano-CdS by precipitation. (Demonstration only)

12 Corrosion experiment-weight loss method.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Engineering Physics Lab, Dr. G. SenthilKumar, VRB publishers. (2019)
2. Engineering Physics Practical, Dr. P. Mani, Dhanam Publications. (2020)

TEXTBOOK:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition,2014).
2. Practical Physical chemistry by B. Viswanathan, P. S. Raghavan (Vivabooks), 2009.
3. Foundation of Experimental Chemistry by Jubaraj B. Baruah, Parikshit Gogoi, 2010.

OUTCOMES:

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

1. Apply the principles of elasticity and thermal physics to evaluate the various modulus of elasticity and conductivity of a bad conductor. (K3)
2. Explicate the properties of semi conductors by evaluating the band gap, I-V characteristics of solar cell and Hall effect of the materials. (K3)
3. Describe multiple measurement techniques, including volumetric titrations, conductivity, pH, redox potential and optical density measurements, used to estimate the amount of substance present in a solution. (K3)
4. Apply spectroscopic techniques, viscometry, synthesize nano particles, analyze the corrosion behaviour of materials in different environments. (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	2
CO3	3	3	-	-	2	-	-	-	-	-	2
Co4	3	3	-	-	2	-	-	-	-	-	2

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Meeting No. 6 Dated: 31/05/2024

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SEMESTER - I

24ESPL101 - SDG NO. 4 & 9	PROGRAMMING IN C LABORATORY	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To develop programs in C using basic Programming Constructs.
- To develop applications in C using Arrays and Strings.
- To design and implement applications in C using Functions, Structures.
- To develop applications in C using Files.

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is a leap year or not? (Hint: not every century is a leap. For example 1700, 1800 and 1900 is not a leap year).
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is an Armstrong number or not.
6. Write a program to check whether a given number is odd or even.
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to print half pyramid of *.
10. Write a program to display array elements using two dimensional arrays.
11. Write a program to perform swapping using a function.
12. Write a program to display all prime numbers between two intervals using functions.
13. Write a program to solve towers of Hanoi using recursion.
14. Write a program to get the largest element of an array using the function.
15. Write a program to concatenate two strings.
16. Write a program to find the length of String.
17. Write a program to find the frequency of a character in a string.
18. Write a program to store Student Information in Structure and Display it.

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Board of Studies of CSE dept.
Meeting No. 7 Dated: 30.5.24

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Department of Computer Science and Engineering
Sri Sairam Engineering College

19. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:

(a) Total marks obtained by each student.

(b) The highest marks in each subject and the marks of the student who secured it.

(c) The student who obtained the highest total marks.

20. Write a program to demonstrate file operations (e.g. count the number of characters, words and lines in a file, replace a specific word with the given word in the same file).

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Stand alone desktops with C compiler 30 Nos. (Or)
   Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Apply basic constructs, arrays, strings,functions and recursion for executing C programming applications.(K3)
2. Analyze C programs involving pointers and structures.(K4)
3. Evaluate applications using sequential and random access files.(K5)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	-	-	-	1	1
CO2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	-	-	3	-	-	-	-	-	-	-	-	2	2

SEMESTER - I

24ESID101 - SDG NO. 1-17	IDEA ENGINEERING LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To understand the significance of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) of the United Nations
- To familiarize with SDG targets and indicators
- To identify the Constitutional implementation pertaining to SDGs in Panchayat Raj

Recommended by
Board of Studies of CSE dept.
Meeting No. 1 Dated: 30.5.24

- To acquire knowledge of the State and the Central government welfare schemes
- To recognize the role of educational Institutions in community development
- To develop critical thinking skills to address complex societal challenges through an immersion program

MODULE - 1 United Nations Sustainability and the Sustainable Development Agenda **3**

- Introduction to Sustainability
- Indian Rural Environment: Necessity and Sustainability
- Millennium Development Goals (MDGs)
- United Nations Sustainable Development Goals (SDGs) & the Agenda
- Overview of the Sustainable Development Goals (SDGs)

MODULE - 2 Universal SDG Targets **4**

- SDG Framework
- Key Components
- Pillars of the SDGs
- Targets of the Goals
- Indicators of the Targets

MODULE-3 SDG and Indian Gram Panchayat **3**

- Gram Panchayat
- Salient Features of Constitutional Amendments
- Transition from SDGs to LSDGs (Localizing Sustainable Development Goals)

MODULE-4 Government Schemes **4**

- Introduction to State and Central Government Schemes
- Overview of Government Schemes
- Localization and Implementation at the Regional Level
- Impact on Local Communities

MODULE-5 Community Engagement **4**

- Key Recommendations of the National Education Policy
- Guidelines for Fostering Social Responsibility
- Awareness
- Participation
- Collaboration

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

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Board of Studies
Department of Humanities & Sciences

MODULE-6 Idea Generation **12**

- Immersion Program
- Focus Areas
- Channelizing Ideas
- Forming Working Teams for SDGs (Sustainable Development Goals)

TOTAL: 30 PERIODS

REFERENCES:

1. Joy Elamon and Ms. Mariamma Sanu George,"The Handbook on Sustainable Development Goals and Gram Panchayats" , State Institute for Rural Development (SIRD).
2. Dr.C.R.Rene Robin, Dr.PA.Shanthi , Dr.B.Thanuja & Dr.V.Yuvaraj ,"Sairam SDG Idea Engineering Lab I", Sri Sairam Engineering College.

WEB REFERENCES

1. UN Sustainable Development Goals
2. https://srmuniv.digimat.in/nptel/courses/video/109106200/L30.html
3. https://avcce.digimat.in/nptel/courses/video/109106200/L26.html

OUTCOMES:

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

1. Analyse and apply the concepts of sustainability,Rural environment,Gram panchayat and various government schemes to design innovative practical solutions that address real life rural challenges. (K2)
2. Compare MDG's,SDG's and LSDG's to analyse village topology and identify specific development targets to propose innovative rural solutions. (K4)
3. Analyse the attainment levels of SDG's and write a reflective report on local community.(K4)
4. Formulate problem statement based on local community needs and propose innovative ideas for community development. (K4)
5. Perform an individual presentation of field observation by mapping them with relevant SDG's and justify their significance for rural development. (K4)

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CO-PO, PSO MAPPING:

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

SEMESTER - I

24ENTP101 - SDG NO.4	FUNCTIONAL LIFE SKILLS	L	T	P	CP	C
		1	0	1	2	1

OBJECTIVES:

- Resolve common communication problems
- Observe the effectiveness of nonverbal messages
- Communicate precisely through the digital media
- Understand the importance of empathetic listening
- Explore reading and speaking processes

MODULE - I LISTENING 5

Techniques of effective listening
Listening and comprehending
Probing questions
Barriers to listening
Reflection from listening

MODULE - II SPEECH MECHANICS 5

Pronunciation
Enunciation
Vocabulary
Fluency
Common errors

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MODULE - III READING SKILLS **5**

Techniques of effective reading
Kinds of reading
Gathering ideas and information from the text
Evaluating the ideas and information
Interpreting the text from multiple angles

MODULE - IV WRITING ASPECTS **5**

Writing process
Effective writing strategies
Different modes of writing
Optimizing the use of resources
Editing

MODULE - V PRESENTATION SKILLS **5**

Types of presentations
Nonverbal communication
Understanding the purpose and the audience
Beginning and closure of presentations
Presentation tools and strategies

MODULE - VI ARTICULATION ASPECTS **5**

Perform exercises
Slow speeches
Long speeches
Monologues, Dialogues and Conversation
Feedback necessity

TOTAL : 30 PERIODS

REFERENCES:

1. Sen, Madhuchanda.2010, An Introduction to Critical Thinking, Delhi, Pearson.
2. Effective Communication Skills Strategies for Success. Edited by Nitin Bhatnager and Mamta Bhatnager. 2023, Pearson
3. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma. Oxford University Press, 2015

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WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

OUTCOMES:

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

1. Employ reading, writing, and listening skills to communicate clearly in academic and professional contexts.
2. Demonstrate confident oral communication and presentation skills using appropriate tools and techniques.
3. Interpret ethical, inclusive, and culturally aware communication in team and societal settings

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

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SEMESTER - II

24BSMA201 - SDG NO. 4	DISCRETE STRUCTURES	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To understand the concepts of Logic, Rules of inference and Quantifiers.
- To learn the concepts of Mathematical induction, Permutation and Combination.
- To impart the knowledge on Groups and Normal subgroups.
- To develop Graph Algorithms by using the concepts of Graphs.
- To learn the concepts of Lattices and Boolean algebra.

MODULE - I LOGICS 9

Basic Connectives – Truth Tables – Logical Equivalence - The Laws of Logic- Logical Implications - Normal Forms – Rules of Inference – The use of Quantifiers.

MODULE - II COMBINATORICS 9

The Principles of Mathematical Induction – Basic counting techniques – Inclusion and exclusion - Pigeonhole principle – Permutation – Combination.

MODULE - III ALGEBRAIC STRUCTURES WITH ONE BINARY OPERATION 12

Semi Groups– Monoids– Groups - Subgroups – Cosets- Normal subgroups –Lagrange's theorem.

MODUL - IV GRAPHS 12

Graphs - Definition -Special types of Graphs- Matrix representation of Graphs - Graph isomorphism- Path, Cycle, Connectivity - Eulerian and Hamiltonian Graphs.

MODULE - V LATTICES 9

Partial ordering - Posets - Lattices as Posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices.

MODULE - VI BOOLEAN ALGEBRA 9

Boolean Algebra – Definition – Identities of Boolean Algebra -Demorgan's laws.

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Discrete Mathematics and its Applications: with Combinatorics and Graph Theory, Kenneth H. Rosen, 7th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2015.
2. Discrete Mathematical Structure with Applications to Computer Science", J.P. Tremblay and R. Manohar, Reprint, McGraw-Hill Education (India), 1997.

REFERENCES:

1. Discrete Mathematics with Applications, Susanna S. Epp, 4th edition, Brooks/Cole, Cengage Learning, 2010.
2. Discrete Mathematics, Norman L. Biggs, 2nd Edition, Oxford University Press, 2002.
3. Discrete Mathematics, Seymour Lipschutz, Marc Lipson, Schaum's Outlines Series, 3rd edition, McGraw-Hill Education, 2009.
4. Elements of Discrete Mathematics: A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 4th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2012.

WEB REFERENCES:

1. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
2. https://www.cs.cornell.edu/~rafael/discmath.pdf
3. http://home.iitk.ac.in/~arlal/book/mth202.pdf
4. https://drive.google.com/file/d/1-PqMUlqDim1-AHQK5_zL34I97zHV3W15/view

ONLINE RESOURSES:

1. https://nptel.ac.in/courses/106106183
2. https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20
3. https://www.youtube.com/watch?v=4LlTmsfDS4Y&list=PLEAYkSg4uSQ2Wfc_l4QEZUSRdx2ZcFziO&index=13
4. https://www.youtube.com/watch?v=jBsEKyx6Rj0&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf
5. https://www.youtube.com/watch?v=rdXw7Ps9vxc&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS

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COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Construct mathematical arguments using logical connectives, quantifiers and verify the correctness of an argument using symbolic logic, truth tables. (K3)
2. Apply counting principle and mathematical induction to solve combinatorial problems. (K3)
3. Explain the fundamental concepts of algebraic structures such as groups and Boolean algebra. (K3)
4. Illustrate the concepts of graphs. (K3)
5. Apply the concepts of Lattices in the field of computer science. (K3)
6. Apply the concepts of Boolean algebra in logical circuits. (K3)

CO-PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3
CO2	3	3	-	-	-	-	-	-	-	-	-	2	3
CO3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	-	-	-	-	-	-	-	-	3	3
CO5	3	2	-	-	-	-	-	-	-	-	-	2	3
CO6	3	-	3	-	-	-	-	-	-	-	-	3	3

SEMESTER - II

24HSEN201 - SDG NO.4	PROFESSIONAL ENGLISH	L	T	P	CP	C
		2	0	0	2	2

OBJECTIVES:

- Acquire techniques for comprehending and critically analyzing passages
- Improve the communicative competence
- Enhance learners' ability to read and write complex texts, summaries, definitions and reports
- Write effective formal letters and reports
- Develop skills for preparing effective job application

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MODULE - I EFFECTIVE COMMUNICATION **6**

Listening – Listening to conversations – Speaking – making conversations in real life occurrences – Reading - short stories, happenings - Writing – autobiographical writing, preparation of checklist – communication and types of communication – Language Development –- subject - verb agreement, commonly confused words – spellings

MODULE - II BASICS OF TECHNICAL WRITING **5**

Listening – listening to advertisements and products – Speaking - creating greetings/wishes/excuses and thanks – Reading – articles/novels - Writing - summary of articles, writing modes, formats, compositions - Language Development - reported speech, numerical adjectives

MODULE - III REPORT WRITING **4**

Listening – listening to podcasts – Speaking - practicing telephonic conversations – observing and responding. Reading – regular columns of newspapers/magazines - Writing – reports – feasibility, accident, preparation of agenda and minutes – Language Development - cause & effect expressions, discourse markers

MODULE - IV DIVERSE WRITING SKILLS **5**

Listening – documentaries, anecdotes and short stories - Speaking – expressing opinions using verbal and non-verbal communication – Reading biographies/autobiographies, travelog, – Writing – formal letters – inviting guests – acceptance/declining letters - Language Development- degrees of comparison – embedded sentences - acronyms and abbreviations

MODULE - V CAREER COMPETENCIES **6**

Listening – expert talks – recommending suggestions & solutions – Speaking – Debate- participating in a group discussion – learning GD strategies – Reading – innovations, ideations - Writing – Job application, resume, – proposals – Language Development – verbal analogies – phrasal verbs

MODULE - VI LEXICAL ENHANCEMENT **4**

Listening - technical and general talks - Speaking - oral presentation with visual aids - Reading - successful stories/autobiographies - Writing - writing blogs - Language Development - common errors in English, idiomatic expressions

TOTAL: 30 PERIODS

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TEXT BOOKS:

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Raman, Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford University Press.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York,2011.
2. Raman, Meenakshi, Sharma, Sangeeta. Technical Communication. Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan & Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamil Nadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Vesilind Aarne P., Public Speaking and Writing Skills for Engineering Students (2nd Ed), Lakeshore press, 2007
5. Richards, Jack C. Interchange Students' Book – 2. Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. https://takelessons.com/en-in/search?service=English&sort=1&utm_

ONLINE RESOURCES:

1. https://www.coursera.org/specializations/improve-english?
2. https://www.fluentu.com/blog/educator-english/business-english-conversation-topics/

OUTCOMES:

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

1. Demonstrate an understanding of various types of communication and prepare effective checklists.(K2)
2. Summarize articles/ write ups (K2)
3. Construct feasibility reports, accident reports, survey reports and meeting minutes (K3)
4. Apply skills to compose official letters with emphasis and clarity (K3)

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5. Compose job applications and technical proposals (K3)
6. Demonstrate the ability to express opinions in both oral and written forms of communication (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	3	-	-
CO5	-	-	-	-	-	-	-	1	3	-	3	-	-
CO6	-	-	-	-	-	-	-	1	3	-	3	-	-

SEMESTER - II

24BSPH203 - SDG NO. 4,7,9	PHYSICS FOR INFORMATION SCIENCE	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the essential principles of physics of conducting materials, superconducting and optical properties of materials
- To educate the basic principles of semiconductor device and electron transport properties
- To become proficient in magnetic materials
- To acquaint the basics of superconducting and optical materials
- To acquire the basic working of nanoelectronic devices
- To understand the basics of quantum computing

MODULE - I CONDUCTING MATERIALS 8

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential - Energy bands in solids – Electron effective mass - Concept of hole.

MODULE - II SEMICONDUCTOR MATERIALS 7

Direct and indirect band gap semiconductors - Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Extrinsic semiconductors

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- Carrier concentration in N-type & P-type semiconductors - Variation of carrier concentration with temperature - Variation of Fermi level with temperature and impurity concentration - Carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and devices.

MODULE - III MAGNETIC PROPERTIES OF MATERIALS **8**

Magnetic dipole moment - atomic magnetic moments - magnetic permeability and susceptibility - Magnetic material classification: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism - ferrimagnetism - Ferromagnetism: Domain Theory - M versus H behaviour - Hard and soft magnetic materials - applications – Magnetic principle in computer data storage - Magnetic hard disc - GMR sensor.

MODULE - IV SUPERCONDUCTING & OPTICAL PROPERTIES OF MATERIALS **7**

Superconductivity - Type-I and Type-II superconductors - Properties and applications - Classification of optical materials - Absorption and emission of light in metals, semiconductors and insulators - Carrier generation and recombination processes - Photo current in a P-N diode - Solar cell - LED - Organic LED - Optical data storage techniques and devices.

MODULE - V NANO DEVICES **8**

Introduction - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials - Tunneling: single electron phenomena and single electron transistor - Quantum dot laser - Carbon nanotubes: Properties and applications.

MODULE - VI QUANTUM COMPUTING **7**

Quantum system for information processing - quantum states – classical bits – quantum bits or qubits – multiple qubits – Bloch sphere - Superposition - Entanglement - quantum gates - CNOT gate - Types of Quantum Computer: Quantum Annealer- Analog Quantum- Universal Quantum.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.
2. Kasap, S.O., "Principles of Electronic Materials and Devices", McGraw- Hill Education, 2017.
3. Kittel C, "Introduction to Solid State Physics", Wiley, 2018.

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4. S.O.Pillai, "Solid State Physics, New Academic Science", 2017.
5. D.K.Bhattacharya & Poonam Tandon., "Physics for Information Science and Electronics Engineering", Oxford Higher Education", 2017.

REFERENCES:

1. Garcia, N. & Damask, A., "Physics for Computer Science Students", Springer-Verlag, 2012.
2. Hanson, G.W., "Fundamentals of Nanoelectronics", Pearson Education, 2009.
3. Rogers, B., Adams, J. & Pennathur, S., "Nanotechnology: Understanding Small Systems", CRC Press, 2014.

OUTCOMES:

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

1. Explore the basic concepts of free electron theory of solids and apply it to determine the conducting properties, carrier concentration and effective mass of an electron in conductors (K3)
2. Analyze the band structures and carrier concentrations of semiconductors, study their variations with temperature, and examine carrier transport mechanisms (K4)
3. Have an insight into the different types of magnetic materials and magnetic data storage device (K3)
4. Analyze the properties of superconductors and optical interactions in materials and explain the working of optoelectronic and optical storage devices (K4)
5. Examine quantum confinement and quantum structures, analyze the working principles of quantum devices, and explore the applications of carbon nanotubes (K4)
6. Apply the basic concepts of quantum computing to demonstrate the operation of quantum gates and the formation of entangled states (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

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SEMESTER - II

24BSCY201 - SDG NO.4	CHEMISTRY FOR ENVIRONMENT AND SUSTAINABILITY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To gain a comprehensive understanding of environmental science, the intricate relationships within ecosystems, and the crucial role of biodiversity conservation..
- To introduce the structure and components of the atmosphere, and provide an overview of the photochemical reactions involved.
- To foster a sound understanding of water quality parameters and water treatment techniques.
- To explore the various components of soil and understand the steps involved in Solid Waste Management (SWM).
- To advocate the benefits of renewable energy and promote awareness of sustainable energy practices. .
- To implement the principles of Green Chemistry in alignment with the Sustainable Development Goals (SDGs).

MODULE - I INTRODUCTION TO ENVIRONMENTAL SCIENCE 8

Environment: Definition, concept of environment and its components - scope and importance of environment – need for public awareness.

Ecosystem: Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, food chains and food webs. Biogeochemical cycles(C,N&P), Ecological succession.

Biodiversity and its conservation: Definition, types, importance of biodiversity, values and threats to biodiversity. Endangered and endemic species - concept and basis of identification of 'Hotspots'; hotspots in India. Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation.

MODULE - II ATMOSPHERIC CHEMISTRY 7

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect - role of greenhouse gases (CO2, CH4, N2O, CFCs) on global warming. Chemical and photochemical reactions in the atmosphere - Formation of smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures).

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MODULE - III WATER CHEMISTRY 8

Importance and scope of water chemistry - Sources and impurities in water - Water Quality Parameters - Specifications as per WHO/BIS standards. Hardness of water, types, numerical problems on hardness of water. Softening of water - Internal treatment (Lime-soda, Phosphate, Calgon, Sodium Aluminate and Colloidal conditioning). External treatments: Ion exchange and Zeolite processes. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water by Reverse osmosis. Sustainable water management practices (water recycling and rainwater harvesting)

MODULE - IV SOIL CHEMISTRY AND SOLID WASTE MANAGEMENT 7

Soil Chemistry: Chemical composition of soil, Acid-Base and Ion-Exchange Reactions in Soil, Soil acidity and salinity. Importance of NPK in Soil Fertility. Modern agriculture - Impacts of both excessive and insufficient fertilizer use, alongside the effects of pesticides on soil chemistry and the environment. Sustainable agriculture - Approaches to improve soil salinity (leaching, soil amendments, crop rotation), Design and use of green pesticides for sustainable farming.

Solid Waste Management System: Sources and types of solid waste, Elements of solid waste management, Methods of residential and commercial waste collection, Treatment / processing - Incineration, Composting, Landfill - Dumpsite rehabilitation.

MODULE - V ENERGY AND ENVIRONMENT 8

Energy sources – Renewable and non-renewable energy sources. Principle and generation of solar energy (solar collectors, photo-voltaic modules, solar ponds), wind energy, geothermal energy; tidal energy, OTEC energy from biomass, biofuels, Nuclear energy - fission and fusion, Nuclear fuels, Nuclear reactor – principles and types. Need for energy efficiency, Energy conservation and sustainability - action strategies for sustainable energy management from a future perspective.

MODULE - VI GREEN CHEMISTRY AND SUSTAINABILITY 7

Green Chemistry: Introduction to green chemistry, Principles of Green Chemistry (12-principles), the concept of atom economy and chemical synthesis, Important techniques used in green chemistry. Application of green chemistry, viz. replacement of ozone depleting substances including CFCs, manufacture of biodegradable polymers, use of H_2O_2 as benign bleaching agents in the paper industry.

Sustainable Development: Definition and concepts of sustainable development, Need for sustainable development; Sustainable development

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goals – 17 SDG goals.

Sustainable practices: Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment and Environmental Impact Assessment.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.
4. Vogel's Textbook of Quantitative Chemical Analysis (8th edition,2014).

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Chemistry for Environmental Engineering, Clair N. Sawyer, Perry L. Mc Carty, Gene F. Parkin, 4th Edition, McGraw-Hill.

OUTCOMES:

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

1. Develop a foundational understanding of environmental science, the interactions within ecosystems, the significance of biodiversity, and the importance of conservation strategies for maintaining ecological balance. (K3)
2. Identify the primary components of the atmosphere, explain the causes of atmospheric pollution, and propose basic strategies to promote a sustainable and clean atmosphere. (K3)
3. Demonstrate complex water quality parameters, and develop innovative methods for producing cost-effective soft water suitable for both industrial use and potable consumption. (K3)
4. Describe the composition and functions of soil components, analyze the sources and characteristics of solid wastes, and evaluate the methods and

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strategies employed in solid waste management (SWM). (K3)

5. Explain renewable and non-renewable resources, describe various methods for harnessing energy from different sources and explain their applications in various contexts. (K3)
6. Illustrate a comprehensive understanding of green chemistry principles and their alignment with sustainable development goals, preparing them to contribute to environmentally friendly and sustainable practices in their future careers.(K3)

CO-PO MAPPING:

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

SEMESTER - II

24HSTA201 - SDG NO. 4	TAMILS AND TECHNOLOGY	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Understand the techniques that help for a better livelihood
- Identify the methods used for scientific Tamil computing

அலகு-I நெசவு மற்றும் பானைத் தொழில்நுட்பம்

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

UNIT-I WEAVING AND POTTERY (CERAMIC) TECHNOLOGY 5

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

அலகு -II சங்ககாலவடிவமைப்புகள்

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள்ரூசங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு -சங்க காலத்தில் கட்டுமான பொருட்களும்நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

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UNIT-II SANGAM AGE DESIGNS 5

Designing and Structural construction - House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age- Details of Stage Constructions in Silappathikaram

அலகு -III பழங்காலகட்டிடத் தொழில்நுட்பம்

மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப்பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டுவீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக்கட்டிடக் கலை.

UNIT-III ANCIENT CONSTRUCTION TECHNOLOGY 5

Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses> Indo - Saracenic architecture at Madras during British Period.

அலகு- IV உற்பத்தித் தொழில்நுட்பம்

கப்பல் கட்டும் கலை -உலோகவியல் -இரும்புத் தொழிற்சாலை இரும்பை உருக்குதல், எஃகு - வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் சங்கு மணிகள் -எலும்புத்துண்டுகள் - தொல்லியல்சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

UNIT-IV MANUFACTURING TECHNOLOGY 5

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting> steel - Copper and gold- Coins as source of history - Minting of Coins - Beads making-industries - Stone beads - Glass beads - Terracotta beads - Shell beads/bone beads - Archaeological evidences - Gem stone types described in Silappathikaram.

அலகு - V வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காகவடிவமைக்கப்பட்டகிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள்- கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

UNIT-V AGRICULTURE AND IRRIGATION TECHNOLOGY 5

Dam, Tank, Ponds, Sluice, Significance of KumizhiThoompu of Chola Period> Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conch diving -Ancient Knowledge of Ocean - Knowledge Specific Society.

அலகு-VI அறிவியல்தமிழ்மற்றும்கணித்தமிழ்

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல்- தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ்

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இணையக்கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

UNIT-VI SCIENTIFIC TAMIL & TAMIL COMPUTING **5**

Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy -Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

TOTAL: 30 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு — மக்களும் பண்பாடும் — கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)
2. கணினித் தமிழ் — முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி — வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை — ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian> Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - „Sangam City Civilization on the banks of river Vaigai... (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation> Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

OUTCOMES:

Upon completion of the course, the learners will be able to:

1. சங்ககால நெசவு மற்றும் பானைத்தொழில்நுட்பங்களைப் பற்றி அறிந்து கொள்ளுதல்
   To learn about the weaving and pottery (ceramic) technologies during the Sangam Age.(K2)
2. சங்ககாலவடிவமைப்புகள் மற்றும் கட்டுமானக்கலையைப் புரிந்து கொள்ளுதல்
   To understand the designs and structural constructions during the Sangam period.(K2)
3. பண்டையகால கட்டிடக்கலையின்நுட்பங்கள் மற்றும் கட்டிடவடிவமைப்புகளை ஆராய்தல்.

Recommended by Board of Studies of HAS dept. Meeting No. 6 Dated: 31/5/2024

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To explore the techniques and architectural patterns of ancient Tamil structures.(K2)

4. உற்பத்தி மற்றும் உலோகவியல்தொழில்நுட்பங்களைப் பற்றி அறிதல்.
   To gain knowledge on manufacturing and metallurgical technologies of ancient Tamils.(K3)
5. வேளாண்மை, நீர்ப்பாசனம் மற்றும் கடல்சார்தொழில்நுட்பங்களைப் பற்றி அறிந்து கொள்ளுதல்.
   To understand agricultural> irrigation> and marine technologies of ancient Tamil society.(K3)
6. அறிவியல்தமிழ் மற்றும் கணித்தமிழின்வளர்ச்சியையும் அதன் கணினி பயன்பாடுகளையும் புரிந்து கொள்ளுதல்.
   To understand the development of Scientific Tamil and its applications in Tamil computing.(K3)

CO- PO, PSO MAPPING

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

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SEMESTER - II

24HSNC201 - SDG NO. 4	NCC COURSE LEVEL 1	L	T	P	CP	C
		2	0	0	2	0

ARMY WING

NCC GENERAL

		6
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS

		4
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 21/5/2024

PERSONALITY DEVELOPMENT **7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP **5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

NAVAL WING

NCC GENERAL **6**

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS **4**

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT **7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

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Board of Studies
Department of Humanities & Sciences

LEADERSHIP **5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

ARMY WING

NCC GENERAL **6**

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS **4**

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT **7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP **5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3

Recommended by
Board of Studies of H & S dept.
Meeting No. 6 Dated: 31/05/2024

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Department of Humanities & Sciences

SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	TOTAL: 30 PERIODS	

SEMESTER - II

24ESGE102 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To provide exposure to the students with hands-on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

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Mechanical Engineering

ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp, and energy meter.
2. Fluorescent lamp wiring.
3. Staircase wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipment – Resistor- colour coding, measurement of AC signal parameter (peak-peak RMS, period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR, and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices, and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of Half Wave Rectifier and Full Wave Rectifier.
6. Simulation of Half Wave Rectifier and Full Wave Rectifier using TinkerCAD.

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings,unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

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Mechanical Engineering

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding demo practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items:	
Iron box, fan and regulator, emergency lamp	1 Each
4. Megger (250V/500V)	1 No
5. Power Tools:	
Range Finder	2 Nos
Digital Live-wire detector	2 Nos

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

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Mechanical Engineering

ELECTRONICS

1. Soldering guns	10 Nos
2. Assorted electronic components for making circuits	50 Nos
3. Small PCBs	10 Nos
4. Multimeters	40 Nos

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2. Carpentry vice (fitted to work bench).	15 Nos
3. Standard woodworking tools.	15 Sets
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
Rotary Hammer	2 Nos
Demolition Hammer	2 Nos
Circular Saw	2 Nos
Planner	2 Nos
Hand Drilling Machine	2 Nos
Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos
2. Arc welding transformer with cables and holders	5 Nos
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5. Centre lathe.	2 Nos
6. Hearth furnace, anvil and smithy tools.	2 Sets
7. Moulding table, foundry tools.	2 Sets
8. Power Tool: Angle Grinder.	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner.	1 each

OUTCOMES:

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

1. Infer the values of resistance, peak to peak RMS values, time period, frequency. [K2]
2. Outline the logic gates, rectifier, timer circuits and soldering practices. [K2]
3. Demonstrate the measurement of electrical parameters such as voltage, current, resistance, power and energy. (K2)

Recommended by Board of Studies of MECH dept. Meeting No. 08 Dated: 01.06.2024

CHAIRMAN Board of Studies Mechanical Engineering

4. Illustrate the residential wiring, staircase wiring and fluorescent lamp wiring.[K2]
5. Prepare the carpentry and plumbing joints. (K2)
6. Perform the basic operations of welding, sheet metal work and basic machining operations in Lathe and Drilling (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-		-	-	-	-	-	-	-	-	2	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2
CO6	2	-	-	-	-	-	-	-	-	-	-	2	2

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Mechanical Engineering

SEMESTER - II

24ITPT201 106107574 & 10610519 SDG NO. 4,9	OOP USING JAVA LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To understand Object Oriented Programming concepts and principles of Packages, Inheritance and Interfaces
- To have the understanding of Exceptions and to make use I/O streams
- To develop a Java application with threads and generic classes.
- To illustrate concepts of Java collection framework
- To design and build simple Graphical User Interfaces

MODULE - I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 8

Object Oriented Programming – Abstraction – Objects and Classes – Encapsulation– Inheritance – Polymorphism– OOP In Java – Characteristics of Java – The Java Environment – Java Source File – Compilation - Fundamental Programming Structures in Java – Defining Classes in Java – Constructors - Methods -Access Specifiers– Static Members – Comments - Data Types – Variables – Operators - Control Flow - Arrays - Packages – Javadoc Comment

List of Experiments

a) Write a program to find the sum of individual digits of a positive integer.
b) Write a program to generate the first n terms of the sequence.

Recommended by
Board of Studies of IT dept.
Meeting No. 7 Dated: 09.04.2025

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c) Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

d) Write a program to find both the largest and smallest number in a list of integers.

e) Write a program to find factorial of list of number reading input as command

MODULE - II INHERITANCE AND INTERFACES **8**

Inheritance – Superclasses– Subclasses –Protected Members – Constructors in SubClasses– The Object Class – Abstract Classes and Methods– Final Methods and Classes – Interfaces – Defining an Interface - Implementing Interface - Differences Between Classes and Interfaces - Extending Interfaces – Object Cloning - Inner Classes - Array Lists – Strings.

List of Experiments

a) 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 BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary

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

c) Write a program to perform string operations using ArrayList. Write functions for the following a. Append - add at end b. Insert – add at particular index c. Search d. List all string starts with given letter

MODULE - III EXCEPTION HANDLING AND I/O **8**

Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – BuiltIn Exceptions - Creating Own Exceptions - Stack Trace Elements - Input /Output Basics – Streams – Byte Streams and Character Streams – Reading and Writing Console – Reading and Writing Files.

List of Experiments

a) Implement exception handling and creation of user defined exceptions

b) Design a Java interface for ADT Stack. Implement this interface using an array. Provide necessary exception handling in both the implementations.

c) Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes

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Module - IV MULTITHREADING AND GENERIC PROGRAMMING 7

Differences between Multithreading and Multitasking - Thread Life Cycle - Creating Threads - Synchronizing Threads - Inter-Thread Communication - Daemon Threads - Thread Groups - Java Concurrency Packages - Generic Programming – Generic Classes – Generic Methods – Bounded Types – Restrictions and Limitations.

List of Experiments

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

b) Write a program to implement the concept of importing classes from user defined package and creating packages

c) Write a java program to find the maximum value from the given type of elements using a generic function

MODULE - V COLLECTION FRAMEWORK 7

Collections overview, Collection interfaces - List, Set, Map, List - ArrayList, LinkedList, Vector, Set - HashSet, TreeSet, Map - HashTable, HashMap, Accessing a collection via an Iterator, Comparator, comparable.

List of Experiments

a) Write a Java program to create a new array list, add some colors and print the collection.

b) Write a Java program to shuffle elements in array list

c) Write a Java program to iterate through all elements in a linked list

d) Write a Java program to create an ArrayList of Student (id,name,dept,age) objects and search for particular Student objects based on id number.

e) Write a Java program to create an ArrayList which will be able to store only char and String but not any other data type.

f) Write a Java program using Queue Collection for Cinema Ticket Sale.

MODULE - VI GUI PROGRAMMING WITH APPLET AND SWING 7

Applets - Applet Class, Applet Skeleton, Simple Applet, Delegation Event Model - Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events. Swing - JLabel and Image icon, JTextField, JButton, JCheckBox, JRadioButton, JComboBox

List of Experiments

a) Develop an Applet program to accept two numbers from the user and output the sum and difference in the respective text boxes.

b) Write a program that identifies key-up key-down event user entering text in a Applet

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c) Write a Java program to design student registration form using Swing controls. The form which having the following fields and button SAVE

d) Write a program to display the digital watch in swing

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java - The Complete Reference", 8th Edition, McGrawHill Education, 2011.
2. E. Balagurusamy - "Programming with Java", 6th Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, Harvey Deitel, "Java SE 8 for Programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Blackbook", Dream Tech Press, 2011.
3. Timothy Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. https://www.edureka.co/blog/object-oriented-programming/
3. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html
4. https://introcs.cs.princeton.edu/java/lectures/

OUTCOMES:

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

1. Apply object-oriented programming principles and Java fundamentals to develop basic programs involving control structures, arrays, and simple algorithmic logic. (K3)
2. Demonstrate the use of inheritance, abstract classes, interfaces, and Java collection classes to construct structured and reusable object-oriented programs. (K3)
3. Implement robust Java applications by integrating exception handling mechanisms and performing file I/O operations using streams. (K3)
4. Analyze the behavior of multithreaded applications and generic programming constructs to improve concurrency and code reusability in Java. (K4)
5. Evaluate the functionality and efficiency of Java Collection Framework components to optimize data storage and retrieval in real-world applications. (K4)

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6. Design and analyze interactive graphical user interfaces (GUIs) using Applet and Swing components to enhance user experience in Java applications. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	2	-	-	-	-	-	-	3	-
CO3	3	3	3	-	2	-	-	-	-	-	2	3	2
CO4	3		-	-	2	-	-	-	-	-	-	-	-
CO5	3	2	3	-	3	-	-	-	-	-	-	3	-
CO6	3	2	3	-	3	-	-	-	-	-	-	3	-

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SEMESTER - II

24ESID201 SDG NO. 1-17	IDEA ENGINEERING LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

To impart the basics of technologies that are used to identify sustainable solutions to societal problems

- To Provide awareness on Printed Circuit Board (PCB) design using ORCAD software.
- To Raise awareness of at least three Internet of Things (IoT) projects and their applications.
- To Upskill learners through practical experience with 3D printing and scanning technologies.
- To prepare the learners to correctly align the ideas to SDGs
- To comprehensive knowledge on entrepreneurship and effective idea presentation techniques.
- To evaluate the effectiveness of SDGs and implementation strategy

MODULE-1 BASICS OF DESIGN THINKING IN ELECTRICAL AND ELECTRONIC COMPONENTS 4

- Awareness Session on Basics of Design Thinking
- Study of Active & Passive Electronic Components
- Study of Basic AC & DC Electrical Circuits

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- Study of Microprocessors & Microcontrollers
- Demonstration of Arduino Board, ESP 32 Board ,Raspberry Pi Board & PCB design software-Eagle
- Demonstration of PCB design using the software's Orcad, Eagle etc.

MODULE-2 EMBEDDED SYSTEMS, IOT AND ROBOTICS 4

- Study of sensors and transducers
- Study of embedded protocols, IOT Protocols & Embedded C
- Demonstration of Robotics & Drone models

MODULE-3 BASICS OF MECHANICAL ENGINEERING 4

- Study of Mechanical Modeling using Fusion 360
- Demonstration of 3D Scanner,3D Printer, Laser Cutter &RD Works Software
- Study of Slicer Software & Master Cam Software

MODULE 4 ALIGNMENT AND MAPPING OF IDEAS 4

- **Project Title:** Justification of SDG and SAP - Problem Statement & Solution

MODULE-5 ENTREPRENEURSHIP SKILLS 4

- Startup Awareness
- Entrepreneurship Opportunities
- Mock Presentations
- Innovation
- Novelty
- Feasibility
- Presentation Skills

MODULE-6 SCOUT for SDG IDEATHON 12

Evaluation Stages:

- First Round
- Second Round
- Idea Pitching

TOTAL: 30 PERIODS

REFERENCES:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
3. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House

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4. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
5. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
6. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2017.
7. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs115/preview
3. https://onlinecourses.nptel.ac.in/noc24_me104/preview
4. https://onlinecourses.nptel.ac.in/noc24_me88/preview

OUTCOMES:

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

1. Gain the knowledge on Basic Electronics & Electrical Circuits (K2)
2. Understand the Basics of Embedded systems,IOT & Robotics (K1)
3. Explore the the Basics of Mechanical Modeling (K2)
4. Interpret the mapping of SDGs to ideas. (K4)
5. Illustrate the ideas in the Ideathon event emphatically .(K4)

CO-PO, PSO MAPPING:

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

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SEMESTER - II

24ENTP201 - SDG NO. 4	DIGITAL DYNAMICS	L	T	P	CP	C
		0	0	2	2	0

OBJECTIVES:

- Explore online communication
- Master computer skills
- Use virtual platforms
- Understand digital ethics and cyber security
- Observe and follow do's and don'ts

MODULE - I DIGITAL CULTURE AND SOCIETY 6

Adapting to changes
Importance in today's digital landscape
Digital identity and self- presentation
Online communities and forums
Digital divide and consequences
Online collaboration and collective action

MODULE - II DIGITAL LITERACY AND ACCESS TO TECHNOLOGY 5

Computer skills
Social and cultural understanding
Social media campaign and Activism
Netiquettes
Trending Technologies
Digital tools and softwares

MODULE - III DIGITAL ETHICS 3

Digital ethics and moral panics
The art of protecting secrets
Overview of digital tools

MODULE - IV CYBER SECURITY 3

Threats, vulnerability and consequences
Data making and usage practice
Importance of security

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MODULE - V DIGITAL NETWORKING 7

Remote work and virtual teams

Authenticity in digital interactions

Engaging content creation

Tools and and techniques for insightful usage

Balancing online and offline interactions

Collaboration for research and innovation

MODULE - VI BUREAU OF INDIAN STANDARDS (BIS): BASIC CONCEPTS, STANDARDS FORMATION PROCESS AND CHALLENGES 6

Standardization –Basic Concepts:

Basic concepts of standardization

Purpose of standardization, marking and certification of articles and processes

Importance of standards to industry, policy makers, trade, sustainability and innovation

Standards Formulation Process and Challenges:

Objectives, roles and functions of BIS, Bureau of Indian Standards Act, ISO/ IEC Directives

WTO Good Practices for Standardization

World of Standards:

Important Indian and International Standards

TOTAL: 30 PERIODS

REFERENCES:

1. Communication Skills and Soft Skills – an Integrated Approach. Edited by E. Sureshkumar, P. Sreehari and J. Savithri, Pearson.
2. Silvia. P.J.2007. How to Read a Lot. Washington DC, American Psychological Association.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

OUTCOMES:

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

1. Apply online communication techniques and collaboration skills (K3)
2. Enumerate the principles of digital ethics in online interactions (K2)
3. Understand the importance of Bureau of Indian Standards (BIS). (K2)

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CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

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SEMESTER - III

24BSMA306 - SDG NO. 4	LINEAR ALGEBRA AND NUMBER THEORY	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The main objective of this course is to provide students with the foundations of Number Theory and linear algebra mostly used in diverse applications in Cyber Security.

MODULE - I VECTOR SPACES 9

Vectors and Linear combinations – Vector spaces (Definitions and examples)– Subspaces (Definitions and examples) – Linear independence and linear dependence – Bases and dimensions.

MODULE II LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation - Null spaces and ranges - Dimension theorem (Statement only) - Matrix of a linear transformation - Eigenvalues and eigenvectors - Diagonalizability- Test for Diagonalization.

MODULE - III INNER PRODUCT SPACES 9

Inner product- norms - Gram Schmidt orthogonalization process - Adjoint of linear operator - Least square approximation.

MODULE - IV DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 9

Division algorithm — Base — b representations — Prime and composite numbers — GCD — Euclidean algorithm — Fundamental theorem of arithmetic — LCM.

MODULE - V DIOPHANTINE EQUATIONS AND CONGRUENCES 12

Linear Diophantine equations — Congruences — Linear Congruences — Applications: Divisibility tests — Modular exponentiation-Chinese remainder theorem.

MODULE - VI CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 9

Wilson's theorem — Fermat's little theorem — Euler's theorem — Euler's Phi functions.

TOTAL : 60 PERIODS

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TEXT BOOKS:

1. Linear Algebra, Stephen Friedberg, Arnold Insel and Lawrence Spence, 5th Edition, Pearson, 2018.
2. Elementary Linear Algebra, Howard Anton and Chris Rorres, 11th Edition, Wiley Publications, 2014 (Units - I, II & III).
3. Elementary Number theory with Applications, Koshy T, 1st Edition, Elsevier Publications, New Delhi, 2002.
4. A course in Number theory and Cryptography, Koblitz N, 2nd Edition, Springer Verlag, New York, 1994.

REFERENCES:

1. Linear Algebra - A Geometric Approach, Kumaresan S., 1st edition (reprint), Prentice – Hall of India, New Delhi, 2010.
2. Linear Algebra and Learning from Data, Gilbert Strang, 1st edition, Wellesley-Cambridge Press, 2019
3. A course in Number Theory, Rose H.E, Clarendon Press, 2nd edition, Oxford, 1995.
4. A classical introduction to Modern Number Theory, Kenneth Ireland & Michael Rosen, Springer International Edition, 2nd edition, New York 2010.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/111/106/111106135/
2. https://archive.nptel.ac.in/courses/111/101/111101137/
3. https://www.imsc.res.in/~svis/Algebra/Sunder-LinearAlg-notes.pdf

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/resources/an-overview-of-linear-algebra-1/
2. https://freevideolectures.com/course/3382/linear-algebra-i
3. https://ocw.mit.edu/courses/18-781-theory-of-numbers-spring-2012/pages/lecture-notes/

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Apply the concepts of vector spaces, subspaces, linear dependence / independence, and basis to solve problems related to vector representation and dimensionality. (K3).
2. Apply the concepts of linear transformations, eigenvalues, and eigenvectors to determine the diagonalizability of matrices. (K3)

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3. Utilize inner product space concepts and the Gram-Schmidt process to obtain an orthonormal basis and perform least square approximations. (K3)
4. Demonstrate understanding of number theoretic concepts such as divisibility, prime factorization, GCD, and the Euclidean algorithm to solve basic arithmetic problems. (K3)
5. Solve linear Diophantine and congruence equations and apply modular arithmetic in real-life and theoretical contexts using the Chinese Remainder Theorem. (K3)
6. Apply classical number theory theorems such as Fermat's, Wilson's, and Euler's to solve problems involving integers and evaluate properties of multiplicative functions. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3
CO6	3	-	-	-	-	-	-	-	-	-	-	-	2

SEMESTER - III

24SCPC301 106105217 SDG NO. 4,9,11&17	CYBER SECURITY ESSENTIALS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Explain the core principles of cybersecurity, including the CIA triad (Confidentiality, Integrity, Availability) and how they apply to real-world scenarios
- Provide a comprehensive understanding of cryptographic techniques,
- Demonstrate tools for secure software development,
- Explore emerging trends and their implications in the cyber security domain.
- Demonstrate frameworks for cybersecurity governance and the importance of policies and procedures in managing security.

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- To understand Cyber security standards, Policies, Governance and Ethical issues.

MODULE - I INTRODUCTION TO CYBER SECURITY 7

Fundamentals of Cyber Security- Cyber Threats and Vulnerabilities- Cyber-Attacks: Malware, Phishing, Denial-of-Service, Ransomware- Cyber Security Architecture: CIA Triad (Confidentiality, Integrity, Availability)- Overview of Cyber Laws and Policies

MODULE - II CRYPTOGRAPHY AND NETWORK SECURITY 8

Principles of Cryptography-Symmetric and Asymmetric Key Algorithms (e.g., AES, RSA)-Digital Signatures and Certificates-Public Key Infrastructure (PKI)-Network Security Basics: Firewalls, VPNs, IDS and IPS

MODULE - III SECURE SOFTWARE DEVELOPMENT 7

Secure Software Development Lifecycle (SDLC)-Threat Modeling and Risk Management-Common Software Vulnerabilities (e.g., OWASP Top 10)-Code Analysis and Secure Coding Practices-DevSecOps: Integrating Security into Development

MODULE - IV CYBER SECURITY TOOLS AND TECHNIQUES 8

Cyber Security Tools: Packet Analysis with Wireshark-Exploitation Frameworks with Metasploit-Web Application Security with Burp Suite-Network Scanning with Nmap- Ethical Hacking and Penetration Testing-Incident Response and Forensic Techniques-Security Information and Event Management (SIEM) Tools-Real-time Monitoring: Log Analysis and Threat Detection.

MODULE - V EMERGING TRENDS IN CYBER SECURITY 7

Artificial Intelligence and Cyber Security -IoT Security Challenges and Best Practices- Blockchain for Cyber Security-Cloud Security: Concepts and Threats- Zero Trust Architecture and Adaptive Security

MODULE - VI CYBER SECURITY GOVERNANCE, STANDARDS AND ETHICS 8

Cyber Security Frameworks (e.g., NIST, ISO 27001) - Standards:PCI DSS,NIST SP 800-53- Security Policies -Ethical and Legal Issues in Cyber Security-Data Protection and Privacy Laws (e.g., GDPR)-Governance, Risk Management, and Compliance (GRC)

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 2020.
2. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics, and Legal Perspectives, Wiley, 2011.

REFERENCES:

1. C.K. Shyamala et al., Cryptography and Security, Wiley India, 2011.
2. Michael T. Simpson et al., Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2020.

NPTEL/WEB LINKS:

1. NPTEL: Cyber Security
2. Coursera: Introduction to Cyber Security by NYU
3. Udemy: Ethical Hacking Bootcamp

OUTCOMES

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

1. Identify cyber threats, vulnerabilities, and relevant cyber laws using fundamental cyber security concepts. (K3).
2. Apply cryptographic techniques and network security mechanisms to protect data confidentiality, integrity, and authentication (K3).
3. Develop secure software practices to address common software vulnerabilities in applications. (K3).
4. Make use of cyber security tools such as Wireshark, Nmap, Metasploit, and Burp Suite for network monitoring and security testing. (K3).
5. Construct basic security solutions by applying cyber security techniques to analyze system vulnerabilities. (K3).
6. Organize cyber security governance frameworks, standards, and ethical practices in information security management. (K3)

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CO – PO, PSO MAPPING:

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

SEMESTER - III

24SCPC302 noc23-cs85 SDG NO. 4, 9, 11	COMPUTER NETWORKS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Provide foundational knowledge of computer networking concepts, architectures, and protocols.
- Enable students to design and analyze network systems for different use cases.
- To learn the functions of network layer and the various routing protocols
- To understand various application layer protocols.
- Foster understanding of the latest advancements in networking technologies and promote awareness of sustainability and ethical considerations in network design and operations.
- To understand the Emerging Technologies like SDN, IoT and Next Generation Networks

MODULE - I INTRODUCTION TO COMPUTER NETWORKS 7

Basics of Computer Networks - Types of Networks: LAN, WAN, MAN, PAN-OSI and TCP/IP Models- Network Topologies and Switching Techniques- Physical Layer: Transmission Media, Signals, and Bit Transmission

MODULE - II DATA LINK LAYER 8

Error Detection and Correction Techniques- Data Link Protocols: Stop-and-Wait, Sliding Window- Medium Access Control (MAC) Protocols: ALOHA, CSMA/CD, CSMA/CA- Ethernet (IEEE 802.3), Wireless LANs (IEEE 802.11)

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MODULE - III NETWORK LAYER 8

Logical Addressing: IPv4 and IPv6- Subnetting and Supernetting- Routing Algorithms: Shortest Path, Distance Vector, Link State- Network Devices: Routers, Switches, Gateways- Internet Protocols: ICMP, ARP, RARP

MODULE - IV TRANSPORT LAYER 7

Transport Layer Protocols: TCP, UDP- Congestion Control Mechanisms- Flow Control Techniques - Quality of Service (QoS) in Transport Layer

MODULE - V APPLICATION LAYER 8

Introduction- Electronic mail (SMTP, POP3, IMAP, MIME)-DNS-FTP-HTTP and SNMP -Introduction to Cloud Networking - Peer-to-Peer Networks- Network Security Basics: Firewalls, IDS & IPS

MODULE - VI EMERGING TOPICS IN NETWORKING 7

Software-Defined Networking (SDN)- Internet of Things (IoT) and Smart Networks- Energy Efficiency in Networking- Next-Generation Networks (5G and Beyond)- Ethical and Sustainability Issues in Networking

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach by James F. Kurose and Keith W. Ross, 8th Edition, 2021
2. Data Communications and Networking by Behrouz A. Forouzan, 5th Edition, 2017.

REFERENCE BOOKS

1. Computer Networks by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, 2013
2. Network Security Essentials: Applications and Standards by William Stallings, 6th Edition, 2020

WEB REFERENCES

1. Computer Networks (Prof. Bhaskar Ramamurthi, IIT Madras)
2. Data Communication Networks (Prof. Sudarshan Iyengar, IIT Ropar)

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OUTCOMES

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

1. Implement the principles, design, terminology, and concepts of network models to configure and manage basic network communications. (K3)
2. Select the protocols of data link layer and apply error control mechanisms (K3)
3. Apply sub netting, routing algorithms, and congestion control techniques to practical scenarios. (K3)
4. Implement the Transport Layer Protocols suitable for transmission of data (K3)
5. Illustrate the application layer protocols and their basic functionalities. (K3)
6. Apply sustainable practices and ethical considerations in networking design and communication systems. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - III

24ITPC301 106105225 SDG NO. 4	DATA STRUCTURES AND ALGORITHMS	L	T	P	CP	C
		3	0	0	3	3

Chairman
Board of Studies
Department of Computer Science and Engineering (Cyber Securi

OBJECTIVES:

- To introduce the concepts of Abstract Data Types (ADTs) and provide a thorough understanding of Stacks and Queues
- To develop proficiency in implementing linked list structures
- To impart knowledge on tree data structures
- To familiarize with the fundamentals of graph theory
- To provide foundational skills in algorithm design and analysis

Recommended by
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Meeting No. 7 Dated: 09.04.2025

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MODULE - I STACKS AND QUEUES 8

Stacks-and-Queues: Abstract-Data-Types-(ADTs): Stack ADT: Operations - Applications - Evaluating arithmetic expressions - Infix, Prefix and Postfix expression - Operations - Queue ADT: Operations - Circular Queue - Priority Queue - Dequeue

MODULE - II LINKED LIST 7

Linked List: List ADT – Array-Based Implementation – Linked List Implementation –- Singly Linked Lists- Circularly Linked Lists- Doubly-Linked Lists – Applications of Lists – All Operations (Insertion, Deletion, Merge, Traversal).

MODULE - III TREES 7

Trees – Tree Traversals - Binary Tree ADT – Expression Trees – Binary Search Tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - Heap

MODULE - IV GRAPHS 8

Graphs: Definition – Representation of Graph – Types of Graph – Breadth First Traversal –Depth First Traversal – Topological Sort – Dijkstra"s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - Minimum spanning tree – Prim's and Kruskal's algorithms

MODULE - V SORTING AND SEARCHING ALGORITHMS 8

Bubble sort – Selection sort – Insertion sort - Divide and Conquer – Merge sort – Quick sort – Analysis of sorting algorithm – Linear search - Binary search.

MODULE - VI ALGORITHM ANALYSIS TECHNIQUES 7

Fundamentals of Algorithmic Problem Solving – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties - –Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms–Greedy Technique - 0/1 Knapsack problem

TOTAL : 45 PERIODS

TEXT BOOKS:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, 2002.
2. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
3. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms/ C++", Second Edition, Universities Press, 2007.

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Meeting No. 7 Dated: 09.04.2025

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REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
3. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983
4. Yashavant Kanetkar," Data Structures Through C", BPB, ISBN-13:978-9388511391,2019.

WEB REFERENCES:

1. https://www.programiz.com/dsa
2. http://masterraghu.com/subjects/Datastructures/ebooks/remathareja.pdf
3. https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/
4. https://nptel.ac.in/courses/106102064

OUTCOMES

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

1. Develop the ADT for stack and Queue Data Structures (K3)
2. Build the ADT for Linked List Data Structures (K3).
3. Analyze the use of tree data Structures in diverse real-world applications and compare their performance (K4).
4. Analyze various graph traversal and optimization Algorithms for specific application scenarios. (K4).
5. Utilize sorting and searching algorithms to compute time and space complexity. (K3)
6. Analyze Recursive and Non-Recursive Algorithms to develop solutions for optimization problems (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	-	-	-	-	-	-	2	3	3
CO5	3	2	-	-	-	-	-	-	-	-	2	2	2
CO6	3	3	3	2	-	-	-	-	-	-	2	3	2

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Meeting No. 7 Dated: 09.4.2025

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SEMESTER - III

24ITPW301 106106220 SDG NO. 4, 9	DATABASE MANAGEMENT SYSTEMS WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To design database and database queries using ER diagrams and SQL respectively
- To understand Dependencies and various types of normalization in database application
- To understand the concepts of concurrent Transaction Processing and recovery procedures
- To understand the cursor, procedure and control structure in PL/SQL
- To obtain knowledge about the Distributed, Object Databases ,XML and NOSQL databases

MODULE - I DATABASE DESIGN AND RELATIONAL DATABASES 8

Purpose of Database System–Views of Data–Database System Architecture-Data Models–Entity Relationship Model–ER Diagrams–Enhanced ER Model-Introduction to Relational Databases – Relational Model-ER-to-Relational Mapping– Keys –Relational Algebra – SQL Fundamentals

MODULE - II FUNCTIONAL DEPENDENCIES AND NORMALIZATION 7

Functional Dependencies–Non-loss Decomposition – First – Second - Third Normal Forms - Dependency Preservation – Boyce/Codd Normal Form – Multi Valued Dependencies and Fourth Normal Form–Join Dependencies and Fifth Normal Form

MODULE - III PL/SQL PROGRAMMING 9

Introduction of PL/SQL -Advantages of PL/SQL- PL/SQL Block Structure, PL/SQL Data Types, Variable, Constant- Control Structure- Conditional Control, Iterative Control, Sequential Control- Exception handling Predefined Exception, User defined Exception-Cursors- Implicit and Explicit Cursors, Declaring, opening and closing cursor, fetching a record from cursor ,cursor for loops, parameterized cursors- Procedures- Advantages, Create, Execute and Delete a Stored Procedure.

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MODULE - IV CONCURRENT TRANSACTION PROCESSING 7

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control–Need for Concurrency–Locking Protocols–Two Phase Locking–Deadlock–Transaction Recovery–Save Points–Isolation Levels– SQL Facilities for Concurrency and Recovery.

MODULE - V FILE ORGANIZATION AND QUERY PROCESSING 7

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ Tree Index Files – B Tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics - Cost Estimation.

MODULE - VI OBJECT ORIENTED DATABASE ,XML DATABASE AND NOSQL 7

Distributed Databases–Architecture-Data Storage-Transaction Processing-Object Based Databases - Object Database Concepts – Object Relational Features - ODMG Object Model – ODL - OQL – XML Databases - XML Hierarchical Model–DTD-XML Schema–Xquery. Introduction to NoSQL-Four types of NoSQL database

LIST OF EXPERIMENTS 15

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying–Simple queries, Nested queries, Sub queries and Joins.
3. Implementation of Views, Sequences and Synonyms.
4. Implicit and Explicit Cursors
5. Procedures and Functions.
6. Triggers.
7. Exception Handling
8. Develop any one application using the following steps
   i) Database Design using ER Model
   ii) Normalization
   iii) Front End and Back End Design and connectivity

TOTAL: 60 PERIODS

Recommended by
Board of Studies of IT dept.
Meeting No. 3 Dated: 09.04.2025

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Board of Studies
Information Technology

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B.Navathe, "Fundamentals of Database Systems",SeventhEdition,PearsonEducation,2016.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan,"An Introduction to Database Systems",Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems ", Fourth Edition, McGraw-Hill Education,2015.
3. G.K.Gupta,"Database Management Systems",Tata McGrawHill,2011.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs46/
2. http://www.nptelvideos.in/2012/11/database-management-system.html
3. https://www.classcentral.com/course/swayam-database-management-system-9914
4. http://learnsql.com
5. https://www.w3schools.com/sql/default.asp
6. https://www.khanacademy.org/computing/computer-programming/sql

OUTCOMES

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

1. Construct the principles of Relational databases to design the Entity relationship diagrams for any given scenario. (K3)
2. Critique the use of normalization and functional dependencies to refine the database system. (K3)
3. Analyze the PL/SQL programs using control structures, Exceptions, Cursors and Procedures. (K4)
4. Apply various SQL queries for Transaction Processing and Locking using the concept of Concurrency control. (K3)
5. Develop indexing and hashing techniques to organize databases and improve advanced query processing. (K3)
6. Examine the various types of modern and traditional databases(K4)

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Information Technology

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Meeting No. 7 Dated: 09.04.2025

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	2	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	-	3	2	3	-	-	-	-	-	-	-	2	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	3	-
CO6	3	-	3	-	-	-	-	-	-	-	-	-	2

SEMESTER - III

CHAIRMAN
Board of Studies
Information Technology

24HSMC301 – SDG NO. 4 & 9	UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Developing clarity with harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.
- Recognizing the potential of excellence than competition

SYLLABUS:

The course has 28 lectures and 14 practice sessions in 6 modules:

MODULE - I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION (5+2)

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario

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Meeting No. Dated:

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

MODULE-II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF (5+2)

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

MODULE-III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP (6+2)

12. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values ofrelationship
13. Understanding the meaning of Trust; Difference between intention and competence
14. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
15. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

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Department of Computer
Science and Engineering (Cyber Security)

MODULE - IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE (6+2)

16. Understanding the harmony in the Nature
17. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
18. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
19. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion ofresources and role of technology etc.

MODULE - V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS (4+4)

20. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family
21. Natural acceptance of human values
22. Definitiveness of Ethical Human Conduct
23. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
24. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

MODULE - VI UNIVERSAL HUMAN ORDER (4+3)

25. Programs to ensure Sanyam and Health
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc

TOTAL : 45 PERIODS

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Meeting No. _____ Dated: _____

TEXT BOOKS:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

REFERENCES:

1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values,A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj- Pandit Sunderlal
9. Rediscovering India- by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda- Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOMES

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

1. 1. Express the harmony of relationship among human being, family, society, nature and existence with right understanding and right feeling. (K2)
2. Develop the responsibility of handling problems by finding holistic and sustainable solutions based on the natural acceptance for maintaining mutual human relationships. (K2)
3. Develop a holistic perspective of life based on self-exploration about self, family, society and nature/existence. (K2)
4. Elucidate a critical ability for dedicative commitment towards human values, relationships and society. (K2)
5. Implement the process of verification and validation of learning in daily life. (K2)
6. Develop self reflection, commitment and courage to act in life challenging situations. (K2)

Recommended by
Board of Studies of _____ dept.
Meeting No. _____ Dated: _____

CO – PO, PSO MAPPING:

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

SEMESTER - III

24HSNC301 – SDG NO. 4	NCC COURSE LEVEL 2	L	T	P	CP	C
		3	0	0	0	0

ARMY WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP **7**

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

Recommended by
Board of Studies of H&S dept.
Dated: 31/5/2024

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Department of Humanities & Sciences

ARMED FORCES		**6**
AF 1	Armed Forces, Army, CAPF, Police	6
ADVENTURE		**1**
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
LEADERSHIP 7		
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
NAVAL ORIENTATION 6		
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
ADVENTURE		**1**
AD 1	Introduction to Adventure Activities	1

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Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies

BORDER & COASTAL AREAS **2**

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL: 45 PERIODS

AIR FORCE WING

PERSONALITY DEVELOPMENT 9

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP **7**

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

GENERAL SERVICE KNOWLEDGE **6**

GSK 1 Armed Forces & IAF Capsule 2

GSK 2 Modes of Entry in IAF, Civil Aviation 2

GSK 3 Aircrafts - Types, Capabilities & Role 2

ADVENTURE 1

AD 1 Introduction to Adventure Actitivities 1

BORDER & COASTAL AREAS **2**

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL :45 PERIODS

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SEMESTER - III

24CIPT301 - SDG NO. 4 & 9	DIGITAL DESIGN AND COMPUTER ORGANIZATION SYSTEM LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and show the correlation between Boolean expressions.
- To introduce the methods for simplifying Boolean expressions.
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
- To illustrate the concept of synchronous and asynchronous sequential circuits.
- To introduce the concept of memories and programmable logic devices

MODULE - I LOGIC SIMPLIFICATION 7

Review of number systems and number representation – Binary codes – Code Conversion; Logic Simplification: Review of Boolean Algebra and De Morgan's Theorem – SOP and POS forms – Canonical forms – Karnaugh maps up to 4 variables- Implementation using logic gates.

List of Experiments

1. Verification of Boolean Theorems using basic gates
2. Converting Boolean functions to Standard SOP/POS Form using K map realization and Implementation.
3. Implementation of boolean functions using NAND and NOR gate.

MODULE - II COMBINATIONAL LOGIC DESIGN 7

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder.

List of Experiments

1. Design and implement Half/Full Adder and Subtractor
2. Design and implement combinational circuits using MSI devices:
   a. 4 bit binary adder/subtractor b. Magnitude comparator

MODULE - III SYNCHRONOUS SEQUENTIAL CIRCUITS 7

Flip - Flops: Bistable elements, Latches, Flip flops – SR, JK, T, D– operation and excitation tables, Triggering of Flip Flop- Master/Slave Flip flop. Registers and Counters: Shift registers - SISO, SIPO, PISO and PIPO; up/down Counters; Design of Synchronous counters - Shift Register Counters.

Recommended by Board of Studies of CSE(Cyber) dept. Meeting No. 6 Dated: 9.4.2026

Accepted CHAIRMAN Board of Studies

List of Experiments

1. To design 4 bit synchronous Counter using JK Flip flops - Ic7476
2. To design and Implement- T and D flip flops

MODULE - IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 7

Introduction to asynchronous sequential circuits - fundamental mode and pulse mode circuits - State Diagram and Excitation Table - Ripple Counters cycles and races, state reduction, race free assignments

List of Experiments

1. To design 4-bit Ripple counter using JK Flip flops - Ic7476
2. To design an asynchronous 4-bit up and down counter.

MODULE - V ARITHMETIC OPERATIONS IN PROCESSORS 5

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism – one's and two's complement – Booth algorithm

List of Experiments

1. Binary number multiplication using Booth's algorithm
2. Addition and Subtraction Operations in Processors

MODULE - VI MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES5

Memory Devices: Basic memory structure – ROM - PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM PLDs: PLA, PAL, PROM, Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. – CPLD.

List of Experiments

1. Implementation of adder using PAL and PLA
2. Implementation of Multiplier using PLA and PAL

TOTAL : 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson, 2014.
2. S. Salivahanan, S. Arivazhagan, "Digital Circuits and Design", Oxford Press India, Fifth Edition, 2018.
3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Eighth Edition, Pearson Education, 2010.

Recommended by
Board of Studies of CSE(SC) dept.
Meeting No. 6 Dated: 7.4.2024

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Board of Studies

REFERENCE BOOKS

1. Charles H.Roth."Fundamentals of Logic Design",6 Edition,Thomson Learning, 2013.
2. Thomas L.Floyd, "DigitalFundamentals",10 Edition, Pearson Education Inc, 2011.
3. S.Salivahananand S.Arivazhagan, "DigitalElectronics", I Edition, Vikas Publishing House pvt Ltd, 2012
4. A.AnandKumar, "Fundamentals of Digital Circuits", 4 Editions, PHI Learning Private Limited, 2016.

WEBRESOURCES:

1. http://nptel.ac.in/courses/117106086/1
2. http://nptel.ac.in/courses/117103064/

ONLINERESOURCES:

1. https://www.allaboutcircuits.com/textbook/digital/
2. http://web.iitd.ac.in/~shouri/eel201/lectures.php

OUTCOMES

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

1. Apply logical reasoning techniques to simplify and implement digital functions for basic circuit realization.(K3)
2. Demonstrate the working of combinational circuits through hardware implementation and verification of outputs(K3)
3. Apply the behavior of sequential digital circuits to determine suitable flip flop and counter configurations for reliable system operations(K3)
4. Utilize asynchronous sequential circuit behavior and evaluate counter design considering race conditions and state reductions (K3)
5. Implement arithmetic algorithms used in processors to perform binary arithmetic and data manipulation operations.(K3)
6. Implementation the digital logic circuits using programmable hardware resources for computing applications(K3)

Recommended by
Board of Studies of CSE(IoT) dept.
Meeting No. 6 Dated: 9.4.2024

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Computer Science and Engineering
(Internet of Things)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	1	-	-	2	3	2
CO2	3	-	-	-	-	-	-	1	-	-	2	3	2
CO3	2	-	-	-	-	-	-	1	-	-	1	3	2
CO4	3	-	-	-	-	-	-	1	-	-	1	3	2
CO5	3	-	-	-	-	-	-	1	-	-	1	3	2
Co6	3	-	-	-	-	-	-	1	-	-	1	3	2

Recommended by
Board of Studies of CSE(SC) dept.
Meeting No. 6 Dated: 9.4.2026

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(Internet of Things)

SEMESTER - III

24ITPL301 - SDG NO. 4	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To implement and demonstrate basic data structures
- To understand and apply algorithmic paradigms
- To apply graph algorithms and optimization techniques
- To develop and analyze efficient searching and sorting techniques
- To implement advanced data structures and algorithms

List of Experiments:

1. Implement the basic operations of a stack using arrays (push, pop, peek, and isEmpty).
2. Implement the basic operations of a queue using arrays (enqueue, dequeue, front, rear, and isEmpty).
3. Implement the conversion of an infix expression to a postfix expression using a stack.
4. Implement a singly linked list with basic operations such as insertion, deletion, and traversal.
5. Implement a doubly linked list with basic operations such as insertion, deletion, and traversal.
6. Implement a binary tree and perform basic operations like insertion, deletion, and traversal (inorder, preorder, postorder).
7. Implementation of AVL tree(all operation).
8. Implementation of Priority queue using Heap.
9. Graph representation and Traversal algorithms a) Depth first Search b) Breadth First Search.
10. Implement Dijkstra's algorithm to find the shortest path from a source vertex to all other vertices in a graph.
11. Implement linear search and Binary search.
12. Implement merge sort and quick sort for Divide and Conquer.
13. Implement the 0/1 Knapsack Problem using the Greedy technique
14. Analyze and implement a recursive algorithm (like factorial or Fibonacci)

TOTAL : 45 PERIODS

LAB REQUIREMENTS : Turbo C/Dev C++, Borland C or GCC equivalent

Recommended by
Board of Studies of IT dept.
Meeting No. 7 Dated: 09.4.25

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Information Technology

OUTCOMES

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

1. Apply basic linear and non linear data structures (K3)
2. Analyze and compare various trees, searching and sorting algorithms (K4)
3. Apply algorithmic strategies such as greedy and graph-based techniques (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	1	3	3
CO2	2	3	3	-	-	-	-	-	-	-	1	3	3
Co3	2	2	3	-	-	-	-	-	-	-	1	3	3

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Information Technology

SEMESTER - III

24SCTP301 - SDG NO. 4	APTITUDE SKILLS - I	L	T	P	CP	C
		0	0	2	4	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Enrich students on quantitative ability, reasoning ability, and verbal ability
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills and Strengthen problem-solving skills.

Recommended by
Board of Studies of IT dept.
Meeting No. 7 Dated: 09.04.25

MODULE - I QUANTITATIVE ABILITY 22

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

MODULE - II QUANTITATIVE ABILITY REASONING ABILITY 16

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY 7

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL: 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS – PHASE 2

OBJECTIVES:

- Familiarize the team and leadership skills.
- Understand the standards relevant to Cyber Security.

MODULE - I JEEVAN KAUSHAL 2.0 – TEAM SKILLS AND LIFE SKILLS 12

Trust and Collaboration: Importance of Trust in Creating a Collaborative Team- Agree to Disagree and Disagree to Agree – Spirit of Teamwork - Understanding Fear of Being Judged and Strategies to Overcome.

Brainstorming: Basics and the process – Effective technique for ideation – Types – Importance and Benefits

Internal Communication: Internal Communication – Meaning and the Need, Use of Various Channels for Transmitting Information to Team Members including Digital and Physical.

Leadership Skills: Leadership concept - Leadership skills – Leadership moralities – Leadership models

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Board of Studies of CSE (SC) dept.
Meeting No. 1 Dated: 21/4/2025

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MODULE - II RANGER AND ROVER **10**

Four Bonds of BSG: Sign, Salute, Left Handshake, Moto and Good Turn.

Discipline and Uniform: Uniform of Rovers and Rangers, 14 Programme ideals.

Knowledge of Merit: Know about Knowledge of Merit Badges (Proficiency Badge).

Sustainability E-learning: (Online Course Available in WOSM Learning Zone).

Activating the Earth Tribe Initiative in your Community.

MODULE - III BIS STANDARDS IN CYBER SECURITY **8**

Introduction to Cyber Security Standardization n-CIA Triad (Confidentiality, Integrity, Availability) as the foundation for all standards- Role of BIS in Cyber Security- LITD 17 (Electronics and IT Division Council)-ISO/IEC JTC 1/SC 27-Key BIS Standards for Cyber Security (Based on ISO/IEC)-Practical Applications and Case Studies- National Cyber Security Framework and BIS Alignment-Cyber Security Policy 2013-CERT-IN, NIC, MeitY

TOTAL: 45 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/course_items/show/1172182?course_id= 214307#course-item-id=1172182
2. https://lms.scout.org/courses/show/214123?force_course_hub= true

OUTCOMES

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

1. Apply quantitative aptitude for solving numerical problems [K3]
2. Describe logical reasoning to tackle emotional challenges. [K2]
3. Use verbal communication and comprehension skills through grammar and language exercises. [K3]
4. Apply critical thinking and problem-solving skills in various cognitive scenarios. [K3]
5. Interpret language nuances in diversified situations and exhibit scouting spirits amidst communities. [K2]
6. Explain the basic principle of BIS Standards relevant to Cyber Tools. [K2]

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Department of Computer Science and Engineering (Cyber Security)

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of CSE(SC) dept.
Meeting No. 1 Dated: 21/4/2025

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SEMESTER - III

24SCID301 – SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To provide opportunities for students to develop an entrepreneurial mindset and explore real-world problem-solving through a startup-centric approach.
- To enable hands-on experience in identifying market needs
- To enable development of skill sets for designing, validating, and realizing a Minimum Viable Product (MVP) for an entrepreneurial venture.
- To guide students in validating market opportunity, and formulating a solution with realistic constraints.
- To inculcate ethical research practices, foster a commitment to lifelong learning, and promote the development of socially responsible and sustainable innovations aligned with relevant Sustainable Development Goals (SDGs).

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- To prepare students to design sustainable business models and present entrepreneurial ideas through structured, outcome-driven business pitches using core startup frameworks.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, specifically through the lens of entrepreneurship and innovation.
2. The project work must involve identifying a problem, validating market opportunity, and developing a solution with realistic constraints, culminating in a business plan and prototype/MVP. It must also include appropriate elements of the following: market research, competitive analysis, value proposition design, business model development, financial feasibility, go-to-market strategy, and potentially software/hardware development for the MVP.
3. Project can be individual work or a group project, with a maximum of 3 students. In case of a group project, the individual project report of each student should specify the individual's contribution to the group project. The roles and responsibilities of all team members must be well-defined and documented.
4. On completion of the project, the student shall submit a detailed project report outlining their entrepreneurial journey, solution development, and business plan. The project should be reviewed and the report shall be evaluated, and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

1. First evaluation (Milestone 1 - Week 4): 20 marks (Focus on Problem Identification, Opportunity Discovery, Customer & Markets, Value Proposition)
2. Second evaluation (Milestone 2 - Week 8): 30 marks (Focus on Competitive Advantage, Business Model, and MVP Development)
3. Final evaluation (Milestone 3 & 4 - Last week of the semester): 50 marks (Focus on Financial Feasibility, Go-to-Market Strategy, Growth and Scale, Funding Strategy, and Overall Project Report & Viva-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

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OUTCOMES:

At the end of the course, the student should be able to:

1. Apply entrepreneurial thinking to identify and articulate real-world problems and explore market needs using structured approaches. (K3)
2. Develop skill sets to design potential solutions and validate market opportunities within realistic constraints. (K4)
3. Evaluate sustainable, ethical, and responsible innovation strategies, and communicate business models effectively. (K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

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Meeting No. 1 Dated: 21/4/2025

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SEMESTER - IV

24BSMA406 - SDG NO. 4	PROBABILITY & STATISTICS WITH R PROGRAMMING	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To introduce basic statistical concepts and data visualization techniques using R.
- To understand probability theory and random variables for modelling uncertainty.
- To explore key probability distributions and their applications in cyber contexts.
- To perform statistical inference and hypothesis testing using R.
- To analyze relationships through correlation, regression, and time series methods.
- To apply statistical methods for cyber security data analysis and anomaly detection.

MODULE - I DESCRIPTIVE STATISTICS AND DATA VISUALIZATION IN R **10**

Types of data: quantitative, qualitative – Measures of Central tendency: Mean, Median, Mode – Measures of Dispersion: Range, Variance, Standard Deviation, Inter-quartile range – Position metrics: percentiles, quartiles – Frequency distribution and Tabulation. Reading data from CSV/text – Using summary(), sd(), quartile() – Visualizations using hist(), boxplot(), pie(), ggplot2.

MODULE - II PROBABILITY CONCEPTS AND RANDOM VARIABLES **10**

Classical, empirical and axiomatic definitions of probability – Conditional probability and independence – Baye's Theorem and applications – Random Variables: Discrete and Continuous – Expectation, Variance and Standard Deviation – Probability distribution and probability density functions. Simulating random experiments (e.g., dice, coin) – Visualizing probability spaces – Using functions sample(), replicate(), mean(), var().

MODULE - III DISCRETE AND CONTINUOUS PROBABILITY DISTRIBUTIONS **10**

Discrete Probability Distributions: Bernoulli, Binomial, Poisson and Geometric – Continuous Probability Distributions: Uniform, Exponential and normal – Properties of Probability mass function, Probability density function, Cumulative distribution function, Mean and variance. Using dbinom(), dpois(), dnorm(), pexp() – Plotting PDFs and CDFs – Parameter estimation via fitting functions.

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MODULE - IV STATISTICAL INFERENCE AND HYPOTHESIS TESTING 10

Sampling and Sampling Distributions – Central Limit Theorem (CLT) – Confidence Intervals for Mean and Proportion – Hypothesis Testing: z-test, t-test, chi-square test, ANOVA. Simulations to demonstrate CLT – Performing and interpreting test results in R using t.test(), chisq.test(), aov().

MODULE - V CORRELATION, REGRESSION AND TIME SERIES ANALYSIS 10

Pearson and Spearman Correlation – Simple and Multiple Linear Regression – Model Fit and Diagnostics – Basics of Time Series: Trends, Seasonal Components, Smoothing. Using functions cor(), lm(), summary(), time series plotting using ts(), 'forecast' package.

MODULE - VI APPLICATIONS IN CYBER SECURITY WITH R 10

Anomaly detection: Detect unusual patterns in network traffic, login attempts or system behavior – use of statistical threshold for detecting outliers in logs or traffic (use ts, forecast, anomalize packages) – Classification overview: logistic regression and Naïve Bayes – Introduction only –Classify network activity as normal or malicious (use caret, glm for classification modelling) – Risk assessment and modelling: Quantify and predict cyber risks using binomial, Poisson distributions and Monte Carlo simulation (use mc2d, fitdistrplus for fitting distributions and simulation).

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Introduction to Probability and Statistics for Engineers and Scientists, Sheldon Ross, 5th Edition. Academic Press, 5th Edition, 2014.
2. Using R for Introductory Statistics, John Verzani, 2nd Edition, CRC Press, 2nd Edition, 2014.

REFERENCES:

1. R in Action: Data Analysis and Graphics with R, Robert I. Kabacoff, 2nd Edition, Manning, 2nd Edition, 2015.
2. An Introduction to Statistical Learning with Applications in R (ISLR), Gareth James et al., 2nd Edition, Springer, 2021.
3. Modern Applied Statistics with S, W. N. Venables and B. D. Ripley, Springer, 4th Edition, 2002.
4. The Art of R Programming, Norman Matloff, 1st Edition, No Starch Press, 2011.

ONLINE RESOURCES:

1. Coursera – Statistical Inference (by Johns Hopkins University) https://www.coursera.org/learn/statistical-inference

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Meeting No. 6 Dated: 31/5/2024

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2. DataCamp – Introduction to R & Statistics with R Track
   https://www.datacamp.com/tracks/statistics-with-r
3. edX – Probability and Statistics in Data Science using R (UC San Diego)
   https://www.edx.org/course/probability-and-statistics-in-data-science-using-r
4. https://www.youtube.com/c/joshstarmer
5. https://www.youtube.com/channel/UCaNIxVagLhqupvUiDK01Mgg

WEB RESOURCES:

1. R Project Official Site: https://www.r-project.org/
2. R Documentation: https://stat.ethz.ch/R-manual/
3. R-bloggers: https://www.r-bloggers.com/
4. Categorized R packages: https://cran.r-project.org/web/views/

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Summarize and visualize data using descriptive statistics and R programming. (K2)
2. Apply fundamental probability concepts and simulate random experiments in R. (K3)
3. Use appropriate probability distributions to solve real-world problems. (K3)
4. Conduct statistical inference and hypothesis testing using R. (K3)
5. Build and interpret correlation, regression, and basic time series models for data analysis. (K3)
6. Implement statistical methods in R for analyzing cyber security datasets. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2	3
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	-	-	-	-	-	-	-	-	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	-	-	2	3
CO6	3	-	-	-	-	-	-	-	-	-	-	3	3

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Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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SEMESTER - IV

24SCPC401 noc21_cs88 SDG NO. 4, 9, 16	CRYPTOGRAPHY AND INFORMATION SECURITY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce the foundations and evolution of cryptography in securing data.
- To explore classical, symmetric, and asymmetric cryptographic algorithms.
- To develop the ability to implement cryptographic systems in practical scenarios.
- To understand modern security protocols and mechanisms like SSL/TLS and PKI.
- To analyze various authentication and access control models for secure systems.
- To examine advanced security techniques including blockchain and quantum cryptography.

MODULE - I INTRODUCTION TO CRYPTOGRAPHY 7

Overview of Cryptography: Definition, History, and Applications- Classical Encryption Techniques: Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Transposition Cipher -Modern Cryptography: Symmetric and Asymmetric Encryption- Cryptographic Algorithms: DES, AES, RSA, ECC (Elliptic Curve Cryptography) -Security Models: Confidentiality, Integrity, Authentication, and Non-repudiation

MODULE - II SYMMETRIC KEY CRYPTOGRAPHY 8

Stream Ciphers and Block Ciphers: Working and examples (e.g., RC4, AES)- Data Encryption Standard (DES): Overview, Block Cipher Structure, Key Schedule, and Modes of Operation-Advanced Encryption Standard (AES): Working, Key Expansion, Rounds, and Modes of Operation-Cipher Block Chaining (CBC), Electronic Codebook (ECB), and Other Modes of Operation

MODULE - III PUBLIC KEY CRYPTOGRAPHY 7

Public Key Encryption: RSA, Diffie-Hellman Key Exchange- Elliptic Curve Cryptography (ECC): Introduction, Uses, and Efficiency -Digital Signatures: Definition, RSA Digital Signature, DSA (Digital Signature Algorithm) -Key Management and Distribution

Recommended by
Board of Studies of CSE (SC) dept.
Meeting No. 1 Dated: 21/4/25

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MODULE - IV CRYPTOGRAPHIC PROTOCOLS AND ALGORITHMS 8

Key Management Protocols: Key Agreement, Key Distribution, Public Key Infrastructure (PKI) -Secure Hash Functions: SHA (Secure Hash Algorithm), MD5, HMAC (Hashed Message Authentication Code)- Message Authentication Codes (MACs): Function and Applications -Digital Certificates and SSL/TLS: Certificate Authorities (CAs), SSL Handshakes, HTTPS

MODULE - V INFORMATION SECURITY MECHANISMS 7

Access Control Models: Discretionary Access Control (DAC), Mandatory Access Control (MAC), Role-Based Access Control (RBAC)- Authentication Mechanisms: Passwords, Biometrics, Two-Factor Authentication-Firewalls and Intrusion Detection Systems (IDS): Network Security and Monitoring Tools- Public Key Infrastructure (PKI) and its use in securing communication

MODULE - VI ADVANCED TOPICS IN CRYPTOGRAPHY AND SECURITY 8

Quantum Cryptography: Introduction and Basics, Quantum Key Distribution (QKD)- Zero-Knowledge Proofs: Concept and Applications in Authentication - Blockchain Technology: Overview, Cryptography in Blockchain, Consensus Algorithms -Secure Multi-party Computation (SMC): Principles and Applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security – Principles and Practice, 8th Ed., Pearson, 2023.
2. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, Springer, 2020.

REFERENCE BOOKS:

1. Jonathan Katz, Yehuda Lindell, Introduction to Modern Cryptography, 3rd Ed., CRC Press, 2021.
2. Douglas Stinson, Cryptography: Theory and Practice, 4th Ed., CRC Press, 2019.
3. Bruce Schneier, Applied Cryptography, 20th Anniversary Edition, Wiley, 2017.

NPTEL COURSES AND LINKS:

1. Cryptography and Network Security
2. Introduction to Cryptography
3. Information Security

Recommended by
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Meeting No. 1 Dated: 21/4/25

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OUTCOMES

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

1. Implement Classical and modern Cryptography techniques to solve real world security challenges, and protocols. (K3)
2. Apply cryptographic algorithms in practical scenarios. (K3)
3. Implement symmetric and asymmetric cryptographic systems in data security applications. (K3)
4. Illustrate the cryptographic techniques in real-world scenarios, such as secure communication and data protection. (K3)
5. Build the security requirements of different systems and determine appropriate cryptographic techniques. (K3)
6. Apply advanced cryptographic techniques like QKD, ZKPs and blockchain to develop secure communication (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24SCPC402 CS32, AI01, Cs39 SDG NO. 9 & 16	MACHINE LEARNING ESSENTIALS FOR CYBER SECURITY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Provide an in-depth understanding of machine learning and its role in enhancing cyber security.
- Equip students with the skills needed to preprocess and analyze security data for machine learning.
- Enable students to implement supervised and unsupervised learning models for detecting and preventing cyber threats.
- Expose students to advanced techniques such as deep learning and anomaly detection in security applications.

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- Equip students with the skills to implement machine learning frameworks and develop cybersecurity-specific solutions through hands-on practice with real-world datasets.
- Prepare students for real-world challenges in deploying and securing machine learning models in the cyber security domain.

MODULE - I INTRODUCTION TO MACHINE LEARNING AND CYBER SECURITY 7

Introduction to Machine Learning (ML): Definitions, Types (Supervised, Unsupervised, Reinforcement Learning)- Overview of Cyber Security: Cyber threats, types of attacks, and their impact- ML in Cyber Security: Introduction to how ML is applied to enhance cyber defense-Overview of ML Algorithms: Basic introduction to key algorithms like Decision Trees, Naive Bayes and SVM.

MODULE - II DATA PREPROCESSING AND FEATURE ENGINEERING FOR SECURITY DATA 7

Data Collection in Cyber Security: Logs, network traffic, system events-Data Cleaning and Normalization: Handling missing values, scaling, and normalizing data- Feature Engineering: Selecting and transforming features to improve model performance- Imbalanced Data: Techniques for dealing with class imbalance in security datasets.

MODULE - III SUPERVISED LEARNING ALGORITHMS IN CYBER SECURITY 8

Supervised Learning Overview: Introduction to classification and regression-Algorithms in Cyber Security: Decision Trees, Random Forest, Naive Bayes, and SVM-Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, Confusion Matrix- Applications in Cyber Security: Intrusion Detection Systems (IDS), email spam detection, and network security.

MODULE - IV UNSUPERVISED LEARNING AND ANOMALY DETECTION 8

Unsupervised Learning Overview: Clustering, dimensionality reduction-Anomaly Detection: Detecting fraud, intrusion, and malicious activities-Algorithms: K-Means, DBSCAN, PCA, Isolation Forest-Challenges in Anomaly Detection: Evaluation methods and real-world challenges.

MODULE - V TOOLS AND FRAMEWORKS FOR MACHINE LEARNING IN CYBER SECURITY 8

Frameworks and Tools: Keras, TensorFlow, PyTorch- Hands-on Practice: Building models for real-world cyber security datasets.Cyber Security-

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Specific Tools :Snort,OpenVAS .Security-Specific ML Toolkits and Libraries:Deep Packet ,Pandas and Matplotlib/Seaborn

MODULE - VI MODEL EVALUATION, DEPLOYMENT, AND SECURITY CONSIDERATIONS 7

Evaluating ML Models for Cyber Security: Cross-validation, hyperparameter tuning- Model Deployment: Best practices for deploying ML models in live security environments- Security Challenges: Adversarial attacks, model poisoning, and securing ML models-Future Trends: Advanced security issues in ML applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Machine Learning for Cybersecurity by Faron Moller (2019)
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron (2022).Third Edition O'Reilly Publisher

REFERENCE BOOKS:

1. Introduction to Machine Learning with Python" by Andreas C. Müller and Sarah Guido (2016)
2. Pattern Recognition and Machine Learning" by Christopher M. Bishop (2006)
3. Data Mining and Machine Learning: Concepts and Techniques" by Jiawei Han and Micheline Kamber (2011)

NPTEL COURSES:

1. Introduction to Machine Learning
2. Cyber Security

OUTCOMES

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

1. Use machine learning methods to find and understand different cyber threats and attacks (K3)
2. Implement data cleaning and feature selection steps to improve machine learning results on cybersecurity data (K3)
3. Solve cybersecurity problems such as intrusion detection and spam filtering using supervised learning algorithms. (K3).
4. Detect unusual or abnormal activities in cybersecurity systems using unsupervised learning methods (K3)
5. Build machine learning models using standard tools and real-world cybersecurity datasets. (K3)

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6. Apply machine learning models by following basic security practices during deployment in cybersecurity applications (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24SCPC403 106105182, 110107130 SDG NO. 4, 9	SOFTWARE DEVELOPMENT AND DESIGN THINKING	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To explain different software process models, distinguish between Agile and traditional models, and describe the principles and practices of Extreme Programming
- To apply core-analytical knowledge and appropriate techniques and provide solutions to real time challenges of national and global society
- Apply ethical knowledge for professional excellence & leadership for the betterment of the society
- Use software design principles and tools to create modular, maintainable and scalable software architectures
- Develop life-long learning skills needed for better employment and entrepreneurship.
- To understand the Empathizing Techniques and Design Thinking Frameworks.

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MODULE - I SOFTWARE PROCESS AND AGILE DEVELOPMENT 7

Introduction to Software Engineering - Software Process Model - Agile Model- Waterfall Model- V-Model- Incremental Model- RAD Model- Iterative Model- Spiral Model- Prototype Model- Perspective and Specialized Process Models – Introduction to Agility - Agile process - Extreme Programming –XP Process

MODULE - II REQUIREMENTS ANALYSIS AND SPECIFICATION 8

Software Requirements: Functional and Non-Functional -User requirements - System requirements - Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary

MODULE - III UNIFIED PROCESS AND USE CASE DIAGRAMS 8

Introduction to OOAD with OO Basics - Unified Process - UML diagrams - Use Case –Case study - the Next Gen POS system, Inception - Use case Modelling- Relating Use cases - include, extend and generalization - When to use Use-cases

MODULE - IV UML DIAGRAMS 8

Class Diagram - Elaboration - Domain Model - Finding conceptual classes and description classes - Domain model refinement - Finding conceptual class Hierarchies - Aggregation and Composition -Relationship between sequence diagrams and use cases - When to use Class Diagrams- Dynamic Diagrams - UML interaction diagrams - System sequence diagram - Collaboration diagram - When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram

MODULE - V PRINCIPLES OF DESIGN THINKING 7

What is Different About Design thinking? Design Thinking Skills Principles of Design Thinking, The Basis for Design Thinking, The Design Thinking Team, Design Thinking Workshops and Meetings – Exercises and case based discussions

MODULE - VI DESIGN THINKING FRAMEWORK 7

Listening and Empathizing Techniques – observation – structured open ended approach - , Design Thinking Frameworks, Ideation tools – brainstorming, innovation heuristics, behaviour models, overcoming cognitive fixedness – Case study for Mind analysis.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. Software Engineering A Practitioner's Approach, Roger S Pressman, 6th edition. McGraw Hill International Edition.2015.
2. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development||, Third Edition, Pearson Education, 2005.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press , 2009.
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

REFERENCES:

1. Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited,2009
2. Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, —Software Engineering, Tata McGraw-Hill Publishing Company Limited,2007
5. Jeanne Liedtka , Andrew King, Kevin Bennett , "Book - Solving Problems with Design Thinking - Ten Stories of What Works" (Columbia Business School Publishing), 2013

ONLINE RESOURCES:

1. http://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf
2. https://freevideolectures.com/course/2318/software-engineering
3. https://courses.cs.washington.edu/courses/cse403/01au/lectures/
4. https://www.ece.rutgers.edu/~marsic/books/SE/instructor/slides/
5. https://swayam.gov.in/nd1_noc19_cs69/preview
6. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs69
7. https://nptel.ac.in/courses/106/105/106105182/

OUTCOMES

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

1. Apply suitable software process models for given application scenarios (K3)
2. Apply requirements engineering techniques to develop software requirement specifications. (K3)
3. Construct object-oriented models using use case diagrams and relevant UML tools (K3)

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4. Make use of UML structural and behavioral diagrams to design software systems (K3)
5. Apply design thinking principles within the software engineering process to identify user requirements and develop user-centric software solutions (K3)
6. Apply design thinking frameworks and ideation techniques to design, prototype, and improve software systems based on real-time user feedback (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24HSNC401 - SDG NO. 4	NCC COURSE LEVEL 3	L	T	P	CP	C
		3	0	0	0	0

ARMY WING

PERSONALITY DEVELOPMENT 9

PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4

BORDER & COASTAL AREAS 4

BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2

ARMED FORCES 3

AF 2	Modes of Entry to Army, CAPF, Police	3

COMMUNICATION 3

C 1	Introduction to Communication & Latest Trends	3

Recommended by Board of Studies of CSE(S) dept. Meeting No. 1 Dated: 21/4/2025

Chairman Board of Studies Department of Humanities & Sciences

INFANTRY		**3**
INF 1	Organisation of Infantry Battalion & its weapons	3
MILITARY HISTORY		**23**
MH 1	Biographies of Renowned Generals	4
MH 2	War Heroes - PVC Awardees	4
MH 3	Study of Battles - Indo Pak War 1965, 1971 & Kargil	9
MH 4	War Movies	6
		TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7

DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4

NAVAL ORIENTATION 6

AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1

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Meeting No. 6 Dated: 31/5/2024

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BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		TOTAL: 45 PERIODS

AIR FORCE WING

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
AIRMANSHIP		**1**
A 1	Airmanship	1
BASIC FLIGHT INSTRUMENTS		**3**
FI 1	Basic Flight Instruments	3
AERO MODELLING		**3**
AM 1	Aero Modelling Capsule	3
GENERAL SERVICE KNOWLEDGE		**2**
GSK 4	Latest Trends & Acquisitions	2
AIR CAMPAIGNS		**6**
AC 1	Air Campaigns	6
PRINCIPLES OF FLIGHT		**6**
PF 1	Principles of Flight	3
PF 2	Forces acting on Aircraft	3
NAVIGATION		**5**
NM 1	Navigation	2
NM 2	Introduction to Met and Atmosphere	3
		TOTAL :45 PERIODS

Recommended by
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Meeting No. 6 Dated: 31/05/2024

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SEMESTER - IV

24SCPL401 - SDG NO. 4, 9, 16, 17	CRYPTOGRAPHY AND CYBER SECURITY LAB	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- Understand the fundamental concepts of cryptography and their implementation in C programming.
- Apply encryption and decryption techniques using symmetric and asymmetric cryptography in C.
- Implement and evaluate hashing algorithms and digital signatures to ensure data integrity and authentication.
- Analyze and perform vulnerability assessments and penetration testing on network systems.
- Design and implement secure applications that integrate encryption, authentication, and secure communication protocols.

NAME OF THE EXPERIMENTS:

Lab 1 Introduction to Cryptography Concepts in C Programming (Key Concepts & Simple Examples).

Lab 2 Implementing Symmetric Key Encryption using the DES Algorithm in C.

Lab 3 Implementing Symmetric Key Encryption using AES Algorithm in C.

Lab 4 Implementing RSA Public Key Cryptography in C (Key Generation and Encryption/Decryption).

Lab 5 Implementing the SHA-256 Hash Function in C.

Lab 6 Implementing MD5 Hash Function and its Applications in Data Integrity in C.

Lab 7 Digital Signatures Implementation in C for Authentication and Verification.

Lab 8 Setting up a Basic Public Key Infrastructure (PKI) in C for Encryption and Decryption.

Lab 9 Implementing Secure Socket Layer (SSL) Communication Protocol in C.

Lab 10 Implementing Simple File Encryption and Decryption using C (AES/DES).

Lab 11 Analyzing Network Traffic with Wireshark and Identifying Security Vulnerabilities.

Lab 12 Performing Penetration Testing on a Sample Network Application (Using Kali Linux).

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Lab 13 Implementing SSL/TLS Encryption for Secure Communication in C.

Lab 14 Vulnerability Assessment using OpenSSL and C Programming to Analyze Weaknesses.

Lab 15 Developing a Secure Communication Application (Capstone Project) with Encryption and Integrity Checking.

TOTAL: 30 PERIODS

Software Tools Required:

C Programming (with libraries for cryptography)

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Stand alone desktops with C compiler 30 Nos. (Or) Server with C compiler supporting 30 terminals or more

OUTCOMES

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

1. Implement symmetric and asymmetric cryptographic algorithms in C. (K3)
2. Apply hashing algorithms and digital signatures in C programming for data integrity and authentication. (K3)
3. Apply network security vulnerabilities and implement solutions using ethical hacking tools. (K3)
4. Build secure communication protocols using C programming. (K3)

CO – PO, PSO MAPPING:

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

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SEMESTER - IV

24SCPT401 noc21_cs88 SDG NO. 4, 9, 16	OPERATING SYSTEM IN KALI LINUX LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- Understand foundational operating system security concepts and the essential security-related features of Kali Linux.
- Demonstrate knowledge of operating system management mechanisms and the theoretical foundations of network monitoring and security analysis within Kali Linux.
- Acquire conceptual knowledge of security testing methodologies and the theoretical roles of Metasploit, Wireshark, and Burp Suite in penetration testing workflows.

MODULE - I INTRODUCTION TO OPERATING SYSTEMS AND KALI LINUX 6

Operating System Overview: Functions and Types -Key OS Concepts: Processes, Threads, Scheduling, and Memory Management- Introduction to Kali Linux: History, Installation, and Key Features-Use Cases of Kali Linux for Penetration Testing

Lab Exercises:

1. Install and configure Kali Linux on VirtualBox or Bare Metal
2. Basic Command-Line Operations in Kali Linux

MODULE - II PROCESS MANAGEMENT AND SCHEDULING IN KALI LINUX 8

Process Lifecycle: Creation, Execution, Termination- Scheduling Algorithms: First Come First Serve (FCFS), Shortest Job Next (SJN), Round Robin (RR)- Managing Processes in Kali Linux using Commands - Multi-tasking and Multi-threading in Kali Linux

Lab Exercises:

1. Using ps, top, kill, nice, and renice commands
2. Create and Manage Background Processes in Kali Linux

MODULE - III MEMORY MANAGEMENT AND FILE SYSTEMS IN KALI LINUX 8

Memory Allocation Techniques: Paging and Segmentation- Virtual Memory and Swapping in Kali Linux- File Systems: EXT, NTFS, FAT32 Overview - File Permissions and Management in Kali Linux

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Lab Exercises:

1. Configure and Monitor Memory Usage
2. Use Commands like chmod, chown, and lsattr to Manage File Permissions
3. Mount and Unmount Drives and File Systems

MODULE IV NETWORKING AND SECURITY FEATURES IN KALI LINUX 8

Basic Networking Concepts: TCP/IP Stack, Ports, and Protocols- Networking Tools in Kali Linux: nmap, netstat, ping- Security Essentials: Firewalls, SELinux, and IP Tables -Managing Network Interfaces in Kali Linux

Lab Exercises:

1. Perform Network Scanning with nmap
2. Monitor Network Traffic using tcpdump and wireshark
3. Configure and Test Firewall Rules with iptables

MODULE - V USER MANAGEMENT AND SCRIPTING IN KALI LINUX 7

Managing Users and Groups in Kali Linux- User Authentication and Password Management- Shell Scripting for Automation in Kali Linux- Automating Security Tasks using Scripts

Lab Exercises:

1. Create and Manage Users and Groups using useradd, usermod, and passwd
2. Write Shell Scripts for Automated Backup or Network Monitoring

MODULE - VI ADVANCED TOPICS AND USE CASES 8

Penetration Testing Workflow in Kali Linux- Advanced Tools in Kali Linux: Metasploit, Wireshark, and Burp Suite- Best Practices for Security and Incident Response-Future Trends in Operating Systems and Cyber Security

Lab Exercises:

1. Conduct a Penetration Testing Simulation with Metasploit
2. Capture and Analyze Packets with Wireshark
3. Perform Vulnerability Scanning using Kali Tools

TOTAL : 45 PERIODS

TEXT BOOKS:

1. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, Greg Gagne (10th Edition, 2018).
2. "Kali Linux Revealed" by Raphael Hertzog, Jim O'Gorman, and Mati Aharoni (2017).

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REFERENCE BOOKS:

1. "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos (4th Edition, 2015).
2. "The Linux Command Line: A Complete Introduction" by William E. Shotts (2nd Edition, 2019).

NPTEL COURSES:

1. Operating System
2. Cyber Security

OUTCOMES

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

1. Demonstrate the application of core operating system concepts using Kali Linux in practical scenarios. (K3)
2. Execute process management techniques and scheduling algorithms within the Kali Linux environment. (K3)
3. Utilize process, memory, and file management mechanisms effectively in Kali Linux systems (K3)
4. Operate networking and security tools in Kali Linux for real-time system analysis and applications. (K3)
5. Implement operating system features and security configurations to solve system-level tasks in Kali Linux (K3)
6. Apply security features and exploitation techniques using Kali Linux tools in controlled environments. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	3
CO2	3	-	-	-	-	2	-	-	-	-	-	3	2
CO3	3	-	-	-	-	2	-	-	-	-	-	2	3
CO4	3	-	-	-	-	3	-	-	-	-	-	2	2
CO5	3	-	-	-	-	3	-	-	-	-	-	2	2
CO6	3	-	-	-	-	3	-	-	-	-	-	2	2

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SEMESTER - IV

24SCTP401 - SDG NO. 4	APTITUDE SKILLS - II	L	T	P	CP	C
		0	0	2	2	0

PROBLEM SOLVING USING JAVA - PHASE 1

OBJECTIVES:

- Develop strong algorithmic problem-solving skills using Java
- Enable students to analyze problems and design efficient solutions
- Familiarize students with coding patterns used in technical interviews and prepare students for competitive programming and placement coding rounds

MODULE - I FOUNDATIONS OF JAVA PROBLEM SOLVING 16

Competitive programming mindset, Understanding problem statements and constraints, Java input and output handling, Time and space complexity, Asymptotic notations, Loop and recursion analysis, Arrays and strings problem patterns, Prefix sum, Sliding window, Two-pointer techniques.

MODULE - II SEARCHING, SORTING AND ADVANCED TECHNIQUES 15

Binary search patterns, Search on answer technique, Sorting-based problem solving, Stack and queue applications, Monotonic stack, Simulation problems, Recursion templates, Backtracking framework, Constraint-based problem solving.

MODULE - IIIDYNAMIC PROGRAMMING, GREEDY AND GRAPH BASICS14

Dynamic programming principles, Memorization and tabulation, One-dimensional and two-dimensional DP problems, Greedy strategies, Interval problems, Graph traversal basics – BFS and DFS, Competitive coding strategies.

TOTAL: 45 PERIODS

REFERENCES:

1. Herbert Schildt, Java: The Complete Reference, McGraw Hill.
2. E. Balagurusamy, Programming with Java, McGraw Hill Education

ONLINE RESOURCES

1. LeetCode – https://leetcode.com
2. HackerRank – https://www.hackerrank.com
3. GeeksforGeeks – Java and DSA Track

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LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS - PHASE 2

OBJECTIVES:

- Explore core domain BIS standards related to Information security and AI.
- Implement strategies to learn career and managerial skills for career growth.

MODULE - I JEEVAN KAUSHAL 2.0 – CAREER SKILLS AND MANAGERIAL SKILLS 14

Group Discussion Skills - Meaning and Methods of Group Discussion - Procedure of Group Discussion - Group Discussion - Simulation - Group Discussion - Common Errors.

Managerial Skills - Basic Managerial Skills - Planning for effective management - How to organize teams? - Recruiting and retaining talent - Delegation of tasks - Learn to coordinate - Conflict management - Self-management Skills - Understanding self-concept - Developing self-awareness - Self-examination - Self-reflection and Introspection - Self-regulation.

Entrepreneurial Skills - Basics of Entrepreneurship - Meaning of entrepreneurship – Classification and types of entrepreneurships - Traits and competencies of entrepreneur -. Creating Business Plan - Problem identification and idea generation - Idea validation - Pitch making.

Managing Personal Finance - Budgeting - Setting personal goals - Estimate likely expenses Monitor spending to obtain the most value for the available funds - Saving and Investing - Advantages of saving money - Concept of present and future value of money.

MODULE - II RANGER AND ROVER 10

Scouting for Boys: Scout Craft, Campaigning.

Knots: Managing of rope, types of ropes and uses, Basic Knots: - Clove Hitch, Reef Knot, Fisherman knot, Sheet bend, Bowline, Sheep shank, whippings.

Growing Together: Understanding the growth context.

Intergenerational Dialogue: How to enhance learning and cooperation across generations.

MODULE - III INFORMATION SECURITY & ARTIFICIAL INTELLIGENCE 6

Information security, network security and privacy protection: Introduction to the standards and concepts related to security [CIA (Confidentiality, Integrity, and Availability)] and privacy.

Software - Quality Assurance, Life Cycle & Testing: Introduction to Software life cycle processes and Software Testing (IS 16124 and IS 11291).

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Artificial Intelligence: Introduction to the concepts of Artificial Intelligence and related standards:

- Overview of trustworthiness in artificial intelligence.
- Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML).
- AI system life cycle processes.
- Data life cycle framework.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214175?force_course_hub=true
2. https://lms.scout.org/courses/show/214194?force_course_hub=true

OUTCOMES

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

1. Interpret problem statements and develop Java programs with appropriate complexity analysis.
2. Apply array, string, searching, sorting, stack, and queue based problem-solving techniques.
3. Design solutions using recursion, backtracking, and dynamic programming approaches.
4. Solve real-time and placement-oriented problems using greedy techniques and graph traversal basics.
5. Demonstrate career and managerial skills. (K2)
6. Understand BIS standards for Information security and AI domain. (K2)

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CO – PO, PSO MAPPING:

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

SEMESTER - IV

24SCID401 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To empower students to transform innovative ideas into viable venture blueprints through structured entrepreneurial exploration and opportunity framing.
- To provide experiential learning in adaptive product evolution by focusing on user-centric redesign, iterative testing, and technical refinement.
- To develop proficiency in assessing market traction, decoding customer behavior, and aligning product strategy with investment-readiness metrics.
- To instill a foundation of ethical entrepreneurship by integrating inclusive design principles, sustainability values, and responsible leadership.
- To enable data-driven innovation by leveraging field research, applying performance analytics, and integrating emerging technologies for solution optimization.
- To facilitate multidisciplinary problem-solving through advanced engineering integration, MVP systemization, and standards-compliant validation.

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COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, focusing on the practical execution and refinement of entrepreneurial ventures.
2. The project work must involve the continuous development, iterative enhancement, and potential launch of an entrepreneurial solution. It must also include appropriate elements of the following: compliance with advanced engineering standards, iterative design analysis, enhanced prototyping, robust experimentation, real-world user feedback collection, data correlation, and advanced software/hardware development for the solution.
3. Projects can be individual work or group projects, with a maximum of Three students. In case of a group project, each student must submit an individual project report clearly specifying their unique contributions to the collective work.
4. On completion of the project, the student shall submit a detailed project report encompassing the evolution of their venture, technical implementation, market validation, and future roadmap. The project shall undergo a formal review process, after which the report will be evaluated. Students shall appear for a mandatory viva-voce examination on the project, approved jointly by the Coordinator and the respective project guide.

EVALUATION:

1. First evaluation (Immediately after first internal examination): 20 marks (Focus on refined problem statement, advanced MVP design, and detailed development plan)
2. Second evaluation (Immediately after second internal examination): 30 marks (Focus on prototype/MVP implementation, initial testing, and preliminary market validation results)
3. Final evaluation (Last week of the semester): 50 marks (Focus on the complete refined solution, comprehensive market validation, growth strategy, final project report, and viva-voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply structured entrepreneurial exploration to convert innovative ideas into venture blueprints, incorporating user-centric and iterative design approaches. (K4)

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2. Assess customer behavior and market traction to align product strategies with ethical and sustainable entrepreneurship principles. (K5)
3. Integrate multidisciplinary knowledge, field data, and emerging technologies to optimize and validate engineered solutions. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

Recommended by
Board of Studies of CSE (SC) dept.
Meeting No. 1 Dated 24/04/25

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SEMESTER V

COURSE CODE: 24SCPC501	THEORETICAL COMPUTER SCIENCE	L	T	P	CP	C
		3	0	2	5	4
NPTEL CODE: 106105196	SYLLABUS VERSION 1.1	SDG NO. 4, 16				
PRE-REQUISITE COURSES	24BSMA201, 24ESCS101, 24ITPC301					

OBJECTIVES:

- To construct automata and equivalent regular expressions
- To design Context-Free Grammars and Pushdown Automata
- To analyze Turing Machines and undecidability
- To understand compiler phases and parsing techniques
- To apply code generation and optimization methods

MODULE - I AUTOMATA FUNDAMENTALS & FINITE AUTOMATA PRINCIPLES 7

Introduction to formal proof, Inductive Proofs, Finite Automata, Deterministic and Non-deterministic Finite Automata, Epsilon Transitions, Equivalence and Minimization of Automata.

MODULE - II REGULAR EXPRESSIONS & CONTEXT FREE GRAMMAR 7

Regular Expressions, FA and Regular Expressions, State Elimination Method, CFG, Parse Trees, Ambiguity in Grammars and Languages, Normal Forms for CFG.

MODULE - III PUSHDOWN AUTOMATA & TURING MACHINE 8

Definition of Pushdown Automata, Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

MODULE - IV TURING MACHINES 8

Introduction to Turing Machines, Programming Techniques for Turing Machine.

MODULE - V INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS 8

Compilation and Interpretation, Phases of Compiler, Lexical Analysis, Role of Lexical Analyzer, Recognition of Tokens, LEX tool.handling - Abstract syntax tree

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MODULE - VI CODE GENERATION & OPTIMIZATION 7

Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, BackPatch, Procedure Calls, Issues in Code Generation, Target Machine, Basic Blocks and Flow Graphs, DAG Representation of Basic Blocks, Principal Sources of Optimization, Peephole Optimization, DAG Optimization of Basic Blocks.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Hopcroft, J.E., Motwani, R., and Ullman, J.D. (2006). Introduction to Automata Theory, Languages, and Computation (3rd ed.). Pearson Education.
2. Aho, A.V., Lam, M.S., Sethi, R., and Ullman, J.D. (2007). Compilers: Principles, Techniques, and Tools (2nd ed.). Pearson Education.

REFERENCE BOOK:

1. Sipser, M. (2012). Introduction to the Theory of Computation (3rd ed.). Cengage Learning.
2. Linz, P. (2016). An Introduction to Formal Languages and Automata (6th ed.). Jones & Bartlett Learning.
3. Grune, D., Bal, H.E., Jacobs, C.J.H., and Langendoen, K.G. (2012). Modern Compiler Design (2nd ed.). Springer.
4. Tremblay, J.P., and Sorenson, P.G. (1985). The Theory and Practice of Compiler Writing. McGraw-Hill Education.
5. Lewis, H.R., and Papadimitriou, C.H. (1997). Elements of the Theory of Computation (2nd ed.). Pearson Education.

NPTEL COURSE LINK:

1. NPTEL – Introduction to Automata, Languages and Computation – NPTEL LINK: https://onlinecourses.nptel.ac.in/noc21_cs19/preview

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts of finite automata to construct and convert DFA, NFA, and Regular Expressions for formal language problems. (K3)
2. Analyze Context-Free Grammars to identify ambiguity and transform them into Chomsky Normal Form (CNF) and Greibach Normal Form (GNF). (K4)

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3. Analyze Pushdown Automata and differentiate between deterministic and non-deterministic models for language recognition. (K4)
4. Apply Turing Machine models to solve computational problems such as addition, subtraction, and multiplication. (K3)
5. Analyze the working of lexical and syntax analyzers using tools like LEX and YACC for parsing of programming languages. (K4)
6. Analyze intermediate code generation and optimization techniques such as DAG representation, flow graphs, and peephole optimization. (K4)

CO - PO, PSO MAPPING:

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

SEMESTER V

COURSE CODE: 24SCPC502	SECURE CODING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106178	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24SCPC302, 24ITPW301					

OBJECTIVES:

- To understand fundamental concepts of information security and cryptography.
- To analyze security threats, vulnerabilities, and attack models.
- To apply secure coding and design principles in software systems.
- To evaluate authentication, authorization, and access control mechanisms.
- To implement security testing and DevSecOps practices.
- To build secure and resilient systems in real-world environments.

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MODULE - I FUNDAMENTALS OF INFORMATION SECURITY AND WEBBASICS **8**

Introduction to Information Security – Security goals (CIA) – Threats, attacks and vulnerabilities – Security services and mechanisms – Basics of cryptography – Client–Server architecture – HTTP/HTTPS protocol – Web components (Browser, Web server) – Cookies and sessions – Introduction to secure coding – Threat landscape – Attack surface – Secure Software Development Lifecycle (SSDLC)

MODULE - II SOFTWARE VULNERABILITIES AND INPUT SECURITY **7**

Design principles to vulnerability identification – Buffer overflows – Injection attacks (SQL, XSS, CSRF, command injection) – Insecure file handling – Input validation (whitelisting, blacklisting) – Data sanitization – Secure error handling – Logging mechanisms – Introduction to OWASP Top 10

MODULE - III AUTHENTICATION, AUTHORIZATION AND SESSION MANAGEMENT **8**

Secure authentication - Password policies - Hashing and salting techniques - Multi-factor authentication - Authorization models such as Role-Based Access Control and Attribute-Based Access Control - Access control mechanisms - Session management - Session hijacking and session fixation prevention - Application of cryptography - Hash functions - Digital signatures - Encryption in authentication protocols - Secure key usage in session management

MODULE - IV SECURE CODING FOR WEB AND APPLICATION SYSTEMS **7**

From access control to application security – XSS and CSRF prevention – Content Security Policy (CSP) – Secure API development – TLS/SSL best practices – Secure data handling – File upload/download security – Path traversal prevention

MODULE - V ADVANCED SECURITY PRACTICES AND CASE STUDIES **7**

Secure code review – Static Application Security Testing (SAST) – Dynamic Application Security Testing (DAST) – Penetration testing – Vulnerability assessment – DevSecOps concepts – Continuous integration with security – Automated security testing

MODULE - VI ADVANCED SECURITY PRACTICES AND EMERGING TREND **8**

Secure architecture patterns – Threat modeling techniques – Zero Trust security model – Cloud and container security – Secure microservices

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architecture – Incident response – Testing real-world resilience – Case studies on real-world cyber attacks and mitigation strategies

TOTAL : 45 PERIODS

TEXT BOOK:

1. Stuttard, D., & Pinto, M. (2011). The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws (2nd Edition). Wiley Publishing, Inc.,
2. Stallings, W. (2017). Network Security Essentials: Applications and Standards (6th Edition). Pearson Education Limited
3. McGraw, G. (2006). Software Security: Building Security In (1st Edition). Addison-Wesley Professional.

REFERENCE BOOK:

1. Erickson, J. (2008). Hacking: The Art of Exploitation (2nd Edition). No Starch Press, USA.
2. Hope, P., & Walther, B. (2008). Web Security Testing Cookbook (1st Edition). O'Reilly Media
3. Shoemaker, D., Conklin, W. A., & O'Bryan, D. (2017). Cybersecurity: The Essential Body of Knowledge (1st Edition). Cengage Learning
4. Goodman, M. (2015). Future Crimes: Inside the Digital Underground and the Battle for Our Connected World (1st Edition). Doubleday

NPTEL Course Link:

1. NPTEL – Introduction to Information Security
   https://nptel.ac.in/courses/106106129

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze fundamental concepts of information security and web technologies to identify potential security risks in systems. (K4)
2. Examine common software vulnerabilities and input validation issues to determine appropriate mitigation techniques. (K4)
3. Analyze authentication, authorization, session management mechanisms, and applied cryptographic techniques in secure systems. (K4)
4. Investigate secure coding practices in web and application systems to identify and prevent security flaws. (K3)
5. Evaluate the effectiveness of security testing methods and DevSecOps practices in software development. (K4)

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6. Assess advanced security architectures, threat models, and real-world case studies to determine system resilience. (K4)

CO - PO, PSO MAPPING:

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

SEMESTER V

COURSE CODE: 24MGMC501	CONSTITUTION OF INDIA	L	T	P	CP	C
		2	0	0	2	0
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To know about Indian constitution.
- To know about central government functionalities in India.
- To know about state government functionalities in India.
- To know about Constitution function.
- To Know about Constitutional remedies

MODULE - I INTRODUCTION 5

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties.

Recommended by
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Meeting No. 09 Dated: 05.6.2024

Professor & Director
Institute of Management Studies

MODULE - II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 5

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

MODULE - III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 5

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

MODULE - IV CONSTITUTION FUNCTIONS 5

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

MODULE - V CONSTITUTIONAL REMEDIES 5

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

MODULE - VI CONSTITUTIONAL GOVERNANCE IN THE DIGITAL ERA AND CONTEMPORARY ISSUES 5

Constitutional Values and Good Governance – Right to Information (RTI) and Citizen Participation – Digital Governance and e-Governance Initiatives in India – Constitutional Perspectives on Artificial Intelligence (AI) and Emerging Technologies.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, 27th Edition (2024), LexisNexis Butterworths Wadhwa.
2. M. V. Pylee, An Introduction to the Constitution of India, Latest Revised Edition (2024), Vikas Publishing House.
3. P. M. Bakshi, The Constitution of India, 18th Edition (2025), Universal LexisNexis
4. Brij Kishore Sharma, Introduction to the Constitution of India, 15th Edition (2024), PHI Learning

REFERENCE BOOKS:

1. D. D. Basu, Shorter Constitution of India, Latest Revised Edition, LexisNexis

Recommended by
Board of Studies of MBA dept.
Meeting No. 09 Dated: 05.6.2026

Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College

2. Subhash C. Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, Latest Edition, National Book Trust
3. M. Laxmikanth, Indian Polity, 7th Edition (2025), McGraw Hill Education
4. J. N. Pandey, Constitutional Law of India, Latest Edition (2024), Central Law Agency.
5. V. N. Shukla, Constitution of India, Revised by Mahendra Pal Singh, 14th Edition / Latest Available Edition, Eastern Book Company

ONLINE REFERENCES

1. https://iasexamportal.com/ebook/the-constitution-of-india
2. https://eclass.cc/courses/udemy_basics_of_indian_constitution_a_refresher_course
3. https://ox.libguides.com/c.php?g=422964&p=2888489
4. https://mylaw.net/litigation/constitutional-law-course
5. www.tutorialspoint.com/indian_polity/indian_polity_sources_consitution.htm
6. www.drishtiias.com/gs-special/gs-special-polity/important-sources-of-the-indian-constitution
7. www.india.gov.in/my-government/constitution-india/constitution-india-full-text
8. http://legislative.gov.in/constitution-of-india

MOOC REFERENCES

1. https://www.mooc-list.com/tags/law
2. https://www.udemy.com/course/polity-and-constitution/
3. https://swayam.gov.in/nd2_cec19_hs13/preview
4. https://www.udemy.com/course/basics-of-indian-constitution-a-refresher-course/

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the historical evolution, philosophy and fundamental principles of the Constitution of India. (K2)
2. Describe the structure, powers and functions of the Union Government under the Constitution. (K2)
3. Interpret the structure and functioning of State Governments and the judicial system in India. (K2)
4. Analyze federal relations, constitutional amendments and constitutional functionaries. (K4)
5. Examine constitutional remedies and mechanisms for protection of fundamental rights. (K4)

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Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

6. Apply constitutional values and principles to contemporary governance, digital rights, AI ethics and emerging societal challenges. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	1	-	-	-	2	1	2	-	-	-	2	2
CO2	-	2	-	-	-	2	2	2	-	-	-	2	2
CO3	-	2	-	-	-	2	2	2	-	-	-	2	2
CO4	-	2	1	-	-	2	2	2	-	-	-	2	2
CO5	-	2	1	-	-	2	2	2	-	-	-	2	2
CO6	-	-	-	-	-	2	1	2	-	-	-	-	-

Recommended by
Board of Studies of CSE(CS) dept.
Meeting No. 2 Dated: 9/4/26

SEMESTER V

COURSE CODE: 24SCPL501	SECURE CODING LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 10, 16				
PRE-REQUISITE COURSES	-					

Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

OBJECTIVES:

- To understand the fundamentals of web application development using client-side and server-side technologies along with session and authentication mechanisms.
- To identify and analyze common web application vulnerabilities such as SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), and buffer overflow attacks.
- To implement secure coding practices including input validation, output encoding, secure file handling, and protection against common web vulnerabilities.
- To design and apply secure authentication, session management, and access control mechanisms (RBAC and ABAC) in web applications.
- To perform security testing using tools such as OWASP ZAP, Burp Suite, and SonarQube through SAST and DAST approaches.
- To evaluate and integrate secure development and deployment practices including REST API security and DevSecOps methodologies for building robust and secure applications.

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LIST OF EXPERIMENTS:

BASIC WEB PROGRAMMING

1. Develop a basic web application using HTML, CSS, and JavaScript with form handling and client-side validation.
2. Develop a server-side web application to handle user input and perform database operations.
3. Implement a simple login system using sessions and cookies.

VULNERABILITY DEMONSTRATION

4. Demonstrate SQL Injection vulnerability in a web application.
5. Demonstrate Cross-Site Scripting (XSS) vulnerability using improper input handling.
6. Demonstrate Cross-Site Request Forgery (CSRF) attack in a web application.
7. Demonstrate buffer overflow vulnerability and analyze using debugging tools.

SECURE CODING PRACTICES

8. Implement SQL Injection prevention using parameterized queries, ORM frameworks, and input validation.
9. Implement Cross-Site Scripting (XSS) prevention using output encoding, input validation, and Content Security Policy.
10. Implement Cross-Site Request Forgery (CSRF) protection using anti-CSRF tokens and secure headers.
11. Implement secure file handling mechanisms including file validation, secure storage, and prevention of path traversal attacks.
12. Implement secure session management techniques such as session token rotation, session timeout, secure cookies, and SameSite attributes in a web application.
13. Implement secure authentication mechanisms including password hashing (bcrypt / Argon2), salting, and Multi-Factor Authentication (MFA) in a web application.

ADVANCED SECURITY TESTING & PRACTICES

14. Implement access control mechanisms using Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC), and test for vulnerabilities using OWASP tools.

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15. Perform security testing and secure deployment practices including Static Application Security Testing (SAST) using tools like SonarQube, Dynamic Application Security Testing (DAST) using OWASP ZAP, secure REST API implementation using JWT/OAuth2 and testing with Postman, and integrating automated security testing in CI/CD pipelines (GitHub Actions / GitLab CI).

TOTAL: 30 PERIODS

SOFTWARE TOOLS REQUIRED:

Python Programming (with security and cryptography libraries), Web Technologies (HTML, CSS, JavaScript), Web Frameworks (Flask/Django), Database Systems (MySQL/SQLite), OWASP ZAP / Burp Suite, API Testing Tool (Postman), Static Analysis Tool (SonarQube), Version Control & CI/CD Tools (Git, GitHub Actions / GitLab CI).

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with Python, Web Development environment, and security tools installed – 30 Nos. (Or) Server with required software supporting 30 terminals or more

OUTCOMES:

At the end of this course, the students should be able to:

1. Examine common security vulnerabilities and analyze their impact on web applications and software systems. (K4)
2. Differentiate secure coding techniques used to prevent vulnerabilities such as SQL Injection, XSS, CSRF, and file-based attacks. (K4)
3. Analyze web applications to identify security flaws and propose appropriate mitigation strategies. (K4)
4. Investigate the effectiveness of security tools such as OWASP ZAP, Burp Suite, and SonarQube in identifying vulnerabilities. (K4)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	-	-	-	2	3
CO2	3	3	-	-	2	-	-	-	-	-	-	3	3
CO3	3	3	-	-	2	-	-	-	-	-	-	3	3
CO4	2	2	-	-	2	-	-	-	-	-	-	3	3

SEMESTER V

COURSE CODE: 24SCPT502	CLOUD SECURITY LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106105167	SYLLABUS VERSION 1.1	SDG NO. 4, 11, 16				
PRE-REQUISITE COURSES	24SCPC301, 24SCPC401					

OBJECTIVES:

- To introduce basic cloud computing and security concepts.
- To understand identity and access management techniques.
- To learn data protection and encryption methods in the cloud.
- To understand cloud network security and secure configurations.
- To gain knowledge of monitoring and incident response in the cloud.

MODULE - I INTRODUCTION TO CLOUD SECURITY 7

Cloud computing basics: service models (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid, Community)- Shared Responsibility Model provider vs customer -Cloud threat landscape: misconfigurations, insecure APIs, insider threats, account hijacking - Cloud Security Alliance (CSA) guidelines.

Lab Exercises:

1. Install OpenStack or AWS Free Tier; configure basic VM and apply OS hardening.
2. Deploy Keycloak on Docker or a local VM/Create users, groups, and roles/Apply role-based access control (RBAC) policies and test access restrictions.

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MODULE - II CLOUD ARCHITECTURE AND INFRASTRUCTURE SECURITY 7

Principles of least privilege, separation of duties, and secure authentication - Role Based Access Control (RBAC) vs Attribute-Based Access Control (ABAC)- Federated identity management using SAML, OAuth 2.0, and OpenID Connect- Multifactor Authentication (MFA) and best practices for cloud IAM policies.

Lab Exercises:

1. Using CloudSim to simulate resource allocation strategies, load balancing, and auto-scaling triggers during simulated infrastructure anomalies or traffic spikes.

MODULE - III DATA SECURITY IN THE CLOUD 7

Encryption Fundamentals: Symmetric vs asymmetric encryption (AES, RSA)- Hashing functions (SHA, MD5) and their role in integrity-Encryption at rest, in transit, and in use. Cloud-Native Data Protection: Cloud provider encryption services - lifecycle management, and secure storage of cryptographic keys- Transparent data encryption (TDE) for databases.

Lab Exercises:

1. Install MinIO locally or on a VM/Create a storage bucket and upload sample files/Enable server-side encryption for the bucket./Verify encryption by checking metadata and attempting unauthorized access.
2. Deploy Vault on a VM or Docker container/Generate symmetric and asymmetric keys/Configure key rotation policies/Use Vault to encrypt/decrypt sample data files.

MODULE - IV NETWORK SECURITY IN CLOUD 8

Virtual Cloud Networks: Building secure architecture using subnets, route tables, and gateways- Access Control: Using firewalls, Security Groups, and Network ACLs to filter traffic and block unauthorized access- Zero Trust Security: Applying the "never trust, always verify" principle and continuous authentication- Secure Connections: Protecting hybrid clouds with VPNs, TLS/SSL, and detecting threats using IDS/IPS systems.

Lab Exercises:

1. Configure VPC with public/private subnets
2. Perform Network Scanning with nmap
3. Monitor Network Traffic using tcpdump and wireshark
4. Configure and Test Firewall Rules with iptables

MODULEV - V CLOUD MONITORING AND INCIDENT RESPONSE 8

Cloud Monitoring Fundamentals: Importance of continuous monitoring in cloud environments- Native tools: AWS CloudTrail, CloudWatch, Azure

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Monitor, GCP Operations Suite-Logging and SIEM Integration: Centralized log collection and analysis- Integration with SIEM platforms -Incident Response Lifecycle - Cloud-specific challenges in incident response- Cloud Forensics and Threat Detection: Techniques for investigating compromised accounts or resources - Use of flow logs, audit trails, and anomaly detection.

Lab Exercises:

1. Deploy an open-source SIEM (Security Information and Event Management) platform, simulate a threat against a cloud instance, and pratice the incident response lifecycle by analyzing centralized logs.

Prerequisites:

Two local Linux VM or Docker containers

MODULE - VI ADVANCE CLOUD COMPLIANCE 7

Cloud Compliance Standards: ISO 27001, NIST Cybersecurity Framework, GDPR, HIPAA, PCI-DSS- Risk Management in Cloud Security: identifying and assessing risks in cloud workloads-Shared responsibility model applied to compliance-Secure configuration and patch automation-Continuous Compliance and Auditing: Cloud-native compliance tools- Automated compliance monitoring and reporting.

Lab Exercises:

1. Install OpenSCAP on a Linux VM/Run compliance scans against CIS benchmarks or NIST profiles/Generate compliance reports and identify violations.
2. To simulate deploying a secure, compliant cloud instance using the OpenStack CLI.

Open-Source Tools:

1. Building & Storing: OpenStack, Docker, MinIO.
2. Network & Security: Keycloak, nmap, Wireshark, iptables.
3. Investigating Hacks: Volatility, TheHive, OpenSCAP.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mather, T., Kumaraswamy, S., & Latif, S. (2009). Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (1st ed.). O'Reilly Media.
2. Erl, T., Puttini, R., & Mahmood, Z. (2013). Cloud Computing: Concepts, Technology & Architecture (1st ed.). Prentice Hall, Pearson Education.

WEB RESOURCES

1. Cloud Security Alliance (CSA) – https://cloudsecurityalliance.org

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2. NIST Cybersecurity Framework - https://www.nist.gov
3. Amazon Web Services (AWS) Documentation - https://docs.aws.amazon.com
4. Microsoft Azure Documentation - https://learn.microsoft.com/en-in/azure/
5. Google Cloud Documentation - https://cloud.google.com/docs

NPTEL Course Link:

1. https://nptel.ac.in/courses/106105167
2. https://nptel.ac.in/courses/106104182
3. Cyber Security NPTEL Link

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply cloud computing concepts, service models, and security fundamentals to configure secure cloud environments. (K3)
2. Implement identity and access management mechanisms such as RBAC, MFA, and federated authentication in cloud systems(K3)
3. Apply encryption techniques and data protection methods to secure cloud data at rest, in transit, and in use. (K3)
4. Configure cloud network security components including VPCs, firewalls, and secure connectivity mechanisms. (K3)
5. Analyze cloud monitoring logs and security events to detect threats and respond to incidents effectively. (K4)
6. Analyze cloud compliance requirements based on standards to ensure secure and compliant cloud operations. (K4)

CO - PO, PSO MAPPING:

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

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SEMESTER V

COURSE CODE: 24SCTP501	SKILL ENHANCEMENT	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4				
PRE-REQUISITE COURSES	-					

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Educate and enrich students on quantitative ability, reasoning ability, and verbal ability.
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills.
- Enhance logical problem-solving skills.

MODULE - I QUANTITATIVE ABILITY **22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

MODULE - II QUANTITATIVE ABILITY REASONING ABILITY **16**

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY **7**

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL : 45 PERIODS

REFERENCES

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

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BIS STANDARDS, RANGER AND ROVER, LIFE SKILLS–PHASE 2

OBJECTIVES

To enable students to,

- Familiarize the team and leadership skills.
- Understand the standards relevant to Cyber Security

MODULE - I JEEVAN KAUSHAL2.0-COGNITIVE SKILLS, INNOVATIVE LEADERSHIP AND DESIGN THINKING, ETHICS AND INTEGRITY 14

Cognitive and Non-cognitive Skills - Cognitive Skills: Meaning, Types of Cognitive Skills, Strategies to Develop Cognitive Skills-Critical Thinking Skills-Problem-solving skills - Ability to Learn, Non-cognitive Skills: Meaning and Types of Non-cognitive Skills, Strategies to Develop Non-cognitive Skills-Empathy- Creativity- Teamwork- Collaboration- Resilience - Interpersonal Skills- Perseverance- Social Control- Social Skill, Peer Pressure – Stress and Stress Management.

Innovative Leadership and Design Thinking- Concept of emotional and social intelligence, Concept of emotional and social intelligence, Innovative Leadership-Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders? Design Thinking-What is design thinking?, Key elements of design thinking, How to transform challenges into opportunities?, How to develop human-centric solutions for creating social good?

Ethics and Integrity - Learning through Biographies - What makes an individual great?, Understanding the person of a leader for deriving holistic inspiration, Drawing in sights for leadership, How leaders sail through difficult situations? Ethics and Conduct-Importance of ethics, Ethical Decision Making, Personal and professional moral codes of conduct, creating a harmonious life

MODULE-II RANGER AND ROVER 10

Scouting for Boys: Camp Life, Trekking Wood Craft.

Community Service: Meaning, Types of Community Service & duration, difference between Community Service and Community Development.

WOSM/WAGGGS/Govt. of India Initiatives (One Event Atleast)-Surf Smart, Free Being Me, Messengers of Peace, Scouts of the World Award Messengers of Peace and Scouts

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MODULE-III CYBER SECURITY TESTING AND COMPLIANCE 6

Cyber Security Testing and Compliance: Introduction to standards and best practices per training to Cyber Security Assessment, Vulnerability Assessment, Penetration Testing, Security Auditing, Incident Response, Digital Forensics, Data Protection, and Regulatory Compliance. Overview of BIS-adopted International Standards such as IS/ISO/IEC 27001:2022 (Information Security Management Systems), IS/ISO/IEC 27002:2022 (Information Security Controls), IS/ISO/IEC 27035 Series (Information Security Incident Management), IS/ISO/IEC30111(Vulnerability Handling Processes), IS/ISO 22301 (Business Continuity Management Systems), and IS/ISO/IEC 27701 (Privacy Information Management),which are extensively used for securing information assets, ensuring regulatory compliance, managing cyber risks, and strengthening organizational cyber resilience.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO/IECGuide59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214209?force_course_hub=true
2. https://free-being-me.com/wp-content/media/ABC_OLDER-2.pdf
3. https://www.wagggs.org/en/what-we-do/surf-smart-20/surf-smart-get-involved/

OUTCOMES

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

1. Demonstrate improved quantitative aptitude for solving numerical problems.[K2]
2. Apply logical reasoning to tackle reasoning-based challenges.[K2]
3. Enhance verbal communication and comprehension skills through grammar and language exercises.[K2]
4. Use ethical principles, emotional intelligence, and leadership in sights from biographies to practice responsible decision-making and professional conduct.(K3)
5. Illustrate the objectives and practices of WOSM/WAGGGS and Government of India initiatives such as Messengers of Peace, Surf Smart, and Scouts of the World Award.(K3)

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6. Apply cyber security standards and compliance frameworks for information security management.(K3)

CO-PO-PSOMAPPING

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

SEMESTER V

COURSE CODE: 24SCID501	PROTOTYPE DEVELOPMENT LABORATORY-I	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUSVERSION1.0	SDG NO.4,9				
PRE-REQUISITE COURSES	24SCID301, 24SCID401					

OBJECTIVES:

- To enable students to transform innovative ideas into feasible prototype solutions through structured problem identification, design thinking, and concept development.
- To provide experiential learning in prototype design and development by focusing on user-centric requirements, iterative design, and technical validation.
- To develop proficiency in problem analysis, feasibility assessment, requirement engineering, and prototype implementation.
- To instill a foundation of innovation and entrepreneurship by integrating ethical design principles, sustainability values, and responsible technology development.
- To enable data-driven solution development through literature survey, user feedback analysis, and technology exploration.
- To facilitate multidisciplinary problem-solving through engineering design, prototype realization, testing, validation, and technical communication.

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COURSE METHODOLOGY

- This course is designed to develop innovation-oriented thinking and practical problem-solving abilities through prototype development activities focusing on real-world challenges.
- The project work shall involve the identification of a problem, requirement analysis, feasibility study, solution design, prototype development, testing, validation, and documentation. Students shall apply design thinking principles throughout the development cycle.
- Projects may be carried out individually or in groups with a maximum of three students. In the case of group projects, each student shall submit an individual project contribution report clearly specifying their role and responsibilities.
- Students shall maintain a detailed project portfolio containing problem statements, literature survey findings, design documents, prototype iterations, testing results, and validation reports.
- Periodic reviews shall be conducted to assess progress in prototype development, implementation, testing, and refinement. Students shall demonstrate prototype functionality during review evaluations.
- At the end of the semester, students shall submit a comprehensive project report and present a working prototype for evaluation by the course coordinator and project review committee.

EVALUATION

1. First Evaluation (Immediately after first internal examination): 20 Marks
   (Problem Identification and Validation, Literature Survey, Requirement Analysis, Initial Design Proposal)
2. Second Evaluation (Immediately after second interval examination):
   30 Marks (Prototype Design Completion, Prototype Devlopment Progress, Initial Testing and Validation Results)
3. Final Evaluation (Last week of the semester): 50 Marks
   (Functional Prototype Demonstration, Innovation and Creativity, Technical Implementation, Project Report, Vice-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL : 30 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze real-world problems, user requirements, and design constraints to formulate innovative prototype solutions using design thinking methodologies. (K4)

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2. Evaluate alternative technologies, development approaches, and feasibility aspects for prototype design and implementation. (K5)
3. Create functional prototypes by integrating appropriate tools, technologies, and engineering principles to address identified problems. (K6)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	3
CO2	3	3	3	--	3	-	-	-	-	-	-	2	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL501	EXPLORATORY DATA ANALYSIS WITH R SOFTWARE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 8, 9				
PRE-REQUISITE COURSES	24BSMA406					

OBJECTIVES:

- To understand the fundamental concepts, applications, and workflow of Data Science.
- To apply R programming concepts and commands for performing data manipulation and statistical computations.
- To prepare and preprocess datasets for analysis using appropriate data cleaning and transformation techniques.
- To perform Exploratory Data Analysis (EDA) using graphical and statistical methods to discover patterns and insights from data.
- To analyze data using measures of central tendency, dispersion, moments, and scaling techniques.

MODULE - I INTRODUCTION TO Data Science and Rsoftware 7

Introduction to Data Science - Introduction to R software with R commands - Calculations with R software - Data Preparation and Introduction to Exploratory Data Analysis

MODULE - II EXPLORATORY DATA ANALYSIS AND UNIVARIATE VISUALIZATION 8

Introduction to Exploratory Data Analysis - Frequency Distribution - Univariate Graphics -Univariate Plots

MODULE - III UNIVARIATE ANALYSIS AND MEASURES OF DATA DISTRIBUTION 7

Univariate Graphics - Plots - Central Tendency of Data - Central Tendency of Data and Variation in Data

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MODULE - IV STATISTICAL MEASURES OF DISPERSION AND DATA TRANSFORMATION **8**

Variation in Data :Variation in Data - Variation in Data - Moments- Scaling of Data

MODULE - V ASSOCIATION ANALYSIS AND CORRELATION OF VARIABLES **7**

Association of Variables with Graphic - Association of Variables and Correlation Coefficient

MODULE - VI MULTIVARIATE DATA ANALYSIS AND REGRESSION TECHNIQUES **8**

Association of Variables for rank data - discrete data - Least Squares Method - Least Squares Method - EDA with Multivariate Data

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly Media, 2nd Edition, 2023.
2. Roger D. Peng, R Programming for Data Science, Leanpub, 2016.

REFERENCE BOOKS

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Professional, 2nd Edition, 2017.
2. Peter Bruce, Andrew Bruce, and Peter Gedeck, Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, O'Reilly Media, 2nd Edition, 2020.
3. John M. Chambers, Software for Data Analysis: Programming with R, Springer, 2nd Edition, 2017.

WEB REFERENCES

1. https://r4ds.hadley.nz/
2. https://posit.co/resources/
3. https://r-graph-gallery.com/

ONLINE REFERENCES

1. https://r4ds.hadley.nz/
2. https://r-graphics.org/
3. https://dplyr.tidyverse.org/

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OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamental concepts of Data Science and R programming to perform data manipulation, computations, and preliminary data preparation tasks.(K3)
2. Utilize exploratory data analysis techniques, frequency distributions, and univariate visualizations to summarize and explore datasets..(K3)
3. Analyze data distributions using graphical methods and measures of central tendency to interpret the characteristics of datasets..(K4)
4. Examine data variability through measures of dispersion, moments, and data scaling techniques for effective data transformation..(K4)
5. Analyze the association between variables using graphical methods and correlation coefficients to identify relationships and dependencies..(K4)
6. Evaluate relationships among rank, discrete, and multivariate data using association measures and least squares regression techniques for data-driven insights.(K4)

CO - PO, PSO MAPPING:

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

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL502	ARTIFICIAL INTELLIGENCE FUNDAMENTALS AND APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106108705	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24SCPC402					

OBJECTIVES:

- To introduce the fundamental concepts, techniques, and applications of Artificial Intelligence.
- To equip learners with problem-solving methods, knowledge representation, machine learning, and deep learning techniques, and to provide an understanding of the ethical implications of AI in society.
- Apply uninformed and informed search algorithms (BFS, DFS, A*, etc.).
- Analyze real-world applications such as: Natural Language Processing (NLP) Expert Systems, Robotics and Computer Vision.
- To understand the machine learning concept.
- To explore real-world AI applications.

MODULE - I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 7

Foundations and history of AI, definitions and goals of AI, the Turing Test and intelligent behaviour, intelligent agents and rationality, agent architectures (reactive, deliberative, hybrid), PEAS framework (Performance measure, Environment, Actuators, Sensors), types of environments — deterministic vs stochastic, static vs dynamic, fully vs partially observable, discrete vs continuous. Applications of AI in healthcare, finance, transportation, and entertainment. Current trends, opportunities, and limitations of AI.

MODULE - II PROBLEM SOLVING AND SEARCH TECHNIQUES 8

Problem formulation and state space representation. Uninformed search strategies — Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search, Depth-Limited Search, Iterative Deepening Search. Informed/heuristic search techniques — Greedy Best-First Search, A* algorithm, IDA*. Properties of heuristics: admissibility and consistency. Local search algorithms — Hill Climbing, Simulated Annealing, Genetic Algorithms. Adversarial search — Minimax algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems (CSPs) and backtracking search.

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MODULE - III KNOWLEDGE REPRESENTATION AND REASONING **8**

Propositional logic — syntax, semantics, inference rules. First-order logic (predicate logic) — quantifiers, variables, functions. Resolution and unification. Forward chaining and backward chaining. Semantic networks, frames, and ontologies. Rule-based expert systems. Reasoning under uncertainty: probability basics, Bayes' theorem, Bayesian networks, Dempster-Shafer theory. Introduction to fuzzy logic — fuzzy sets, membership functions, fuzzy inference systems.

MODULE IV MACHINE LEARNING FOUNDATIONS **8**

Introduction to machine learning and its relationship with AI. Supervised, unsupervised, and reinforcement learning paradigms. Regression techniques — linear and logistic regression. Classification algorithms — Decision Trees, k-Nearest Neighbours (k-NN), Naive Bayes classifier, Support Vector Machines (SVM). Unsupervised learning — k-Means clustering, hierarchical clustering- Performance metric evaluation

MODULE - V NEURAL NETWORKS AND DEEP LEARNING **7**

Biological inspiration and the artificial neuron. Perceptron and Multilayer Perceptron (MLP). Activation functions — sigmoid, tanh, ReLU, softmax. Forward propagation and the backpropagation algorithm. Gradient descent and its variants — SGD, Momentum, Adam. Convolutional Neural Networks (CNNs) — convolution, pooling, architectures like LeNet, AlexNet, ResNet. Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), and Gated Recurrent Units (GRU).

MODULE - VI ETHICS AND AI APPLICATIONS **7**

AI ethics — bias and fairness, accountability, explainable AI (XAI), privacy and security concerns. Societal impact and the future of AI.Natural Language Processing (NLP) — tokenization, stemming, lemmatization, word embeddings (Word2Vec, GloVe), sentiment analysis, chatbots. Computer Vision — image classification, object detection, face recognition. Expert Systems — architecture and case studies (MYCIN, DENDRAL). Robotics and autonomous systems — perception, planning, control. Generative AI and Large Language Models (LLMs) — GPT, BERT, diffusion models.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, 3rd Edition, McGraw Hill, 2017.

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3. TomM.Mitchell, Machine Learning, McGraw Hill, 2017.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow, 3rd Edition,O'Reilly,2022

REFERENCE BOOKS:

1. Search Methods in Artificial Intelligence by Deepak Khemani Published by Cambridge University Press in 2024.
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F.Luger

WEBREFERENCES:

1. NPTEL–Artificial Intelligence: Search Methods for Problem Solving
2. NPTEL–Introduction to Machine Learning
3. IBM Artificial Intelligence Resources

ONLINERESOURCES:

1. NPTEL Course–Artificial Intelligence
2. NPTEL Course–Introduction to Machine Learning
3. Coursera– Artificial Intelligence Courses
4. edX–Artificial Intelligence Programs
5. KaggleLearn–Machine Learning and AI Tutorials

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamental concepts, history, definitions, and goals of Artificial Intelligence to analyze intelligent systems. (K3)
2. Apply problem formulation and state space representation techniques to model Artificial Intelligence search problems. (K3)
3. Analyze propositional logic concepts, including syntax, semantics, and inference rules, for solving problems in Artificial Intelligence. (K4)
4. Apply the fundamentals of machine learning and its relationship with Artificial Intelligence, including supervised, unsupervised, and reinforcement learning. (K3)
5. Implement artificial neuron models, Perceptron, and Multilayer Perceptron (MLP) networks for basic neural network applications. (K3)
6. Analyze expert system architectures and case studies such as MYCIN and DENDRAL forknowledge-based problem solving.(K4)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	3	-	-	-	-	-	-	-	-	-	2	3
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3	-	-	-	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL503	HUMAN COMPUTER INTERACTION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To understand the principles, concepts, and foundations of Human–Computer Interaction (HCI).
- To learn user-centered design methodologies and interaction design processes.
- To apply design principles, usability guidelines, and accessibility standards in interface design.
- To develop prototypes and user interfaces using modern design tools and frameworks.
- To evaluate interactive systems using qualitative and quantitative usability assessment techniques.
- To explore emerging interaction paradigms, AI-driven interfaces, and ethical considerations in HCI.

MODULE - I FOUNDATIONS OF HCI 8

Introduction to Human-Computer Interaction (HCI), history and evolution of HCI, importance of human-centered design. The human — sensory perception

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(vision, hearing, touch), memory (sensory, short-term, long-term), cognition, attention, and motor skills. The computer — input devices (keyboard, mouse, touchscreen, voice, gesture), output devices (display, audio, haptic). Interaction styles — command line interfaces, menu-based, form fill-in, direct manipulation, GUI/WIMP, web-based, mobile, voice, and immersive interfaces. Norman's seven stages of action and the gulfs of execution and evaluation.

MODULE - II INTERACTION DESIGN PROCESS **8**

User-Centered Design (UCD) principles and philosophy. Design thinking framework — empathize, define, ideate, prototype, test. Requirements gathering techniques — interviews, surveys, questionnaires, ethnographic studies, contextual inquiry, focus groups. Personas, user profiles, and scenarios. User stories and use cases. Task analysis — Hierarchical Task Analysis (HTA), GOMS model. Participatory and co-design approaches. Iterative design cycle and the role of stakeholders.

MODULE - III DESIGN PRINCIPLES AND GUIDELINES **8**

Shneiderman's Eight Golden Rules of interface design. Nielsen's Ten Usability Heuristics. Don Norman's design principles — visibility, feedback, affordance, signifiers, mapping, constraints, consistency. Gestalt principles of visual perception — proximity, similarity, closure, continuity, figure-ground. Visual design fundamentals — color theory, typography, layout, white space, hierarchy. Accessibility — Web Content Accessibility Guidelines (WCAG), assistive technologies, universal design principles. Designing for diverse users including users with disabilities, elderly users, and children.

MODULE - IV PROTOTYPING AND IMPLEMENTATION **7**

Importance and role of prototyping in design. Low-fidelity prototyping — sketches, paper prototypes, storyboards, wireframes. High-fidelity prototyping — interactive mockups, clickable prototypes. Industry-standard prototyping tools — Figma, Adobe XD, Sketch, Balsamiq, InVision, Axure. Design systems and style guides (Material Design, Apple Human Interface Guidelines). Responsive and adaptive design. Mobile-first design approach. Cross-platform design considerations — web, iOS, Android. Handoff from designer to developer.

MODULE - V EVALUATION TECHNIQUES **7**

Goals and types of evaluation — formative vs summative. Expert-based evaluation methods — heuristic evaluation, cognitive walkthrough, pluralistic walkthrough. User-based evaluation methods — usability testing, think-aloud

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protocol, A/B testing, eye-tracking studies. Quantitative metrics — task completion time, error rate, success rate, System Usability Scale (SUS), Net Promoter Score (NPS). Qualitative analysis — affinity diagrams, thematic analysis. Remote vs lab-based testing. Use of analytics and heatmaps. Ethics in user research and informed consent.

MODULE - VI ADVANCED TOPICS AND EMERGING INTERFACES **7**

Mobile and touch interfaces — gestures, multi-touch, haptics. Voice User Interfaces (VUI) and conversational design — Alexa, Siri, Google Assistant. Augmented Reality (AR) and Virtual Reality (VR) interfaces — design challenges and opportunities. Wearable computing and smart devices. Tangible and embedded interaction. Brain-Computer Interfaces (BCI). Designing for AI systems and chatbots — trust, transparency, explainability. Ethics in design — dark patterns, persuasive design, addictive design, privacy. Case studies of successful and failed interface designs.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Human-Computer Interaction: Authors: Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Pearson/Prentice-Hall, 2004
2. Designing the User Interface: Strategies for Effective Human-Computer Interaction

REFERENCE BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human-Computer Interaction, 3rd Edition, Pearson, 2004.
2. Ben Shneiderman, Catherine Plaisant et al., Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition, Pearson, 2016.
3. Donald A. Norman, The Design of Everyday Things, Revised and Expanded Edition, Basic Books, 2013.
4. Helen Sharp, Jennifer Preece, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 5th Edition, Wiley, 2019.
5. Steve Krug, Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability, 3rd Edition, New Riders, 2014.

WEB REFERENCES:

1. https://www.interaction-design.org
2. https://www.nngroup.com
3. World Wide Web Consortium (W3C) Web Accessibility Initiative https://www.w3.org/WAI

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ONLINE RESOURCES:

1. NPTEL Course – Human Computer Interaction
2. Coursera – User Experience (UX) Design Courses
3. edX – Human Computer Interaction Courses

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply human cognitive and perceptual principles in interaction design. (K3)
2. Apply user-centered design methods to identify user requirements and problems. (K3)
3. Analyse usability principles and design guidelines to create user interfaces. (K4)
4. Develop low- and high-fidelity prototypes using design tools. (K3)
5. Analyse usability issues using expert reviews and user testing methods. (K4)
6. Analyse emerging interaction technologies and ethical aspects of interface design. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	-	-	-	-	-	-	-	-	-	2	3
CO4	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3	-	-	-	-	-	-	-	-	-	3	2

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITPC401	USER INTERFACE / USER EXPERIENCE (UIUX) DESIGNING SKILLS	L	T	P	CP	C
		3	0	0	4	3
NPTEL CODE: 106106701	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24SCPC302					

OBJECTIVES:

- To learn the basics of User Interface/User Experience Designing Skills
- To become familiar with the design technologies for individuals and persons with disabilities
- To be aware of Mobile HCI
- To learn the guidelines to design user interface
- To design an UI using UX skills.

MODULE - I OVERVIEW OF USER INTERFACE 8

Importance of User Interface – Definition – Importance of Good Design - History of HCI- Blossoming of the World Wide Web - Characteristics of Graphical and Web User Interface - Interaction Styles - The Graphical User Interface - The Web User Interface - The Merging of Graphical Business Systems and the Web

MODULE - II USER INTERFACE DESIGN PROCESS 8

Principles of User Interface Design - Obstacles and Pitfalls – Usability - Human Considerations in the Design of Business Systems - Business Function - Determining Basic Business Functions - Design Standards or Style Guides - System Training and Documentation Needs – Usability Testing – Purpose – Importance – Scope- Prototypes – Kinds of Tests

MODULE - III UI ELEMENTS 8

System Menus – Navigation Schemes – Window –Characteristics – Components- Presentation Styles – Types – Screen based Controls – Graphics, Icons, Images – Colors – Case Study: Creation of Visual designs and clickable prototypes.

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MODULE - IV OVERVIEW OF USER EXPERIENCE 7

UX Design Concepts - Intersection of Design, Technology, & Business- Knowing Your User - User Research Through Interviews - Refining User Research and Creating Personas- Synthesis of User Research, Journey Maps, and User Flows

MODULE - V USER EXPERIENCE ELEMENTS 7

Wireframing – Types of Wireframing - Sketching, Prototyping - Types - User Testing - Iterating the Prototype - User Testing

MODULE - VI WEB INTERFACE DESIGN 7

Designing Web Interfaces – Drag and Drop - Direct Selection - Contextual Tools - Overlays, Inlays and Virtual Pages - Process Flow – Case Studies – Introduction to Figma – Tools in Figma – Figma Layers Panel – Components – Design Panel – Libraries – Code Panel – Prototyping – Masks - Figma Exports – Mockup in photoshop – Plugins – Wireframing in Figma

TOTAL : 45 PERIODS

TEXT BOOKS

1. Edward Stull, "UX Fundamentals for Non-UX Professionals User Experience Principles for Managers, Writers, Designers, and Developers", Apress, Spinger Nature Link, 2018.
2. Wilbert O. Galitz, "The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques", 3rd Edition, Wiley Publishing Inc., 2007.

REFERENCES:

1. Brian Fling, "Mobile Design and Development, First Edition", O'Reilly Media Inc., 2009.
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.
3. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: beyond human-computer interaction", Second Edition, John-Wiley and Sons Inc.,2009.
4. DovTe-eni, Jane Carey, Ping Zhang, "Human-Computer Interaction: Developing Effective Organizational Information Systems", John-Wiley and Sons Inc., 2007.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc23_cs116
2. UI/UX Design With Figma : 5+ Real World Projects | Udemy

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Information Technology

3. https://www.nobledesktop.com/outlines/ux-and-ui-design-certificate-syllabus.pdf

ONLINE RESOURCES:

1. https://freevideolectures.com/course/4491/nptel-introduction-human-computer-interaction
2. https://www.iare.ac.in/sites/default/files/lecture_notes/HCI%20LECTURE%20NOTES.pdf
3. https://mrcet.com/pdf/Lab%20Manuals/IT/R15A0562%20HCI.pdf

OUTCOMES:

At the end of this course, the students should be able to:

1. Utilize the basic concepts of User Interface and its types to design. (K3)
2. Make use of the design process and its testing strategy in real time UI designs. (K3)
3. Examine various UI elements in real time visual designs and prototypes. (K4)
4. Experiment with the basic fundamentals of UX designing. (K3)
5. Inspect wireframing, sketching and prototyping and test with usability testing. (K4)
6. Dissect the Web Based User Interface Design for Multimedia / Ecommerce / E-Learning Websites using Figma. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	-	3	-	-	-	-	-	2	2	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	2	-	3	-	-	-	-	-	2	2	2
CO6	3	3	2	-	3	-	-	-	-	-	2	2	2

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24CSEL501	INTRODUCTION TO MOBILE TECHNOLOGIES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106147	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24SCPC302					

OBJECTIVES:

- To understand the basic concepts of Mobile Computing
- To learn the basics of Mobile Tele communication System
- To be familiar with the Mobile communication Layers
- To explore emerging future wireless communication technologies

MODULE - I INTRODUCTION 8

Introduction to Mobile Computing – Applications of Mobile Computing Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum - MAC Protocols – Wireless MAC Issues– SDMA– TDMA– FDMA– CDMA.

MODULE - II MOBILE TELE COMMUNICATION SYSTEM 8

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) –Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE), 5G NR.

MODULE - III MOBILE NETWORK LAYER 7

Mobile IP –Ad Hoc– Proactive Protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP.

MODULE - IV MOBILE TRANSPORT AND APPLICATION LAYER 8

Mobile TCP– Improvements in TCP – I TCP – STCP – MTCP – WAP – Architecture – WDP – WTLS – WTP – WSP – WAE – WML.

MODULE - V MOBILE OPERATING SYSTEM 7

Mobile Device Operating Systems – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone.

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MODULE - VI FUTURE MOBILE NETWORKS 7

Drone networking - Multi-UAV networks, architectures and civilian applications - Communication challenges and protocols for micro UAVs - Connected and autonomous cars – VANET - Wireless technologies for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communications.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jochen Schiller, "Mobile Communications", Prentice Hall India, Second Edition,2009.
2. Andrea Goldsmith, Wireless Communications. Cambridge University Press, 2012.

REFERENCES:

1. Raj Kamal, Mobile Computing, Oxford University Press; 3rd edition, 2019 Andre Perez, Mobile Networks Architecture, Wiley, 2013
2. Rishabh Anand, Mobile Computing, Khanna Publishing House, 1st Edition 2012
3. Prasant Kumar Pattnaik, Rajib Mall,"Fundamentals of Mobile Computing", PrenticeHallIndia Learning Pvt.Ltd,NewDelhi, 2012.

WEB REFERENCES:

1. https://www.tutorialspoint.com/mobile_computing/index.htm?
2. https://www.techtarget.com/searchmobilecomputing/tutorials3. https://www.geeksforgeeks.org/computer-networks/wireless-mobile-computing-technologies/
4. https://www.tutorialspoint.com/mobile_computing/index.htm

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106147
2. https://www.coursera.org/learn/wireless-communications
3. https://www.getyoureducation.net/course/5g-4g-lte-3g-2g-mobile-cellular-networks-for-beginners?utm_source=chatgpt.com
4. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee109
5. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee72

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OUTCOMES:

At the end of this course, the students should be able to:

1. Illustrate mobile computing concepts, wireless communication systems, multiplexing techniques, spread spectrum methods, and MAC protocols. (K3)
2. Analyze the architecture, functionality, and performance characteristics of GSM, GPRS, UMTS, LTE, and 5G NR mobile communication technologies. (K4)
3. Examine the routing strategies and performance of DSDV, DSR, AODV, ZRP, and ODMRP protocols in mobile networks. (K4)
4. Interpret the operation of Mobile TCP enhancements and WAP architecture for supporting mobile communication services. (K4)
5. Examine the architecture, features, and development environments of commercial mobile operating systems and their software development kits. (K4)
6. Investigate the architectures and communication technologies supporting drone networks, connected vehicles, and autonomous transportation systems. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	2	2
CO2	3	3	2	-	3	-	-	-	-	-	-	2	2
CO3	3	3	3	-	3	-	-	-	-	-	-	2	2
CO4	2	3	2	2	3	-	-	-	-	-	-	2	2
CO5	2	2	3	-	3	-	-	-	-	-	-	2	2
CO6	2	3	3	-	3	-	-	-	-	-	2	2	2

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24CSEL502	NO SQL DATABASES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 9, 12				
PRE-REQUISITE COURSES	24ITPT201, 24ITPT301					

OBJECTIVES:

- Understand RDBMS limitations and need for NoSQL
- Explain NoSQL concepts and architectures
- Apply aggregate data models
- Analyze consistency and transaction models
- Evaluate key-value and document databases
- Examine column-family, graph databases, and schema design

MODULE - I INTRODUCTION TO DATA SCIENCE AND R SOFTWARE 7

The Value of Relational Databases - Structured Data & ACID Properties - Impedance Mismatch(Object vs Relational Model) - Application vs Integration Databases - Limitations of RDBMS in Modern Applications

MODULE - II EMERGENCE OF NOSQL 8

Development of Non-Relational Technologies - The Emergence of NoSQL - CAP Theorem - NoSQL Database Management Systems (overview) - Types of NoSQL Databases

MODULE - III AGGREGATE DATA MODELS AND RELATIONSHIPS 8

Aggregate Data Models - Aggregate-Oriented Databases - Relationships in NoSQL Systems - Consequences of Aggregate Orientation - Design Considerations

MODULE - IV CONSISTENCY, TRANSACTIONS AND DISTRIBUTION 8

Consistency Models - Update Consistency - Read Consistency - Relaxing Consistency - Relaxing Durability - Business Transactions vs System Transactions - Version Stamps on Multiple Nodes

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MODULE - V KEY-VALUE AND DOCUMENT DATABASES 7

Key-Value Databases: Key-Value Store Concept-Features-Suitable Use Cases - Document Document Data Model - Features - Suitable Use Cases

MODULE - VI COLUMN-FAMILY STORES, GRAPH DATABASES & SCHEMA DESIGN 7

Column-Family Databases: Data Model - Features - Suitable Use Cases - Graph Databases: Graph Model - Features - Suitable Use Cases - Schema Design and Evolution: Schema Migrations - Schema Changes - Schema Changes in RDBMS vs NoSQL

TOTAL : 45 PERIODS

TEXT BOOKS

1. Pramod J. Sadalage & Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley, 2012.
2. SQL and NoSQL Databases: Modeling, Languages, Security and Architectures for Big Data Management Kindle Edition by Michael Kaufmann (Author), Andreas Meier (Author), 2023.

REFERENCES:

1. Martin Kleppmann, Designing Data-Intensive Applications, O'Reilly, 2017.
2. Eric Redmond & Jim Wilson, Seven Databases in Seven Weeks, 2nd Edition, 2018.
3. Guy Harrison, NoSQL Database: New Era of Databases for Big Data Analytics, Apress.

WEB REFERENCES:

1. https://www.mongodb.com/resources/basics/databases/nosql-explained
2. https://www.ibm.com/think/topics/nosql-databases
3. https://www.geeksforgeeks.org/dbms/introduction-to-nosql/
4. https://www.datacamp.com/tutorial/nosql-tutorial
5. https://www.thoughtworks.com/insights/blog/nosql-databases-overview
6. https://en.wikipedia.org/wiki/NoSQL

ONLINE RESOURCES:

1. https://www.freecodecamp.org/news/sql-vs-nosql-tutorial/
2. https://www.youtube.com/watch?v=-s29jUAkg70

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OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamentals of relational databases to identify the limitations of RDBMS in modern applications. (K3)
2. Develop appropriate database solutions for distributed and scalable applications using NoSQL concepts. (K3)
3. Apply aggregate data models and design principles to represent relationships and design efficient NoSQL database structures for real-world applications. (K3)
4. Demonstrate the use of consistency models and distribution strategies to maintain data consistency across multiple nodes. (K3)
5. Apply key-value and document database models to implement suitable data storage solutions based on application needs. (K3)
6. Apply column-family and graph database models to design schemas and perform schema evolution in NoSQL systems. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	2	2
CO2	3	3	2	-	3	-	-	-	-	-	-	2	2
CO3	3	3	3	-	3	-	-	-	-	-	-	2	2
CO4	2	3	2	2	3	-	-	-	-	-	-	2	2
CO5	2	2	3	-	3	-	-	-	-	-	-	2	2
CO6	2	3	3	-	3	-	-	-	-	-	2	2	2

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL501	FUNDAMENTALS OF QUANTUM COMPUTING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106104845	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24BSMA201, 24ESCS101, 24BSMA101					

OBJECTIVES:

- Explain the theoretical foundations of quantum computation.
- Understand quantum information representation and transformations.
- Analyze quantum measurement and probabilistic behavior.
- Interpret quantum circuit models and computational complexity.
- Examine foundational quantum algorithms and information theory.
- Evaluate the impact of quantum computing on modern technology.

MODULE - I BASICS OF COMPUTING & QUANTUM INTRODUCTION 8

Classical vs Modern Computing – Bits vs Qubits – Need for Quantum Computing–Real-world Applications of Quantum Computing–Qubit States –Bloch Sphere Representation – Superposition – Measurement – Quantum Gates – Introduction to Quantum Computing – Classical and Quantum Information – Quantum Bits and Bloch Sphere – Applications of Quantum Computing.

MODULE - II BASIC MATHEMATICAL CONCEPTS 7

Complex Numbers – Vectors and Vector Spaces – Matrix Operations – Dirac Notation – Tensor Products – Inner Product and Orthogonality – Probability Basics – Representation of Quantum States – Linear Algebra for Quantum Computing – Complex Vector Spaces – Matrix Representation – Bra-Ket Notation.

MODULE - III QUANTUM MEASUREMENT & INFORMATION REPRESENTATION 7

Quantum Measurement Principles – Quantum State Collapse – Probability Amplitudes – Density Matrix Basics – Quantum Entanglement – Bell States – Quantum Information Representation – Basics of Quantum Communication.

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MODULE - IV QUANTUM COMPUTATION MODELS 7

Quantum Circuit Model – Quantum Logic Gates – Quantum Turing Machines- Quantum Parallelism – Reversible Computing – Quantum Circuit Design –Quantum Simulation Concepts – Quantum Computational Models – Circuit Representation – Circuit Simulation.

MODULE - V QUANTUM ALGORITHMS & COMPLEXITY THEORY 8

Complexity classes (P, NP, BQP) - Quantum speedup concepts- Complexity Classes – Quantum Speed-up Concepts – Deutsch Algorithm – Deutsch-Jozsa Algorithm–Grover's Search Algorithm – Shor's Algorithm–Quantum Fourier Transform – Quantum Algorithms – Complexity Analysis – Search and Factorization Algorithms.

MODULE - VI QUANTUM INFORMATION, ERROR & EMERGING PARADIGMS 7

Quantum Error Correction – Decoherence and Noise Models – Quantum Cryptography Basics – Quantum Key Distribution–Quantum Teleportation – Superdense Coding – Quantum Supremacy – Ethical and Societal Implications of Quantum Computing – Quantum Error Models – Quantum Security –Communication Protocols.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press.
2. Yanofsky, N. S., & Mannucci, M. A. (2008). Quantum Computing for Computer Scientists (1st Edition). Cambridge University Press.
3. Bernhardt, C. (2019). Quantum Computing for Everyone. MIT Press.

REFERENCE BOOK:

1. Hidary, J. D. (2019). Quantum Computing: An Applied Approach (1stEdition).Springer
2. Rieffel, E., & Polak, W. (2011). Quantum Computing: A Gentle Introduction(2ndEdition). MITPress.
3. Kaye, P., Laflamme, R., & Mosca, M. (2007). An Introduction to Quantum Computing. Oxford University Press.

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WEB RESOURCES:

1. IBM Quantum Learning – https://quantum.ibm.com
2. Qiskit Documentation – https://qiskit.org
3. Microsoft Quantum (Q#) – https://learn.microsoft.com/quantum
4. Quantum Country – https://quantum.country
5. National Institute of Standards and Technology
6. NIST Quantum Resources – https://www.nist.gov

NPTEL COURSE LINK:

1. IBM Quantum – Introduction to Quantum Computing
   https://quantum.ibm.com
2. Qiskit Documentation – Quantum Programming Framework
   https://qiskit.org

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamental concepts of quantum information and quantum mechanics to represent quantum states. (K3)
2. Implement quantum gates and circuits for processing quantum information. (K3)
3. Utilize quantum measurement techniques and entanglement in information processing tasks. (K3)
4. Apply quantum communication protocols and information-theoretic measures in secure communication. (K3)
5. Illustrate quantum algorithms to solve computational problems efficiently. (K3)
6. Build solutions using quantum channels, error correction, and cryptographic techniques. (K3)

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Science and Engineering (Cyber Security)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	–	–	–	–	–	2	2
CO2	3	3	–	–	–	–	–	2	–	–	–	–	1	2
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	–	1	–	–	–	2	3
CO5	2	2	–	–	–	–	–	–	–	2	–	–	1	2
CO6	2	2	–	–	–	–	–	–	–	–	–	–	2	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL507	QUANTUM TOOLS AND APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 104104082	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24BSMA201, 24BSMA306					

OBJECTIVES:

- To apply the mathematical foundations and principles of quantum computation.
- To implement quantum circuits, multi-qubit systems, and programming tools.
- To utilize quantum transformations and estimation techniques for problem solving.
- To apply quantum communication and cryptographic techniques in secure systems.
- To employ quantum optimization methods and machine learning techniques.
- To examine and apply concepts of quantum hardware, noise, and real-world applications.

MODULE - I FOUNDATIONS AND MATHEMATICAL TOOLS 7

Limitations of classical systems – Basics of quantum computation – Review of linear algebra (vectors, matrices, eigenvalues, eigenvectors) – Complex vector

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spaces - Dirac notation - Qubits and superposition - Bloch sphere representation - Quantum states and measurement.

MODULE - II QUANTUM CIRCUITS AND PROGRAMMING TOOLS 8

Quantum gates (Pauli, Hadamard, Phase gates) - Multi-qubit systems and tensor products - Entanglement and Bell states - Controlled gates (CNOT, Toffoli) - Quantum circuit design and optimization - Reversible computation - Introduction to Qiskit and Quantum Circuit simulation.

MODULE - III QUANTUM TRANSFORMS AND ESTIMATION TECHNIQUES 7

Quantum Fourier Transform (QFT) - Inverse QFT - Phase estimation algorithm - Quantum state preparation - Measurement strategies and basis transformation - Applications of transform techniques

MODULE - IV QUANTUM COMMUNICATION AND CRYPTOGRAPHY APPLICATIONS 8

Quantum key distribution (QKD) - BB84 and E91 protocols - Quantum teleportation - Superdense coding - No-cloning theorem - Quantum secure communication - Entanglement-based communication - Applications in secure networks - Practical challenges in quantum communication

MODULE - V QUANTUM OPTIMIZATION AND MACHINE LEARNING 8

Grover's search algorithm - Variational Quantum Algorithms (VQA) - Quantum Approximate Optimization Algorithm (QAOA) - Hybrid quantum-classical computing - Introduction to quantum machine learning - Quantum classifiers- Applications in optimization problems

MODULE - VI QUANTUM PROGRAMMING TOOLS AND SIMULATION TECHNIQUES 7

Introduction to Quantum Programming Environments - Overview of IBM Quantum Experience and Qiskit - Quantum Circuit Construction and Simulation using Qiskit - Quantum Gates and Multi-Qubit Circuit Implementation - Introduction to Cirq and PennyLane - Execution of Quantum Programs on Simulators and Real Quantum Hardware - Applications of Quantum Programming Tools.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 09/04/2026

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TEXT BOOKS

1. Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press.
2. Johnston, E., Harrigan, N., & Gimeno-Segovia, M. (2019). Programming Quantum Computers (1st Edition). O'Reilly Media.
3. Rieffel, E. G., & Polak, W. H. (2011). Quantum Computing: A Gentle Introduction (1st Edition). MIT Press.
4. Learn Quantum Computing with Python and Qiskit, Loredo,R. (2020). (1st Edition). Packt Publishing.

REFERENCE BOOK:

1. Lipton, R. J., & Regan, K. W. (2021). Introduction to Quantum Algorithms via Linear Algebra (2nd Edition). MIT Press.
2. Wilde, M. M. (2017). Quantum Information Theory (2nd Edition).Cambridge University Press.
3. Preskill, J. (2015). Lecture Notes on Quantum Computation. California Institute of Technology.

WEB RESOURCES:

1. IBM Quantum Learning – https://quantum.ibm.com
2. Xanadu Quantum (PennyLane) – https://pennylane.ai
3. Quantum Algorithm Zoo – https://quantumalgorithmzoo.org
4. Rigetti Forest SDK – https://www.rigetti.com

NPTEL COURSE LINK:

1. NPTEL – Quantum Computation / Quantum Information Processing
2. https://onlinecourses.nptel.ac.in/noc26_ph02/preview
3. NPTEL – Introduction to Quantum Computing: Quantum Algorithms and Qiskit
4. https://onlinecourses.nptel.ac.in/noc25_cs95/preview

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the mathematical foundations and principles of quantum computation to represent quantum states and operations. (K3)
2. Implement quantum circuits using multi-qubit systems and quantum programming tools. (K3)

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 9/4/2026

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3. Utilize quantum transforms and estimation techniques to solve computational problems. (K3)
4. Apply quantum communication and cryptographic techniques for secure information transfer. (K3)
5. Illustrate quantum algorithms for optimization and basic machine learning applications. (K3)
6. Build models using concepts of quantum hardware and noise to analyze real-world quantum systems. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	–	–	–	–	–	2	2
CO2	3	–	–	–	2	–	–	1	–	–	–	–	2	2
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	1	2	–	–	–	2	3
CO5	3	–	–	–	1	–	–	–	–	–	–	–	1	2
CO6	2	–	–	–	–	–	–	–	–	–	–	–	2	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL503	QUANTUM INFORMATION THEORY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 104104082	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24ITPC301, 24BSMA406					

OBJECTIVES:

- To apply the fundamental principles of quantum mechanics in information theory.
- To implement quantum bits, gates, and circuit models for computation.
- To utilize quantum measurement and entanglement concepts in information processing.
- To apply quantum communication protocols and information-theoretic measures.

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- To employ quantum algorithms for solving computational problems.
- To build solutions using quantum channels, error correction, and cryptographic techniques.

MODULE - I INTRODUCTION TO QUANTUM INFORMATION 7

Understanding limitations of classical information – Basics of quantum mechanics – State vectors and Hilbert space – Dirac notation – Postulates of quantum mechanics – Superposition principle – Representation of qubits – Bloch sphere visualization

MODULE - II QUBITS AND QUANTUM GATES 8

Single qubit operations – Pauli gates (X, Y, Z) – Hadamard gate – Multi-qubit systems – Tensor product representation – Quantum gates and quantum circuits – Controlled gates (CNOT) – No-cloning theorem

MODULE - III QUANTUM MEASUREMENT AND ENTANGLEMENT 7

Quantum measurement postulates – Projective measurement – POVM – Density matrix representation (pure and mixed states) – Entanglement and Bell states – EPR paradox – Bell inequalities

MODULE - IV QUANTUM INFORMATION AND COMMUNICATION 8

Quantum teleportation – Superdense coding – Classical vs quantum information – Shannon entropy (review) – Von Neumann entropy – Quantum mutual information – Quantum communication systems

MODULE - V QUANTUM ALGORITHMS 8

Deutsch algorithm – Deutsch–Jozsa algorithm – Grover's search algorithm – Quantum Fourier transform – Shor's factorization algorithm – Computational advantages of quantum systems

MODULE - VI QUANTUM CHANNELS AND CRYPTOGRAPHY 7

Quantum channels and noise – Channel capacity – Holevo bound – Quantum error correction codes – Schumacher compression – Quantum cryptography (BB84, B92, EPR-based protocols)

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press.

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 29/04/26

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2. Wilde, M. M. (2017). Quantum Information Theory (2nd Edition). Cambridge University Press.
3. Rieffel, E. G., & Polak, W. H. (2011). Quantum Computing: A Gentle Introduction. MIT Press.

REFERENCE BOOK:

1. Preskill, J. (1998). Lecture Notes on Quantum Computation. California Institute of Technology.
2. Schumacher, B., & Westmoreland, M. D. (2010). Quantum Processes, Systems and Information. Cambridge University Press.

WEB RESOURCES:

1. IBM Quantum Learning – https://quantum.ibm.com
2. Qiskit Documentation – https://qiskit.org
3. Microsoft Quantum (Q#) – https://learn.microsoft.com/quantum
4. Quantum Country – https://quantum.country

NPTEL COURSE LINK:

1. NPTEL – Quantum Computation and Quantum Information https://onlinecourses.nptel.ac.in/noc26_ph02/preview
2. NPTEL – Quantum Information and Computing (IIT Madras) https://nptel.ac.in
3. NPTEL–QuantumComputation (IIT Kanpur) https://nptel.ac.in

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamental concepts of quantum information and quantum mechanics to represent quantum states. (K3)
2. Implement quantum gates and circuits for processing quantum information. (K3)
3. Utilize quantum measurement techniques and entanglement in information processing tasks. (K3)
4. Apply quantum communication protocols and information-theoretic measures in secure communication. (K3)
5. Illustrate quantum algorithms to solve computational problems efficiently. (K3)
6. Build solutions using quantum channels, error correction, and cryptographic techniques. (K3)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	–	–	–	–	–	2	2
CO2	3	3	–	–	–	–	–	2	–	–	–	–	1	2
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	–	1	–	–	–	2	3
CO5	2	2	–	–	–	–	–	–	–	2	–	–	1	2
CO6	2	2	–	–	–	–	–	–	–	–	–	–	2	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL504	APPLIED FINTECH FOR BUSINESS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24SCPC402					

OBJECTIVES:

- Introduce the BFSI ecosystem and examine the transformative role of FinTech in modern financial services.
- Understand the core functions, technologies, and applications of FinTech in banking, payments, lending, investments, and insurance.
- Explore FinTech architecture, platforms, emerging technologies, and industry trends.
- Analyze FinTech business models, startup ecosystems, and practical use cases across industries.
- Examine the role of Artificial Intelligence and Machine Learning in enhancing business and financial decision-making.
- Understand cloud computing architectures, APIs, and digital platforms that enable scalable FinTech solutions.

MODULE - I INTRODUCTION TO BFSI 8

BFSI Value chain - How FinTech changed BFSI Modern Banking Landscape - Introduction to Bank Tech - Introduction to Insure Tech

Recommended in Board of Studies (BoS) Meeting No. 02 held on 09/04/26

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MODULE - II CORE FUNCTIONS AND APPLICATIONS OF FINTECH **8**

Functions of Fintech- Digital Payments and Money Transfer- Online Banking and Neobanking- Automated Lending and Borrowing- Investment Management and Robo-Advisors- Insurance Tech- Financial Planning and Budgeting Tools

MODULE - III FINTECH PRIMER **8**

Introduction to the Fintech landscape - FinTech Architecture FinTech Technologies- Latest Trends and future of FinTech

MODULE - IV APPLICATIONS OF FINTECH **7**

Applications of FinTech Use cases of FinTech in banks- Fintech startups Fintech unicorns and business models.

MODULE - V MACHINE LEARNING & AI **7**

Introduction to Machine Learning - ML Algorithms and applications AI and applications AI/ML –changing business landscape AI/ML –in practice Use cases and applications.

MODULE - VI TECHNOLOGIES AND PLATFORMS FOR CLOUD COMPUTING **7**

Introduction to Cloud Computing - Cloud Computing Architecture Technologies for Cloud - Building Robust, Secure & Scalable APIs API Economy, Open APIs & Connected Businesses Use case.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Chandan Sengupta. FinTech: Foundations and Applications, Wiley Publications.
2. Susanne Chishti & Janos Barberis. The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications.
3. Thomas Erl, Ricardo Puttini & Zaigham Mahmood. Cloud Computing: Concepts, Technology & Architecture, Pearson.

REFERENCE BOOKS

1. FinTech Foundations and Applications by Chandan Sengupta FinTech fundamentals, digital banking, AI, blockchain, and financial technologies.
2. Cloud Computing by Dr. Kumar Saurabh and Dr. Rakesh Kumar cloud architecture, virtualization, APIs, and cloud platforms.

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3. Artificial Intelligence by S. Kaushik Covers AI concepts, machine learning, intelligent systems, and business applications.
4. The FINTECH Book by Susanne Chishti and Janos Barberis FinTech ecosystem, digital payments, and InsurTech.
5. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig Standard international textbook for AI and machine learning concepts.
6. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl cloud computing architecture, scalable systems, APIs, and enterprise cloud technologies.

WEB RESOURCES:

1. edX – University-level courses on AI, FinTech, banking, and cloud technologies.
2. Oracle Cloud Infrastructure – Cloud computing architecture and enterprise cloud solutions.
3. AWS Training and Certification – Cloud computing, API management, and scalable system resources.
4. Google Cloud Learning – Cloud technologies, AI/ML, and API development resources.
5. ISACA – Governance, risk, compliance, and financial technology security resources.
6. IBM AI and Machine Learning Resources – AI and machine learning applications in business and finance.

ONLINE RESOURCES

1. NPTEL – Courses on Financial Technologies, Artificial Intelligence, Machine Learning, and Cloud Computing.
2. Coursera – FinTech, Digital Transformation, AI, and Cloud certifications.
3. Google Cloud Skills Boost – AI/ML, cloud services, and API development.
4. Investopedia – FinTech, digital banking, investment technologies, and business finance concepts.
5. World Economic Forum FinTech Insights – Global FinTech trends and innovation reports.

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the BFSI value chain and assess the impact of FinTech innovations on banking, insurance, and financial services. (K2)

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2. Analyze core FinTech functions including digital payments, neobanking, lending platforms, investment management systems, and InsurTech solutions. (K4)
3. Evaluate FinTech architectures, enabling technologies, and emerging trends shaping the future of digital financial ecosystems. (K5)
4. Examine real-world FinTech applications, startup ecosystems, unicorn business models, and technology-driven financial services. (K4)
5. Apply Artificial Intelligence and Machine Learning techniques to solve business and financial challenges using intelligent systems. (K3)
6. Analyze cloud computing architectures, API-driven platforms, and connected business ecosystems for developing scalable FinTech solutions. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	--	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL505	PAYMENTS, CRYPTO-CURRENCIES & ALTERNATIVE FINANCE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24SCPC401					

OBJECTIVES:

- Introduce the concepts of cryptocurrencies, digital assets, token economies, and emerging digital finance ecosystems.
- Examine digital wallets, ICOs, tokenization frameworks, and global cryptocurrency regulations.

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- Understand payment architectures, payment gateways, and the global digital payment ecosystem.
- Analyze blockchain-enabled payment technologies and innovations in consumer and retail payments.
- Explore peer-to-peer lending, crowdfunding technologies, and alternative finance platforms.
- Evaluate business models, risk management strategies, and future opportunities in alternative finance and FinTech ecosystems.

MODULE - I INTRODUCTION TO CRYPTO-CURRENCIES AND DIGITAL FINANCE **8**

Crypto currencies Primer -Evolution of Digital Finance -Bit coin and Applications -Types of Crypto currencies -Crypto currencies and Applications -Digital Assets and Token Economy

MODULE - II DIGITAL WALLETS, ICOS AND CRYPTO REGULATIONS **8**

Crypto currencies and Digital Crypto Wallets - What is an ICO? - Importance of ICO in Alternative Finance -Tokenization Concepts -Regulations for Cryptos and Tokens -Global Trends in Crypto Regulation.

MODULE - III PAYMENT ARCHITECTURE AND GLOBAL PAYMENT ECOSYSTEM **7**

Global Payment Ecosystem -Payments Architecture and Setup -Payment Gateways and Payment Processing -Innovation in Consumer and Retail Payments -Digital Banking and FinTech -Payments -Cross-border Payment Systems.

MODULE - IV PAYMENT TECHNOLOGIES AND FINANCIAL INNOVATION **8**

Popular Payments Technology -Blockchain and Crypto currencies in Payments -Payment Stacks in India -Mobile-based Payment Ecosystem -Credit Card and POS-based Ecosystem - B2B & B2B2C Payment Solutions.

MODULE - V P2P LENDING AND CROWD FUNDING TECHNOLOGIES **7**

Concept of P2P Lending -P2P and Marketplace Lending -P2P Infrastructure and Technologies-Concept of Crowd funding –Crowd funding Architecture and Technology-FinTech Platforms for Alternative Finance.

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MODULE - VI ALTERNATIVE FINANCE BUSINESS MODELS AND EMERGING OPPORTUNITIES 7

P2P and Crowd funding Unicorns and Business Models -SME/MSME Lending Opportunities and Challenges -Financial Inclusion through Alternative Finance -Risk Management in Digital-Lending -Innovative Solutions in Lending Technologies -Future Trends in Alternative Finance and FinTech Ecosystems.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sengupta, Chandan. FinTech: Foundations and Applications, Wiley Publications.
2. Antonopoulos, Andreas M. Mastering Bitcoin: Programming the Open Blockchain, O'Reilly Media.
3. Chishti, Susanne & Barberis, Janos. The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications.

REFERENCE BOOKS:

1. FinTech Foundations and Applications by Chandan Sengupta digital payments, crypto currencies, alternative finance, P2P lending, and crowd funding.
2. Blockchain Technology and Cryptocurrency by S. Shanmuga Priya and K. Mala blockchain payments, cryptocurrencies, digital wallets, ICOs, and payment systems.
3. Digital Banking and FinTech by Indian Institute of Banking and Finance (IIBF) Focuses on digital payments, payment ecosystems, mobile banking, and financial innovation
4. Mastering Bit coin by Andreas M. Antonopoulos Comprehensive guide on Bit coin, crypto currencies, wallets, blockchain, and digital finance.
5. The FINTECH Book by Susanne Chishti and Janos Barberis Covers FinTech innovation, digital payments, alternative finance, crowd funding, and financial ecosystems.
6. Peer-to-Peer lending and Crowd funding by Kim Wales Discusses P2P lending infrastructure, crowd funding technologies, and alternative finance models.

WEB RESOURCES:

1. NPTEL – Courses on blockchain, FinTech, digital payments, and crypto currencies.

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2. Coursera – Online courses on crypto currencies, blockchain, crowd funding, and digital banking. Ethereum Documentation – Smart contracts, blockchain payments, wallets, and decentralized applications.
3. Coin Desk Learn – Learning resources on crypto currencies, ICOs, blockchain payments, and regulations.
4. Reserve Bank of India (RBI) – Indian payment systems, digital payment regulations, and fintech policies.
5. NPCI – National Payments Corporation of India – UPI, digital payment infrastructure, and payment stacks, and retail payment innovations.

ONLINE RESOURCES:

1. CoinDesk Learn – Cryptocurrency, blockchain, digital assets, and crypto regulations.
2. Ethereum Documentation – Smart contracts, blockchain architecture, wallets, and decentralized applications.
3. Investopedia – Tutorials on payments, cryptocurrencies, ICOs, and alternative finance.
4. World Economic Forum FinTech Hub – Global fintech trends and digital finance insights.
5. World Bank Financial Inclusion Resources – Financial inclusion and digital finance initiatives.

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the concepts of cryptocurrencies, digital assets, token economies, and their role in modern digital finance ecosystems.(K2)
2. Analyze cryptocurrency wallets, ICO mechanisms, tokenization frameworks, and regulatory challenges associated with digital assets.(K4)
3. Evaluate payment architectures, payment gateways, digital banking systems, and global payment ecosystems.(K4)
4. Apply blockchain technologies and innovative payment solutions to understand consumer, retail, and cross-border payment systems.(K3)
5. Assess peer-to-peer lending, crowdfunding platforms, and technology-driven alternative finance models.(K5)
6. Examine business models, financial inclusion initiatives, risk management practices, and future trends in alternative finance and FinTech ecosystems.(K5)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24SCEL506	BLOCKCHAIN FOR FINTECH & APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24SCPC401					

OBJECTIVES:

- Introduce blockchain technology, distributed ledger infrastructure, and consensus mechanisms.
- Explain cryptographic techniques and their applications in blockchain networks.
- Develop an understanding of smart contracts and decentralized application architectures.
- Explore enterprise blockchain platforms such as Ethereum and Hyperledger.
- Analyze practical blockchain implementations and FinTech applications across industries.
- Examine regulatory, security, compliance, and emerging digital asset ecosystems in blockchain environments.

MODULE - I BLOCKCHAIN TECHNOLOGY AND INFRASTRUCTURE 8

Block chain Foundations - Blocks and Block chain, the Chain, Nodes and Network - Block chain in Use - Trust Framework and Consensus Mechanisms, Public, Consortium, Private Block chains, Block chain Interoperability

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MODULE - II BLOCKCHAIN AND CRYPTOGRAPHY 7

Cryptography - Application to Block chain - Hash Functions - Public Key Cryptography and signing - Use cases and applications

MODULE - III SMART CONTRACTS 7

Understand smart contracts - Computational model of Smart contracts - Ethereal and Working with Smart Contracts.

MODULE - IV LEDGER ARCHITECTURE 7

Hyper ledger Architecture - Hyper ledger Block chain Technology - Use cases of Smart contracts

MODULE V APPLICATIONS OF BLOCKCHAIN ARCHITECTURE 8

Setting up a Private Block chain Environment - Block chain and Bit coin - Example Block chain Networks and Use Cases - Practical Block chain Architecture and use-cases

MODULE - VI REGULATORY LANDSCAPE & SECURITY 8

Global Regulatory Trends for Digital Assets - Risks and Security in Blockchains: Ransom ware, Money Laundering, and Smart Contract Vulnerabilities - KYC/AML Compliance on Blockchain - Central Bank Digital Currencies (CBDCs)

TOTAL : 45 PERIODS

TEXT BOOKS

1. Imran Bashir. Mastering Blockchain, Packt Publishing.
2. Chandramouli Subramanian, Asha A. George, and Abhillash K. A. Blockchain Technology, Universities Press.
3. Chris Dannen. Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming, Apress.

REFERENCE BOOKS:

1. Blockchain Technology by Chandramouli Subramanian, Asha A. George, and Abhillash K. A Covers blockchain foundations, cryptography, smart contracts, and applications.
2. Blockchain Technology and Applications by S. Shanmuga Priya and K. Mala blockchain architecture, Hyperledger, Ethereum, and use cases.
3. Blockchain for Beginners by Tiana Laurence (Indian Edition – McGraw Hill India) Introductory reference on blockchain infrastructure, cryptocurrency, and digital assets.

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4. Mastering Blockchain by Imran Bashir Comprehensive coverage of blockchain architecture, smart contracts, Hyperledger, and security.
5. Blockchain Basics by Daniel Drescher Covers blockchain concepts, consensus mechanisms, and cryptographic foundations.
6. Introducing Ethereum and Solidity by Chris Dannen Focuses on Ethereum, smart contracts, Solidity programming, and decentralized applications.

WEB RESOURCES

1. IBM Blockchain Platform – Blockchain infrastructure, enterprise use cases, and security practices.
2. NPTEL – Online courses on blockchain technology, cryptography, and distributed systems.
3. Coursera – Courses on blockchain, cryptocurrency, smart contracts, and digital finance. Coin Desk Learning Center – Articles and tutorials on blockchain, cryptocurrency, CBDCs, and regulatory trends.

ONLINE RESOURCES:

1. CoinDesk Learn – Blockchain, cryptocurrency, CBDCs, and regulatory developments.
2. World Economic Forum Blockchain Hub – Global blockchain adoption and policy initiatives.
3. Reserve Bank of India (RBI) – CBDC initiatives and digital financial ecosystem regulations.
4. National Institute of Standards and Technology (NIST) Blockchain Resources – Blockchain standards, security frameworks, and best practices.

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain blockchain fundamentals, distributed ledger architectures, consensus mechanisms, and various blockchain network models. (K2)
2. Apply cryptographic principles including hashing, digital signatures, and public key cryptography to secure blockchain systems. (K3)
3. Analyze the architecture, execution models, and applications of smart contracts in decentralized environments. (K4)
4. Evaluate enterprise blockchain frameworks such as Ethereum and Hyperledger for developing blockchain-based solutions. (K5)
5. Design and assess blockchain-based applications for FinTech and other industry use cases using practical blockchain architectures. (K5)

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6. Examine blockchain security challenges, regulatory frameworks, KYC/AML compliance requirements, and emerging digital asset ecosystems including CBDCs. (K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL504	BUSINESS INTELLIGENCE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106101224	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- Understand the fundamentals, concepts, and architecture of Business Intelligence systems.
- Apply data analysis, visualization, and reporting techniques for business decision-making.
- Analyze business data using statistical and analytical tools.
- Develop dashboards, KPIs, and performance monitoring systems for organizations.
- Explore predictive analytics and intelligent business applications using BI tools.
- Apply Business Intelligence techniques to solve real-world business and industrial problems.

MODULE - I INTRODUCTION TO BUSINESS INTELLIGENCE 7

Introduction to Business Intelligence – Evolution and Importance of BI – BI Architecture and Components – Data, Information, and Knowledge – Business Analytics and Decision Support Systems – BI Process and Framework – Applications of BI in Finance, Marketing, Healthcare, Retail, Manufacturing, and Education – BI Tools and Technologies – Ethics, Privacy, and Security Issues in Business Intelligence.

MODULE - II DATA WAREHOUSING AND DATA MANAGEMENT 7

Data Warehousing Concepts – Data Sources and Data Integration – ETL (Extract, Transform, Load) Process – Data Cleaning and Data Preprocessing – Data Marts and Metadata – OLTP and OLAP Systems – Multidimensional Data Models – Star Schema and Snowflake Schema – Big Data Concepts in BI – Data Governance and Quality Management.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 9/04/26

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Artificial Intelligence and Data Science

MODULE - III DATA ANALYTICS AND STATISTICAL TECHNIQUES 8

Introduction to Data Analytics – Descriptive, Predictive, and Prescriptive Analytics – Statistical Analysis for BI – Correlation and Regression Analysis – Classification and Clustering Techniques – Forecasting and Trend Analysis – Association Rule Mining – Text Analytics and Sentiment Analysis – Business Metrics and KPI Analysis – Data-driven Decision Making.

MODULE - IV DATA VISUALIZATION AND DASHBOARD DESIGN 8

Importance of Data Visualization – Principles of Effective Visualization – Types of Charts and Graphs – Interactive Dashboards – Dashboard Design Process – KPI Dashboards and Executive Dashboards – Storytelling with Data – Visualization Tools: Power BI, Tableau, Google Data Studio – Designing Reports and Infographics – Common Visualization and Dashboard Design Pitfalls.

MODULE - V BUSINESS INTELLIGENCE TOOLS AND APPLICATIONS 8

Business Intelligence Tools Overview – Microsoft Power BI – Tableau – Excel for Business Analytics – Creating Reports and Dashboards – Data Modeling using BI Tools – Real-time Business Monitoring – Cloud-based BI Systems – Mobile BI Applications – BI for Customer Relationship Management (CRM) and Supply Chain Management (SCM) – Case Studies in Business Intelligence Applications.

MODULE - VI EMERGING TRENDS IN BUSINESS INTELLIGENCE 7

Artificial Intelligence and Machine Learning in BI – Predictive Analytics and Forecasting – Self-service BI – IoT and Real-time Analytics – Data Mining Techniques – Natural Language Processing in BI – Intelligent Decision Support Systems – Blockchain and BI – Cybersecurity Analytics – Future Trends and Challenges in Business Intelligence Systems.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Efraim Turban, Ramesh Sharda, and Dursun Delen, "Decision Support and Business Intelligence Systems", Pearson Education, 10th Edition, 2017.
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", Morgan Kaufmann Publishers, 2nd Edition, 2012.
3. Cindi Howson, "Successful Business Intelligence: Unlock the Value of BI and Big Data", McGraw Hill Education.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/26

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Board of Studies
Artificial Intelligence and Data

REFERENCES:

1. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit", Wiley Publications.
2. Larissa T. Moss and Shaku Atre, "Business Intelligence Roadmap", Addison Wesley.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications.
4. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.
5. Wayne Winston, "Microsoft Excel Data Analysis and Business Modeling", Microsoft Press.

WEB REFERENCES:

1. Microsoft Power BI Documentation: https://learn.microsoft.com/power-bi/
2. Tableau Learning Resources: https://www.tableau.com/learn
3. IBM Business Analytics Resources: https://www.ibm.com/analytics

ONLINE RESOURCES:

1. Coursera – Business Intelligence Courses: https://www.coursera.org/
2. Google Looker Studio Documentation: https://support.google.com/looker-studio
3. NPTEL–Business Intelligence and Analytics Courses: https://nptel.ac.in/courses/110105089

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply Business Intelligence concepts, architectures, frameworks, and decision support systems to address business problems in diverse domains. (K3)
2. Analyze data warehousing architectures, ETL processes, multidimensional data models, and data management techniques for effective business intelligence solutions (K4)
3. Apply statistical and analytical techniques such as regression, classification, clustering, forecasting, and KPI analysis for data-driven decision making. (K3)
4. Analyze and design effective visualizations, dashboards, and reports using BI principles and modern visualization tools. (K4)

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5. Develop business intelligence solutions using contemporary BI tools such as Power BI, Tableau, and Excel for real-time monitoring and business analytics. (K3)
6. Analyze the impact of emerging technologies such as AI, Machine Learning, IoT, NLP, Blockchain, and cybersecurity analytics in next-generation business intelligence systems. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	2	3	-	-	-	-	-	-	-	–	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	2	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3		-	-	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL505	MACHINE LEARNING ESSENTIALS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106139	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24SCPC402					

OBJECTIVES:

- Understand the fundamental concepts, techniques, and applications of Machine Learning.
- Apply data preprocessing and feature engineering techniques for machine learning models.
- Analyze supervised and unsupervised learning algorithms for predictive analytics.
- Implement machine learning models using appropriate tools and frameworks.

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- Evaluate and optimize machine learning models using performance metrics.
- Apply machine learning techniques to solve real-world intelligent system problems.

MODULE - I INTRODUCTION TO MACHINE LEARNING 7

Introduction to Artificial Intelligence and Machine Learning – Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning – Applications of Machine Learning – Machine Learning Workflow – Data Collection and Preparation – Training, Validation, and Testing Datasets – Introduction to Python Libraries for Machine Learning – Introduction to Scikit-learn – Challenges and Limitations of Machine Learning – Ethical Issues in Machine Learning.

MODULE - II DATA PREPROCESSING AND FEATURE ENGINEERING 8

Data Cleaning and Data Integration – Handling Missing Values and Outliers – Data Transformation Techniques – Feature Scaling: Normalization and Standardization – Feature Selection Methods – Dimensionality Reduction Techniques – Principal Component Analysis (PCA) – Encoding Categorical Variables – Data Visualization for Machine Learning – Introduction to Exploratory Data Analysis (EDA).

MODULE - III SUPERVISED LEARNING ALGORITHMS 7

Introduction to Supervised Learning – Regression and Classification Concepts – Linear Regression – Logistic Regression – Decision Trees – Random Forest – Support Vector Machines – K-Nearest Neighbor Algorithm – Naive Bayes Classification – Model Training and Testing – Bias and Variance – Overfitting and Underfitting – Cross Validation Techniques – Performance Metrics: Accuracy, Precision, Recall, F1-Score, ROC Curve.

MODULE - IV UNSUPERVISED LEARNING AND CLUSTERING TECHNIQUES 8

Introduction to Unsupervised Learning – Clustering Concepts and Applications – K-Means Clustering – Hierarchical Clustering – Density-based Clustering – Association Rule Mining – Market Basket Analysis – Dimensionality Reduction for Visualization – Anomaly Detection – Recommendation Systems – Applications of Unsupervised Learning in Business and Industry.

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MODULE - V NEURAL NETWORKS AND DEEP LEARNING FUNDAMENTALS **8**

Introduction to Artificial Neural Networks – Biological Inspiration of Neural Networks – Structure of Neurons and Layers – Activation Functions – Feed forward Neural Networks – Back propagation Algorithm – Deep Learning Concepts – Convolutional Neural Networks (CNN) – Recurrent Neural Networks (RNN) – Introduction to Tensor Flow and Keras – Applications of Deep Learning in Image Processing, Speech Recognition, and Natural Language Processing.

MODULE - VI MACHINE LEARNING APPLICATIONS AND EMERGING TRENDS **7**

Machine Learning for Predictive Analytics – Natural Language Processing Basics – Computer Vision Applications – Time Series Forecasting – Reinforcement Learning Fundamentals – Explainable AI and Responsible AI – Edge AI and IoT Applications – Machine Learning in Healthcare, Finance, Smart Manufacturing, and Cyber security – Model Deployment Concepts – Future Trends in Machine Learning and Intelligent Systems.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, International Edition.
2. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, 1st Edition, 2016.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 3rd Edition, 2022.

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press.
4. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning", Springer.
5. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", Packt Publishing.

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WEB REFERENCES:

1. Scikit-learn Official Documentation: https://scikit-learn.org/stable/
2. TensorFlow Official Documentation: https://www.tensorflow.org/
3. Keras Documentation: https://keras.io/

ONLINE RESOURCES:

1. Google Machine Learning Crash Course: https://developers.google.com/machine-learning/crash-course
2. Coursera – Machine Learning by Andrew Ng: https://www.coursera.org/learn/machine-learning
3. Kaggle Learn – Machine Learning Courses: https://www.kaggle.com/learn

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply machine learning concepts, workflows, data preparation techniques, and Python-based tools to develop basic machine learning solutions for real-world problems. (K3)
2. Analyze and preprocess datasets using data cleaning, feature engineering, dimensionality reduction, and exploratory data analysis techniques to improve model performance. (K4)
3. Apply supervised learning algorithms such as regression, classification, decision trees, random forests, and support vector machines for predictive modeling tasks. (K3)
4. Analyze unsupervised learning techniques including clustering, association rule mining, anomaly detection, and recommendation systems for pattern discovery and knowledge extraction. (K4)
5. Apply neural network architectures and deep learning frameworks to develop solutions for image, speech, and natural language processing applications. (K3)
6. Analyze emerging machine learning technologies, responsible AI practices, and domain-specific applications to address complex challenges in intelligent systems. (K4)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	-	-	2	3
CO6	2	3	-	-	-	-	-	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL506	DECISION SUPPORT SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110105147	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- Understand the fundamentals, concepts, and applications of Decision Support Systems (DSS).
- Analyze organizational decision-making processes and the role of DSS in improving business performance.
- Apply data management, model management, and knowledge-based techniques in DSS design.
- Develop skills in data analysis, visualization, and reporting for managerial decision-making.
- Explore intelligent and group decision support systems using modern analytical tools.
- Apply DSS concepts to real-world business, healthcare, industrial, and strategic decision-making scenarios.

MODULE - I INTRODUCTION TO DECISION SUPPORT SYSTEMS 7

Introduction to Decision Making – Types of Decisions: Structured, Semi-structured, and Unstructured Decisions – Characteristics and Components of

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Decision Support Systems – Evolution and Importance of DSS – DSS Architecture and Framework – Role of DSS in Organizations – Types of DSS: Data-driven DSS, Model-driven DSS, Knowledge-driven DSS, Document-driven DSS, Communication-driven DSS – Decision-making Process and Simon's Model – Benefits and Limitations of DSS – Applications of DSS in Business and Industry.

MODULE - II DATA MANAGEMENT FOR DECISION SUPPORT 8

Data and Information for DSS – Database Concepts and Data Warehousing – Data Collection and Integration – Data Cleaning and Preprocessing – Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP) – Data Marts and Metadata – Introduction to Big Data in DSS – Data Visualization and Reporting Techniques – Business Intelligence Tools and Dashboards – Data Security and Privacy Issues in DSS.

MODULE - III MODEL MANAGEMENT AND ANALYTICAL TECHNIQUES 7

Introduction to Model Management Systems – Types of Models used in DSS – Mathematical and Statistical Models - Optimization Models – Forecasting and Predictive Models – Simulation Techniques – What-if Analysis, Goal Seeking, Sensitivity Analysis – Decision Trees and Risk Analysis – Linear Programming and Multi-Criteria Decision Making – Spreadsheet-based DSS Models – Analytical Tools for Business Decision Support.

MODULE - IV KNOWLEDGE-BASED AND INTELLIGENT DECISION SUPPORT SYSTEMS 8

Knowledge Management Concepts – Knowledge-based DSS – Expert Systems and Rule-based Systems – Artificial Intelligence in DSS – Machine Learning Applications in Decision Support – Fuzzy Logic and Neural Networks – Intelligent Agents and Recommender Systems – Natural Language Processing for DSS – Case-based Reasoning – Integration of AI and DSS for Intelligent Decision Making – Applications in Healthcare, Finance, and Smart Systems.

MODULE - V GROUP DECISION SUPPORT SYSTEMS AND BUSINESS APPLICATIONS 8

Group Decision Making Concepts – Group Decision Support Systems (GDSS) – Collaboration and Communication Technologies – Electronic Meeting Systems – Conflict Resolution and Negotiation Support – Enterprise Decision Support Systems – Customer Relationship Management (CRM) and Supply Chain Decision Support – DSS in E-commerce and Digital Business – Mobile and Web-based DSS – Cloud-based Decision Support Applications – Ethical and Social Issues in DSS.

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MODULE - VI EMERGING TRENDS AND APPLICATIONS IN DECISION SUPPORT SYSTEMS **7**

Business Analytics and Predictive Analytics – Real-time Decision Support Systems – Internet of Things (IoT) and DSS – Decision Support using Big Data Analytics – Data Mining Techniques for DSS – Geographic Information Systems (GIS) in DSS – Blockchain Applications in Decision Support – Cyber security and Risk Management DSS – DSS for Sustainable Development and Smart Cities – Future Trends in Intelligent Decision Support Systems.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Efraim Turban, Ramesh Sharda, and Dursun Delen, "Decision Support and Business Intelligence Systems", Pearson Education, 10th Edition, 2017.
2. Marakas George M., "Decision Support Systems in the Twenty-First Century", Prentice Hall, 2nd Edition, 2003.
3. Power D.J., "Decision Support, Analytics, and Business Intelligence", Business Expert Press, 2019.

REFERENCES:

1. Daniel J. Power, "Decision Support Systems: Concepts and Resources for Managers", Greenwood Publishing.
2. Ralph H. Sprague and Hugh J. Watson, "Decision Support Systems: Putting Theory into Practice", Prentice Hall.
3. Sauter Vicki L., "Decision Support Systems for Business Intelligence", Wiley Publications.
4. James O'Brien and George Marakas, "Management Information Systems", McGraw Hill Education.
5. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.

WEB REFERENCES:

1. Decision Support Systems Journal – Elsevier: https://www.journals.elsevier.com/decision-support-systems
2. IBM Business Analytics Resources: https://www.ibm.com/analytics
3. Microsoft Power BI Documentation: https://learn.microsoft.com/power-bi/

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ONLINE RESOURCES:

1. Tableau Learning Resources: https://www.tableau.com/learn
2. Coursera – Business Intelligence and Decision Support Courses: https://www.coursera.org/
3. Google Cloud Decision Intelligence Resources: https://cloud.google.com /solutions

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts, architecture, frameworks, and decision-making models of Decision Support Systems to solve organizational decision problems. (K3)
2. Analyze data management techniques, data warehousing, OLTP/OLAP systems, and business intelligence tools for effective decision support. (K4)
3. Apply analytical, statistical, optimization, forecasting, and simulation models to support business decision-making processes. (K3)
4. Analyze the role of knowledge-based systems, artificial intelligence, machine learning, and intelligent agents in enhancing decision support capabilities. (K4)
5. Apply Group Decision Support Systems (GDSS), enterprise decision support applications, and cloud-based DSS solutions for collaborative decision making. (K3)
6. Analyze emerging trends such as Big Data Analytics, IoT, GIS, Blockchain, Cybersecurity, and Sustainable DSS for intelligent and strategic decision support. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	-	-	2	3
CO6	2	3		-	-	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24CSEL511	USABILITY DESIGN OF SOFTWARE APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 9, 10				
PRE-REQUISITE COURSES	24SCPC403					

OBJECTIVES:

- To understand the fundamentals of User-Centered Design (UCD) and usability principles.
- To learn human-computer interaction concepts and user behavior.
- To apply usability engineering and evaluation techniques.
- To analyze user requirements using UX research methods.
- To design and develop user-friendly software interfaces.

MODULE - I INTRODUCTION TO USER-CENTERED DESIGN 7

Basics of UCD – Elements - Models and approaches - Usability concepts - UCD principles - UCD lifecycle - Agile integration.

MODULE - II HUMAN FACTORS AND INTERACTION DESIGN 8

Human perception - Cognition, Memory - Attention - User behavior - Interaction styles – accessibility - Inclusive design.

MODULE - III UX RESEARCH AND REQUIREMENT ANALYSIS 8

User analysis - Context of use - Personas - Scenarios - Essential use cases - Contextual enquiry - Interviews - Competitive analysis.

MODULE - IV INTERFACE DESIGN AND PROTOTYPING 7

Design thinking - Layout design - Navigation design - Wireframing - Prototyping (paper & digital) - Tools and techniques.

MODULE - V USABILITY EVALUATION TECHNIQUES 7

Evaluation methods - Heuristic evaluation (10 principles) - Cognitive walkthrough - Usability metrics - Case studies.

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MODULE - VI APPLICATION DEVELOPMENT AND ITERATIVE DESIGN 8

Design life cycle: requirements - Design - Prototyping - Construction - Iteration - Feedback – Real-world case studies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 3rd Edition, Wiley, 2011.
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Pearson, 2021.

REFERENCE BOOKS

1. Alan Cooper, Robert Reimann, David Cronin, About Face: The Essentials of Interaction Design, Wiley, 2007.
2. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, Observing the User Experience: A Practitioner's Guide to User Research, 2nd Edition, 2012.
3. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2nd Edition, 2010.

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_de03/preview
2. https://www.interaction-design.org
3. https://www.nngroup.com/articles/

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply user-centered design principles to evaluate usability of software applications.K3
2. Utilize human-computer interaction concepts to design effective user interfaces.K3
3. Develop user requirements using UX research techniques such as personas and scenarios.K3
4. Build interface prototypes using appropriate design tools and methodologies.K3
5. Apply usability evaluation methods to assess and improve software interfaces.K3
6. Implement user-friendly software applications through iterative design and testing processes.K3

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3
CO5	2	3	3	-	-	-	-	-	-	-	-	2	2
CO6	3	3	3	-	-	-	-	-	-	-	-	2	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24CSEL509	WEB DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105084	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24SCPC302					

OBJECTIVES:

- To understand the fundamentals of Internet technologies, web communication, and web architecture.
- To develop web pages using XHTML, XML, and Cascading Style Sheets for structured and styled web design.
- To Apply JavaScript programming concepts to create interactive and dynamic client-side web applications.
- To implement objects, arrays, and built-in JavaScript features for developing efficient web-based solutions.

MODULE - I WEB ESSENTIALS: CLIENTS, SERVERS, AND COMMUNICATION 7

Basic Web Essentials- Client Server Architecture- Basic Internet Protocols-The World Wide Web-HTTP Request Message-HTTP Response Message-Web Clients-Web Servers

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MODULE - II MARKUP LANGUAGES: XHTML 1.0 **8**

HTML's History and Versions-Basic XHTML Syntax and Semantics -Document Type Declaration -Attributes -HTML Elements-Headings-Spacing-Formatting Text Phrases-Horizontal Rule-Images-Links-Nesting Elements-Relative URLs-Lists-Tables-Frames-Forms

MODULE - III XML **8**

XHTML's SYNTAX - Element Type Declarations- Attribute List Declarations- Entity Declarations- DTD Files- Creating HTML Documents- XML Documents and Vocabularies- XML Versions and the XML Declaration- XML Namespaces- Transforming XML Documents

MODULE - IV STYLE SHEETS **7**

Introduction to Cascading Style Sheets -CSS Features - CSS Core Syntax- Style Sheets and HTML- Style Rule Cascading and Inheritance- Text Properties- CSS Box Model- Normal Flow Box Layout.

MODULE - V CLIENT-SIDE PROGRAMMING **7**

Introduction to JavaScript - Scripting Languages- Variables and Data Types- Statements- Operators- Literals- Functions.

MODULE - VI OBJECTS AND ARRAYS **8**

Objects- Object Properties- Enumerating Properties -Array Notation - Object References- Methods- Constructors- Arrays- Creating an Array- Array Methods- Built-in Objects- String, Number, and Boolean- Date- Math- RegExp- JavaScript Debuggers.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", 1st Edition, Pearson Education, 2015, ISBN: 9788131717158.
2. Chris Minnick & Eva Holland, HTML5 and CSS3 for the Real World, 3rd Edition, SitePoint, 2024.

REFERENCES:

1. Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, Updated Edition, Wiley, 2022.
2. Laura Lemay, Rafe Colburn & Jennifer Kyrnin, Sams Teach Yourself HTML, CSS & JavaScript All in One, 2nd Edition, Pearson, 2023.

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3. Elisabeth Robson & Eric Freeman, Head First JavaScript Programming, 2nd Edition, O'Reilly Media, 2024.

WEB REFERENCES:

1. https://developer.mozilla.org/en-US/docs/Learn
2. https://www.w3schools.com/html/
3. https://www.w3schools.com/css/
4. https://javascript.info/
5. https://www.freecodecamp.org/learn/2022/responsive-web-design/
6. https://www.w3.org/Style/CSS/Overview.en.html

ONLINE RESOURCES:

1. https://www.udemy.com/course/the-complete-web-development-bootcamp/
2. https://www.coursera.org/specializations/web-design
3. https://www.edx.org/learn/web-design
4. https://www.freecodecamp.org/learn/responsive-web-design/
5. https://www.codecademy.com/learn/paths/web-development
6. https://www.udacity.com/course/intro-to-html-and-css--ud0011

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts of Internet protocols, HTTP communication, web clients, and web servers in web-based applications.. (K3)
2. Develop web pages using XHTML elements, forms, tables, frames, images, links, and lists following standard web design principles.. (K3)
3. Construct XML documents using DTDs, namespaces, vocabularies, and XML transformation techniques. (K3)
4. Use Cascading Style Sheets (CSS) to design and format web pages with proper layout, inheritance, and styling features. (K3)
5. Implement JavaScript programs using variables, operators, statements, literals, and functions for client-side scripting. (K4)
6. Develop dynamic web applications using JavaScript objects, arrays, constructors, built-in objects, and debugging techniques. (K3)

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CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24CSEL510	MOBILE APPLICATION DEVELOPMENT	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24SCPC302					

OBJECTIVES:

- To facilitate students to understand android SDK
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile applications

MODULE - I MOBILE COMPUTING FUNDAMENTALS 7

Introduction to Mobile Computing — Evolution of Mobile Devices — Mobile Device Operating Systems — Special Constraints & Requirements — Modern Mobile Platforms and Ecosystem — Mobile Security and Privacy — Mobile Application Development Paradigms.

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MODULE - II MOBILE OPERATING SYSTEMS ARCHITECTURE 8

Mobile Operating Systems Architecture — Android Architecture — iOS Architecture — Android Runtime and Dalvik Virtual Machine — Android Software Stack — Android Libraries — Integration with Cloud Services and Backend APIs — Sensors and Location-Based Services.

MODULE - III INTRODUCTION TO ANDROID APPLICATION DEVELOPMENT 8

Introduction to Modern Android Platform — Android SDK and SDK Features — Android Application Architecture — Installing and Configuring Android Studio — Building First Android Application — Anatomy of Android Applications — Android Terminologies — Application Context and Application Lifecycle.

MODULE - IV ANDROID APPLICATION COMPONENTS 8

Activities — Services — Intents — Receiving and Broadcasting Intents — Android Manifest File and Common Settings — Intent Filters — Android Permissions and Security — Event Handling and User Interaction.

MODULE - V ANDROID USER INTERFACE AND MULTIMEDIA 7

User Interface Screen Elements — Designing User Interfaces with Layouts — Views and ViewGroups — Menus and Dialogs — Drawing and Working with Animation — Playing Audio and Video — Recording Audio and Video — Using Camera to Capture and Process Images.

MODULE - VI ANDROID DATA MANAGEMENT AND NETWORKING APIs 7

Using Android Data and Storage APIs — Managing Data using SQLite — Shared Preferences and File Handling — Content Providers and Sharing Data Between Applications — Android Networking APIs — Android Web APIs — Android Telephony APIs — Deploying Android Applications to the World.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jerome F. DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, Wiley India, 2020.

REFERENCES

1. Google Developer Training, "Android Developer Fundamentals Course - Concept Reference", Google Developer Training Team, 2017.

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2. Lauren Darcey and Shane Conder, Android Wireless Application Development Volume II: Advanced Topics, 3rd Edition, Addison-Wesley Professional, 2012
3. Prasanth Kumar Pattnaik,Rajib Mall,"Fundamentals of Mobile Computing",PHI Learning Pvt.Ltd,New Delhi-2012
4. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2009

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106156?utm_source=chatgpt.com
2. https://www.brainkart.com/subject/Mobile-Application-Development_909

ONLINE RESOURCES:

1. https://developer.android.com/studio/intro?utm_source=chatgpt.com
2. https://www.coursera.org/specializations/android-app-development

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamentals of mobile computing, mobile platforms, operating systems, security, and application development paradigms.K3
2. Implement, test, and debug Android applications by setting up the Android development environment.K3
3. Analyze, test, and debug Android applications by setting up the Android development environment.K4
4. Examine methods for storing, sharing, and retrieving data in Android applications.K4
5. Apply rapid prototyping techniques to design and develop sophisticated mobile interfaces.K3
6. Implement interactive Android applications using databases, multiple activities, audio, video, notifications, and deploy them in the marketplace.K3

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CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL507	INTRODUCTION TO QUANTUM PROGRAMMING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106232	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24BSMA201, 24BSMA306					

OBJECTIVES:

- Understand the fundamentals of quantum computing and its differences from classical computing.
- Explain qubits, superposition, and entanglement concepts.
- Apply quantum gates and circuits for basic computations.
- Use quantum programming frameworks for simple implementations.
- Analyze quantum algorithms and their applications.
- Interpret real-world use cases of quantum computing.

MODULE - I INTRODUCTION TO QUANTUM COMPUTING 7

Limitations of Classical Computing- Basics of Quantum Computing- History and Evolution- Quantum vs Classical Bits- Introduction to Qubits- Bloch Sphere Representation.

Recommended in Board of Studies (BoS) Meeting No. 02 held on 09/04/26

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MODULE - II QUANTUM MECHANICS FOUNDATIONS FOR COMPUTING **8**

Superposition -Entanglement- Measurement Postulates- Quantum States and Dirac Notation -Probability amplitudes -Basic linear algebra (vectors, matrices).

MODULE - III QUANTUM GATES AND CIRCUITS **7**

Single Qubit Gates (X, Y, Z, H) - Multi-Qubit Gates (CNOT, Toffoli)- Quantum Circuit Representation - Reversible Computation- Circuit design basics.

MODULE - IV QUANTUM PROGRAMMING FRAMEWORKS **7**

Introduction to Qiskit -Quantum circuit simulation- Writing basic quantum programs- Running circuits on simulators- Introduction to quantum hardware access.

MODULE - V QUANTUM ALGORITHMS **8**

Deutsch Algorithm -Deutsch-Jozsa Algorithm-Grover's Search Algorithm-Introduction to Shor's Algorithm- Algorithm complexity comparison.

MODULE - VI APPLICATIONS AND FUTURE OF QUANTUM COMPUTING **8**

Quantum Cryptography Fundamentals – BB84 Quantum Key Distribution Protocol: Photon Polarization, Key Generation and Eavesdropping Detection – Introduction to Quantum Machine Learning – Quantum Optimization Problems – Emerging Trends and Recent Advances in Quantum Technologies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nielsen, Michael A., & Chuang, Isaac L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press.
2. Yanofsky, Noson S., & Mannucci, Mirco A. (2008). Quantum Computing for Computer Scientists (1st Edition). Cambridge University Press.

REFERENCE BOOK:

1. Hidary, Jack D. (2019). Quantum Computing: An Applied Approach (1st Edition). Springer.
2. Rieffel, Eleanor G., & Polak, Wolfgang H. (2011). Quantum Computing: A Gentle Introduction (2nd Edition). MIT Press.

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WEB RESOURCES:

1. IBM Quantum Learning – https://quantum.ibm.com
2. Qiskit Documentation – https://qiskit.org
3. Microsoft Quantum (Q#) – https://learn.microsoft.com/quantum
4. Quantum Country – https://quantum.country
5. NIST Quantum Resources – https://www.nist.gov

NPTEL COURSE LINK:

1. NPTEL – Quantum Information and Computing (IIT Madras / IIT Kanpur) https://nptel.ac.in
2. NPTEL – Advanced Quantum Mechanics (Supportive) https://nptel.ac.in

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply basic quantum computing principles to differentiate classical and quantum systems. (K3)
2. Apply quantum mechanical concepts such as superposition and entanglement in problem-solving. (K3)
3. Construct quantum circuits using standard quantum gates. (K3)
4. Implement simple quantum programs using frameworks like Qiskit. (K3)
5. Apply quantum algorithms to solve basic computational problems. (K3)
6. Use quantum computing concepts in real-world applications and scenarios. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	1	–	–	–	–	2	3
CO2	3	–	–	–	2	–	–	–	–	–	–	–	2	3
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	1	–	–	–	–	1	3
CO5	3	–	–	–	2	–	–	–	–	–	–	–	2	3
CO6	2	–	–	–	1	–	–	1	–	–	–	–	1	2

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL506	QUANTUM ALGORITHMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106232	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24BSMA201, 24ITPC301, 24SCPC501					

OBJECTIVES:

- To apply the fundamental principles of quantum computation and algorithm design.
- To implement quantum circuit models and analyze computational complexity.
- To utilize quantum algorithms and evaluate their advantages over classical methods.
- To apply quantum search and optimization techniques in problem-solving scenarios.
- To employ quantum transform techniques such as Quantum Fourier Transform in applications.
- To build solutions using advanced quantum algorithms and analyze their real-world relevance.

MODULE - I ADVANCED QUANTUM COMPUTATIONAL FOUNDATIONS 7

Review of Quantum Circuit Models – Multi-Qubit Operations – Quantum Parallelism – Reversible Computation– Quantum Complexity Classes (P, NP, BQP) – Quantum Computational Advantage – Quantum Information Representation – Measurement Strategies.

MODULE - II QUANTUM ALGORITHM DESIGN TECHNIQUES 8

Oracle-Based Computing – Amplitude Amplification – Phase Kickback – Quantum Query Models – Quantum Walks (Introduction) – Algorithm Design Principles – Computational Speedup Analysis – Black-Box Algorithms – Quantum Decision Problems.

MODULE - III TRANSFORM-BASED QUANTUM ALGORITHMS 8

Quantum Fourier Transform (QFT) – Inverse QFT – Phase Estimation Algorithm – Period Finding – Hidden Subgroup Problem – Applications of QFT in Quantum Algorithms – Basis Transformation – Quantum State Preparation.

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MODULE - IV QUANTUM SEARCH AND OPTIMIZATION ALGORITHMS 7

Grover's Search Algorithm – Quantum Search Space Reduction – Quantum Approximate Optimization Algorithm (QAOA) – Variational Quantum Algorithms (VQA) – Hybrid Quantum–Classical Optimization – Quantum Annealing – Optimization Applications.

MODULE - V QUANTUM ALGORITHMS FOR MACHINE LEARNING AND SECURITY 8

Quantum Machine Learning Fundamentals – Quantum Classifiers – Quantum Kernel Methods – Quantum Algorithms for Cryptography – Post-Quantum Cryptography Concepts – Secure Quantum Communication Applications – Quantum Data Encoding – Quantum Feature Mapping.

MODULE - VI EMERGING QUANTUM ALGORITHMIC PARADIGMS 7

Hamiltonian Simulation – Quantum Sampling Techniques – NISQ-Era Algorithms–Noise and Decoherence in Algorithms – Scalability Challenges – Industrial Applications – Emerging Research Trends – Quantum Cloud Computing – Fault-Tolerant Quantum Computing.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition).
2. Kaye, P., Laflamme, R., & Mosca, M. (2006). An Introduction to Quantum Computing (1st Edition).
3. Rieffel, E. G., & Polak, W. H. (2011). Quantum Computing: A Gentle Introduction (1st Edition). MIT Press

REFERENCE BOOK:

1. Lipton, R. J., & Regan, K. W. (2021). Introduction to Quantum Algorithms via Linear Algebra(2ndEdition). MIT Press
2. Wilde, M. M. (2017). Quantum Information Theory (2nd Edition).Cambridge University Press. VI)
3. Preskill, J. (2015). Lecture Notes on Quantum Computation. California Institute of Technology.

WEB RESOURCES:

1. IBM Quantum Learning
2. Xanadu Quantum (PennyLane)

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3. Quantum Algorithm Zoo
4. Rigetti Forest SDK

NPTEL COURSE LINK:

1. NPTEL – Quantum Computation / Quantum Information Theory https://onlinecourses.nptel.ac.in/noc26_ph02/preview
2. NPTEL – Quantum Algorithms and Cryptography (IIT Madras) https://onlinecourses.nptel.ac.in/noc25_cs61/preview

OUTCOMES:

At the end of this course, the students should be able to:

1. Implement the fundamental concepts of quantum computation and circuit models. (K3)
2. Build quantum circuits and computational models for problem solving. (K3)
3. Apply fundamental quantum algorithms for computational tasks. (K3)
4. Execute quantum search and optimization techniques in relevant scenarios. (K3)
5. Employ Fourier-based quantum algorithms for practical applications. (K3)
6. Illustrate the use of advanced quantum algorithms in real-world contexts. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	–	–	–	–	–	2	2
CO2	3	–	–	–	–	–	–	1	–	–	–	–	2	2
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	1	1	–	–	–	2	3
CO5	3	–	–	–	–	–	–	–	–	2	–	–	1	2
CO6	2	–	–	–	–	–	–	–	–	–	–	–	2	3

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL509	QUANTUM–CLASSICAL SYSTEMS OF COMPUTING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 115106925	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24BSMA201, 24ITPC301					

OBJECTIVES:

- Understand the concept of hybrid quantum–classical computing.
- Explain the interaction between classical and quantum systems.
- Apply basic hybrid algorithms and workflows.
- Analyze optimization and machine learning in hybrid settings.
- Use hybrid frameworks for simple implementations.
- Evaluate practical applications and limitations of hybrid computing.

MODULE -I INTRODUCTION TO HYBRID COMPUTING PARADIGM 7

Classical vs Quantum vs Hybrid Computing -Need for Hybrid Systems (NISQ era concept)- Overview of Hybrid Architectures- Role of classical processors in quantum workflows- Real-world use cases (optimization, AI, cryptography)

MODULE -II BASIC COMPONENTS OF HYBRID SYSTEMS 8

Qubits and classical bits (interaction view)- Classical preprocessing and post-processing -Data encoding into quantum systems - Measurement and feedback loops- Hybrid computation cycle

MODULE -III HYBRID QUANTUM ALGORITHMS 7

Variational Quantum Algorithms (VQA – concept)- Variational Quantum Eigensolver (VQE – overview)- Quantum Approximate Optimization Algorithm (QAOA – intro)- Parameterized quantum circuits- Role of classical optimization

MODULE -IV HYBRID PROGRAMMING FRAMEWORKS 7

Introduction to Qiskit Runtime - Hybrid workflows in Python- Classical optimization libraries integration - Running hybrid circuits on simulators - Cloud-based quantum platforms

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MODULE–V QUANTUM HYBRID MACHINELEARNING & OPTIMIZATION 8

Quantum Machine Learning (hybrid approach) - Hybrid neural networks (basic idea)- Optimization problems using hybrid models- Data-driven quantum circuits- Performance comparison with classical models.

MODULE -VI APPLICATIONS, CHALLENGES & FUTURE DIRECTIONS 8

Applications in finance, healthcare, logistics - Noise and error challenges in hybrid systems- Scalability issues- Industry adoption (IBM, Google, startups)- Future trends in hybrid computing

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hidary, Jack D. (2019). Quantum Computing: An Applied Approach (1st Edition). Springer.
2. Nielsen, Michael A., & Chuang, Isaac L. (2010). Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press.

REFERENCE BOOK:

1. Schuld, Maria, & Petruccione, Francesco. (2018). Machine Learning with Quantum Computers (1st Edition). Springer.
2. Yanofsky, Noson S., & Mannucci, Mirco A. (2008). Quantum Computing for Computer Scientists (1st Edition). Cambridge University Press.

WEB RESOURCES:

1. IBM Quantum – https://quantum.ibm.com
2. Qiskit Runtime – https://qiskit.org
3. Google Quantum AI – https://quantumai.google
4. Microsoft Azure Quantum – https://azure.microsoft.com/quantum
5. Xanadu Quantum (PennyLane) – https://pennylane.ai

NPTEL COURSE LINK:

1. NPTEL - Quantum Computing https://onlinecourses.nptel.ac.in /noc25_cs95/preview
2. NPTEL - Artificial Intelligence (for hybrid machine learning concepts) https://onlinecourses.nptel.ac.in/noc26_ph02/preview
3. NPTEL - Optimization Techniques https://onlinecourses.nptel.ac.in /noc25_cs61/preview

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OUTCOMES:

At the end of this course, the students should be able to:

1. Apply hybrid computing concepts to differentiate classical and quantum workflows. (K3)
2. Apply interaction models between classical and quantum systems. (K3)
3. Use hybrid algorithms for solving optimization problems. (K3)
4. Implement basic hybrid workflows using programming frameworks. (K3)
5. Apply hybrid techniques in machine learning and optimization. (K3)
6. Use hybrid computing concepts in real-world applications. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	–	–	–	–	–	–	1	–	–	–	–	2	3
CO2	3	–	–	–	2	–	–	–	–	–	–	–	2	3
CO3	3	–	–	–	–	–	–	–	–	–	–	–	2	3
CO4	3	–	–	–	–	–	–	1	–	–	–	–	1	3
CO5	3	–	–	–	2	–	–	–	–	2	–	–	2	3
CO6	2	–	–	–	1	–	–	1	–	–	–	–	1	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL510	FINANCIAL AND CORPORATE ACCOUNTING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110106368	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- Introduce the fundamental concepts, principles, and procedures of financial accounting.
- Develop the ability to prepare and analyze financial statements for business decision-making.
- Understand corporate accounting practices related to share capital, debentures, valuation, and financial reporting.

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- Examine accounting information systems, ERP applications, auditing processes, and compliance requirements.
- Explore cybersecurity challenges, fraud prevention techniques, and risk management practices in financial systems.
- Analyze the impact of FinTech, blockchain, artificial intelligence, cloud computing, and emerging technologies on modern accounting practices.

MODULE - I FUNDAMENTALS OF FINANCIAL ACCOUNTING **8**

Meaning and Scope of Accounting-Objectives and Functions of Accounting-Accounting Principles and Concepts-Accounting Cycle- Double Entry System-Journal Entries-Ledger Posting-Trial Balance-Subsidiary Books.

MODULE - II FINANCIAL STATEMENTS AND ANALYSIS **8**

Capital and Revenue Expenditure-Depreciation Accounting-Final Accounts-Trading Account-Profit and Loss Account-Balance Sheet-Cash Flow Statement-Fund Flow Statement-Ratio Analysis-Financial Statement Interpretation.

MODULE - III CORPORATE ACCOUNTING **8**

Introduction to Corporate Accounting-Share Capital and Share Issue-Debentures and Bonds-Redemption of Shares-Company Final Accounts-Valuation of Shares and Goodwill-Dividend Policies-Corporate Financial Reporting-Accounting Standards

MODULE - IV ACCOUNTING INFORMATION SYSTEMS AND AUDITING **7**

Accounting Information Systems (AIS) - ERP Systems in Accounting Computerized Accounting - Internal Control Systems - Auditing Concepts - Internal and External Audit Taxation Basics - Financial Fraud Detection - Compliance and Regulatory Requirements.

MODULE - V CYBER SECURITY IN FINANCIAL SYSTEMS **7**

Cyber Security Fundamentals in Finance - Threats to Financial Information Systems - Banking and Payment Security - Phishing and Financial Malware - Identity Theft and Fraud Detection

Data Privacy and Confidentiality - Cyber Laws in Financial Systems - Incident Response and Risk Management

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MODULE - VI FINTECH AND EMERGING TECHNOLOGIES IN ACCOUNTING 7

Introduction to FinTech - Digital Banking Systems - Blockchain in Accounting - Artificial Intelligence in Financial Analysis - Cloud-based Accounting Systems - Big Data Analytics in Finance - Business Continuity and Disaster Recovery - Future Trends in Corporate Accounting.

TOTAL : 45 PERIODS

TEXT BOOKS

1. R.L. Gupta and M. Radhaswamy. Advanced Accountancy, Sultan Chand & Sons.
2. T.S. Grewal and S.C. Gupta. Advanced Accounts, Sultan Chand & Sons.
3. Ross, Westerfield, and Jordan. Fundamentals of Corporate Finance, McGraw-Hill Education.

REFERENCE BOOKS:

1. Shukla and Grewal, Advanced Accounts.
2. William Stallings, Cyber Security Essentials.
3. OECD Principles of Corporate Governance.
4. Ross, Westerfield, and Jordan, Fundamentals of Corporate Finance.

WEB RESOURCES:

1. NPTEL – Online courses on accounting, finance, ERP, and cyber security.
2. Coursera – Professional courses on financial accounting, corporate finance, and FinTech.
3. Oracle ERP Resources – ERP systems, financial management, and compliance resources.
4. ISACA – Information systems auditing, governance, risk management, and cyber security materials.
5. NIST Cyber security Framework – Cyber security standards and best practices for risk management.

ONLINE RESOURCES:

1. edX – Accounting, Financial Analysis, Business Analytics, and Digital Finance courses.
2. Institute of Chartered Accountants of India (ICAI) – Accounting standards, auditing standards, and professional guidance.
3. Ministry of Corporate Affairs (MCA) – Corporate governance, company law, and compliance regulations.

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4. OECD Corporate Governance Resources – Corporate governance frameworks and best practices.
5. Investopedia – Financial accounting, corporate finance, ratio analysis, and FinTech concepts.

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply accounting principles, concepts, and cycles to construct books of accounts using the double-entry system. (K3)
2. Prepare and analyze financial statements, cash flow statements, fund flow statements, and financial ratios for business decision-making. (K4)
3. Analyze corporate accounting transactions related to share capital, debentures, dividend policies, valuation, and financial reporting standards. (K4)
4. Analyze the operational efficiency of accounting information systems, ERP-enabled accounting processes, auditing mechanisms, and regulatory compliance requirements. (K4)
5. Analyze cybersecurity risks, fraud detection techniques, data privacy concerns, and risk management strategies in financial information systems. (K4)
6. Analyze the integration and impact of FinTech, blockchain, artificial intelligence, cloud computing, and data analytics on modern accounting and financial management practices. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL511	BANKTECH, INSURTECH & REGTECH	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- Understand the evolution of digital banking technologies and BankTech innovations in modern financial services.
- Examine the role of data analytics, artificial intelligence, and machine learning in banking and lending ecosystems.
- Analyze intelligent financial systems for customer analytics, decision-making, and predictive modeling.
- Explore InsurTech technologies, digital insurance platforms, and innovations in insurance services.
- Evaluate risk modeling, fraud detection mechanisms, and emerging business models in the insurance sector.
- Understand RegTech frameworks, compliance management, smart regulation, and future regulatory technologies.

MODULE - I INTRODUCTION TO BANKTECH AND DIGITAL BANKING 8

Introduction to BankTech -Evolution of Digital Banking-Regulatory Framework for Product Pricing- Loan Origination and Servicing- Digital Banking Platforms and Technologies- Financial Innovation in Banking.

MODULE - II DATA ANALYTICS, AI AND LENDING TECHNOLOGIES IN BANKING 7

Social Media-based Profiling-Comparison Tools and Aggregators-Dynamic Credit Rating-Risk Management and Underwriting- Credit Counsellor Robo/Bot Systems-Hybrid Lending Products.

MODULE - III DATA SCIENCE AND MACHINE LEARNING IN FINANCIAL SERVICES 7

Data Science Tools in Banking-Machine Learning for Data Mining-Cross-selling and Customer Analytics-AI-based Decision Making-Predictive Analytics in Financial Services-Intelligent Financial Systems.

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MODULE - IV INSURTECH AND DIGITAL INSURANCE ECOSYSTEM 8

Introduction to InsurTech- How InsurTech Works?-Business Model Disruption in Insurance-Aggregators and Digital Insurance Platforms- AI/ML in InsurTech-IoT and InsurTech Applications.

MODULE - V RISK MODELING, FRAUD DETECTION AND INSURANCE INNOVATION 8

Risk Modeling in Insurance-Fraud Detection Techniques-Claims Processing and Underwriting-Innovations in Insurance Services-InsurTech Unicorns and Business Models-Emerging Trends in Digital Insurance.

MODULE - VI REGTECH, COMPLIANCE AND SMART REGULATION 7

Evolution of RegTech-RegTech Ecosystem: Financial Institutions, Startups and Regulators-Compliance Management and Smart Regulation-Suitability and Funds Monitoring-Regulatory Sandboxes -AI in Smart Regulation and Fraud Detection -Challenges and Future of RegTech.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sengupta, Chandan. FinTech: Foundations and Applications, Wiley Publications.
2. Skinner, Chris. Digital Bank: Strategies to Launch or Become a Digital Bank, Marshall Cavendish Business.
3. Chishti, Susanne & Barberis, Janos. The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications.

REFERENCE BOOKS:

1. FinTech Foundations and Applications by Chandan Sengupta BankTech, InsurTech, RegTech, AI, and digital financial services.
2. Digital Banking by Indian Institute of Banking and Finance (IIBF) digital banking systems, loan servicing, compliance, and financial technologies.
3. Artificial Intelligence and Machine Learning by S. Kaushik AI/ML concepts, predictive analytics, and intelligent systems
4. The FINTECH Book by Susanne Chishti and Janos Barberis FinTech, InsurTech, RegTech, digital banking, and innovation.
5. Digital Bank by Chris Skinner AI in banking, and customer-centric financial systems.

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6. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig Standard reference for AI applications, machine learning, and intelligent decision systems.

ONLINE RESOURCES:

1. IBM Financial Services Insights – AI and analytics applications in banking and insurance.
2. Investopedia – Banking, insurance, risk management, and regulatory technology concepts.
3. McKinsey Financial Services Insights – Digital transformation trends in banking and insurance.
4. World Economic Forum FinTech Hub – Global FinTech and regulatory innovation trends.

WEB RESOURCES

1. NPTEL – Courses on AI, machine learning, digital banking, and financial technologies.
2. Coursera – Online certifications on FinTech, InsurTech, RegTech, and analytics.
3. Reserve Bank of India (RBI) – Banking regulations, compliance guidelines, and financial technology frameworks.
4. IRDAI – Insurance Regulatory and Development Authority of India – Insurance regulations, InsurTech initiatives, and digital insurance policies.
5. ISACA – Governance, compliance, audit, and risk management resources.
6. IBM AI and Financial Services – AI/ML applications in banking, insurance, fraud detection, and smart regulation.

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the evolution of BankTech and digital banking systems, including banking operations, loan servicing, and financial innovations.(K2)
2. Analyze data-driven lending technologies, credit assessment models, risk management techniques, and AI-enabled banking solutions.(K4)
3. Apply data science, machine learning, and predictive analytics techniques to customer analytics and intelligent financial decision-making systems.(K3)
4. Evaluate InsurTech ecosystems, digital insurance platforms, AI/ML applications, and IoT-enabled insurance services.(K4)

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5. Assess risk modeling, fraud detection techniques, claims processing innovations, and emerging business models in the insurance sector. (K5)
6. Examine RegTech frameworks, compliance management systems, regulatory sandboxes, and AI-driven smart regulation for modern financial institutions. (K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	--	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24SCEL512	FINTECH FOR CAPITAL MARKETS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24MGOE904					

OBJECTIVES:

- Understand the role of FinTech innovations in transforming capital markets and brokerage services.
- Analyze the technological infrastructure supporting discount broking and digital trading platforms.
- Explain the architecture, lifecycle, and implementation of algorithmic trading systems.
- Apply AI and Machine Learning concepts in trading strategy development and risk management.
- Examine the design and functioning of robo-advisory and digital wealth management platforms.
- Evaluate emerging technologies, challenges, and future trends in FinTech-driven capital market ecosystems.

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 09/04/26

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Department of Computer
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MODULE - I INTRODUCTION TO DISCOUNT BROKING AND DIGITAL TRADING 7

Introduction to Discount Broking-Evolution of Digital Brokerage Services-Disruption to Traditional Broking Models-Core Services and Business Models-Online Trading Platforms-Financial Technology in Capital Markets

MODULE - II TECHNOLOGY INFRASTRUCTURE FOR DISCOUNT BROKING 8

Technology Setup for Discount Brokers-Trading Platforms and Market Connectivity-Technology Stacks for Discount Brokers-Data Analytics in Trading Platforms-Unicorns of Discount Broking and Business Models-Differentiated Offerings and Services

MODULE - III FUNDAMENTALS OF ALGORITHMIC TRADING 8

Introduction to Algorithmic Trading-Architecture of Algorithmic Trading-Lifecycle of Algorithmic Trading-Automated Trading Strategies-Roles and Participants in Algorithmic Trading-Trading Execution Systems

MODULE - IV RISK MANAGEMENT AND AI IN ALGORITHMIC TRADING 8

Risk and Costs in Algorithmic Trading-Conceptualization of Trading Strategies-Back testing Strategies-Fund Management and Algorithmic Trading-AI and Machine Learning in Trading

Setting up an Algo Bot.

MODULE - V ROBO-ADVISORY AND INTELLIGENT INVESTMENT SYSTEMS 7

Introduction to Robo-Advisory-Automating Investment Rules-ML/AI in Robo-Advisory-Robo-Advisory Platforms and Architecture-Personalized Investment Management-Digital Wealth Management Systems

MODULE - VI ROBO-ADVISORY PLATFORMS AND FUTURE OF CAPITAL MARKET FINTECH 7

Building a Robo-Advisory Platform-Unicorns of Robo-Advisory and Business Models-State of Robo-Advisory in India-Future Trends in Capital Market FinTech-Challenges in Digital Investment Platforms-Emerging Technologies in Wealth Management

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 04/04/26

Chairman
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TEXT BOOKS

1. Sengupta, Chandan. FinTech: Foundations and Applications, Wiley Publications.
2. Chan, Ernest P. Algorithmic Trading: Winning Strategies and Their Rationale, Wiley Publications.
3. Chishti, Susanne & Barberis, Janos. The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications.

REFERENCE BOOKS:

1. FinTech Foundations and Applications by Chandan Sengupta FinTech applications in capital markets, robo-advisory, AI, and trading systems.
2. Indian Financial System by M.Y. Indian capital markets, financial institutions, and technology-driven financial services.
3. Artificial Intelligence and Machine Learning by S. Kaushik AI and ML applicable to algorithmic trading and robo-advisory systems.
4. Algorithmic Trading by Ernest P. Chan Covers trading strategies, back testing, quantitative trading, and automation.
5. The FINTECH Book by Susanne Chishti and Janos Barberis FinTech innovation, capital markets, robo-advisory, and digital finance.
6. Advances in Financial Machine Learning by Marcos Lopez de Prado in trading, portfolio management, and financial analytics.

ONLINE RESOURCES:

1. NPTEL – Courses on Financial Markets, AI, Machine Learning, and FinTech.
2. Coursera – Quantitative Finance, Algorithmic Trading, and FinTech Specializations.
3. edX – Financial Engineering, Data Science, and AI courses.
4. National Stock Exchange of India (NSE) – Market structure, trading systems, and algorithmic trading resources.
5. BSE India – Capital market data and investor education.
6. SEBI – Regulatory framework for Indian capital markets.

WEB RESOURCES:

1. NPTEL – Courses on AI, machine learning, financial markets, and algorithmic trading.
2. Coursera – Online courses on quantitative finance, trading algorithms, and robo-advisory.

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 09/04/26

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Science and

3. National Stock Exchange of India (NSE) – Indian stock market operations, algorithmic trading, and market data resources.
4. BSE India – Capital market information, trading systems, and investment resources.
5. Investopedia – Tutorials on discount broking, robo-advisory, and algorithmic trading.
6. QuantInsti – Resources on algorithmic trading, quantitative finance, AI in trading, and trading bots.

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the evolution of FinTech in capital markets and analyze the business models of discount brokerage platforms. (K2)
2. Evaluate the technology infrastructure, trading platforms, and data analytics frameworks used in digital trading ecosystems.(K4)
3. Design and interpret algorithmic trading workflows, trading strategies, and execution mechanisms.(K3)
4. Apply risk management principles, back-testing techniques, and AI/ML models in algorithmic trading environments.(K3)
5. Analyze robo-advisory architectures and develop intelligent investment solutions for personalized wealth management.(K4)
6. Assess emerging FinTech technologies, industry challenges, and future developments in digital investment and capital market platforms.(K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

Recommended in Board of Studies (BoS) Meeting No. 02 **held on** 09/04/26

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Department of Computer

SEMESTER – V

24CIOE501	DESIGN OF INTERNET OF THINGS	L	T	P	CP	C
noc26-cs161		3	0	0	3	3
SDG NO. 9,11,12						

PREREQUISTES

- **24CIPC301** – Introduction to Internet of Things - III Semester

OBJECTIVES:

- To Understand the fundamentals of IoT systems and analyze the key challenges.
- To apply sensor interfacing and embedded hardware design principles to build IoT devices.
- To understand and select suitable wireless communication technologies and IoT protocols.
- To develop and integrate end-to-end IoT solutions

MODULE -I FOUNDATIONS & CORE CHALLENGES OF IOT 9

Introduction to IoT - The IoT Value Equation (sensing + connectivity + actuation + data) - Application Domains - Energy and power Constraints - Data explosion, storage, and processing at the edge - Security, privacy, and attack surfaces - Scalability, reliability, and maintainability trade-offs

MODULE – II IOT HARDWARE ARCHITECTURE & SENSOR INTERFACING8

System partitioning: sensor, processor, power, and communication blocks - Microcontroller and processor selection - Memory hierarchy and storage options - Sensor interfacing: analog, digital, and smart sensors (I^2C, SPI, UART)

MODULE - III WIRELESS CONNECTIVITY & NETWORKING 7

Short-range: BLE, Wi-Fi, RFID/NFC -Low-power wide-area networks (LPWAN): LoRa, LTE-M, NB-IoT, Sigfox - Range, data rate, power, and cost trade-offs -Choosing the right radio based on application requirements

MODULE -IV POWER MANAGEMENT & ENERGY HARVESTING 7

Voltage Regulation - Power Pathing - Ambient Energy Harvesting - Harvesting Front-Ends - Power Profiling

Recommended by

Board of Studies of CSE(SC) dept.

Meeting No. 6 Dated: 9.4.2026

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MODULE -V IOT COMMUNICATION PROTOCOLS 7

Network Layer Dynamics - MAC layer considerations in IoT networks - REST over CoAP (constrained environments) - Publish-subscribe model: MQTT and AMQP - Service discovery with mDNS - Protocol selection criteria and overhead analysis

MODULE -VI SYSTEM INTEGRATION, SECURITY & CASE STUDIES 7

Building an IoT System - End-to-end design walkthroughs: Joule Jotter and Chhaya - Integration of power management, wireless, sensors, and protocols - Security implementation and system validation - Deployment Engineering

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015

REFERENCE BOOK:

1. Pethuru Raj and Anupama C.Raman, "The Internet of Things:Enabling Technologies and use case, CRC press,2022 by Aurebach Publications.
2. Jonathan W. Valvano, "Embedded Systems:Introduction to ARM Cortex-M Microcontrollers", CreateSpace Independent Publishing Platform, 2016.
3. Olivier Hersent, David Boswarthick, Omar Elloumni, "the Internet of Things -Key applications and Protocolos", Wiley 2012

WEB REFERENCES:

1. https://nptel.ac.in/courses/108108098
2. https://link.springer.com/chapter/10.1007/978-3-030-41110-7_1

OUTCOMES:

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

1. Apply the core components of the IoT value equation to model performance, scalability, and security trade-offs (K3)
2. Utilize IoT hardware architecture and sensor interfacing techniques using I^2C, SPI, and UART protocols. (K3)
3. Demonstrate wireless connectivity using BLE, Wi-Fi, RFID/NFC, and LPWAN technologies for IoT systems. (K3)
4. Demonstrate power management and energy harvesting techniques in IoT device design. (K3)

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5. Examine network layer dynamics, MAC layer considerations, and protocol selection criteria for efficient IoT communication. (K4)
6. Assess the integration of IoT hardware, communication protocols, and security mechanisms for reliable system deployment. (K4)

CO – PO, PSO MAPPING:

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

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Board of Studies of CSE(IoT) dept.
Meeting No. 6 Dated: 9.4.2026

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Computer Science and Engineering
(Internet of Things)

Imagine the Future and

Make it happen!





Together let's build a better world where there is NO POVERTY and ZERO HUNGER.

We have GOOD HEALTH AND WELL BEING QUALITY EDUCATION and full GENDER EQUALITY everywhere.

There is CLEAN WATER AND SANITATION for everyone. AFFORDABLE AND CLEAN ENERGY

which will help to create DECENT WORK AND ECONOMIC GROWTH. Our prosperity shall be fuelled

by investments in INDUSTRY, INNOVATION AND INFRASTRUCTURE that will help us to

REDUCE INEQUALITIES by all means. We will live in SUSTAINABLE CITIES AND COMMUNITIES.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing LIFE BELOW WATER, rich and diverse LIFE ON LAND.

We will enjoy PEACE AND JUSTICE through STRONG INSTITUTIONS

and will build long term PARTNERSHIPS FOR THE GOALS.



For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

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