



BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

PROGRAMME CODE: IN

**CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)**

SCHEME OF EXAMINATION & SYLLABUS

(w.e.f 2026 -27 onwards)

REGULATIONS 2026

UNDERGRADUATE PROGRAMMES

(a) Qualification Descriptors

Aligned with NHEQF Level 6 (Bachelor's Degree Level).

A Bachelor's Degree signifies that a learner has completed a structured programme of study that develops disciplinary knowledge, professional competence, transferable skills and ethical values.

Graduates are expected to demonstrate:

- A systematic understanding of the discipline and its linkages with related fields
- Procedural and professional knowledge relevant to employment, higher education and public service
- Ability to identify problems, collect and analyse data, and develop evidence-based solutions
- Effective communication of academic and professional work
- Capacity for self-directed learning and adaptation to new contexts
- Ability to apply disciplinary knowledge and transferable skills in real-world contexts
- Development of employability skills relevant to professional careers

(b) Graduate Attributes (GAs)

GA Code	Graduate Attributes
GA1	Disciplinary Knowledge
GA2	Communication Skills
GA3	Critical Thinking
GA4	Problem Solving
GA5	Analytical Reasoning
GA6	Research-related Skills
GA7	Cooperation/Teamwork
GA8	Scientific Reasoning
GA9	Reflective Thinking
GA10	Information/Digital Literacy
GA11	Self-Directed Learning
GA12	Multicultural Competence
GA13	Moral and Ethical Awareness/Reasoning
GA14	Leadership Readiness
GA15	Lifelong Learning

(c) GAs – Written Measured

These GAs are directly measurable through written examinations, assignments, or structured theory evaluation.

GA	Attribute	Measure	Assessment Method
GA1	Disciplinary Knowledge	Strongly	Theory examinations, concept-based questions, structured problem solving
GA3	Critical Thinking	Strongly	Case analysis, reasoning questions
GA4	Problem Solving	Strongly	Application-oriented problems, scenario-based questions
GA5	Analytical Reasoning	Strongly	Data interpretation, logical analysis, numerical exercises
GA6	Research-related Skills	Partially	Research oriented questions, data interpretation, literature review writing
GA8	Scientific Reasoning	Partially	Evidence-based explanations, logical justification questions
GA9	Reflective Thinking	Limited	Short reflective writing responses
GA10	Information/Digital Literacy	Limited	Application of digital tools and information ethics

(d) GAs – Performance based

These require observation of behaviour, participation, skill demonstration, or real-time engagement.

GA	Attribute	Measure	Assessment Method
GA2	Communication Skills	Strongly	Presentations, seminars, viva voce, group discussions
GA7	Cooperation/Teamwork	Strongly	Group projects, peer evaluation, collaborative assignments
GA11	Self-Directed Learning	Limited	Independent assignment / Project work / Online learning task
GA12	Multicultural Competence	Partially	Group activities with diverse teams / Fieldwork / Community engagement, Participation in cultural activities,
GA13	Moral and Ethical Awareness/Reasoning	Partially	Behavioural observation methods, Reflective reports
GA14	Leadership Readiness	Limited	Team leadership in project, Event coordination
GA15	Lifelong Learning	Limited	Participation in value added courses, certification

Department of Information Technology

Vision

- To nurture students with strong technological competence and innovative thinking, enabling them to develop advanced digital systems, adapt to evolving technologies, and provide responsible and sustainable solutions that address societal and industry needs with creativity, ethical values, and social responsibility, preparing graduates to excel in the global digital society.

Mission

- To impart strong foundations in computing principles, programming, and advanced technological tools through quality education.
- To cultivate analytical thinking, creativity, and problem-solving abilities for developing effective digital solutions.
- To integrate emerging technologies and industry-relevant practices to enhance professional competence and employability.
- To promote innovation, research, and collaborative learning to address real-world societal and industrial challenges.
- To instil ethical values, professionalism, and social responsibility in the development and application of technology.

Bachelor of Science in Information Technology

Programme Objectives, Outcomes and Mapping

Programme Educational Objectives (PEOs)

(Expected career and professional achievements of graduates within three to five years of completing the programme)

PEO1: Graduates will achieve successful careers or higher education in IT through technical expertise, professionalism, and ethical practices.

PEO2: Analyse societal and industry challenges to develop innovative, sustainable, and inclusive digital solutions.

PEO3: Engage in lifelong learning, professional development, and research-oriented activities to adapt to evolving technologies and contribute effectively to the global digital ecosystem.

PEO4: Demonstrate leadership, teamwork, and entrepreneurship in developing responsible technological solutions for sustainable societal well-being.

PEO5: Contribute to society by applying technological knowledge and values to promote digital inclusion and solve real-world challenges.

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Programme Learning Outcomes (PLOs)

(Specific abilities, knowledge, and skills that graduates are expected to demonstrate upon Graduation)

PLO1: Apply fundamental concepts of computing, programming, and information technology to develop effective digital solutions for real-world applications.

PLO2: Analyse computational problems and system requirements using logical, analytical, and critical thinking skills to design appropriate technology-based solutions.

PLO3: Design and develop software applications and digital systems by integrating suitable tools, technologies, and development methodologies.

PLO4: Evaluate technological alternatives and system performance to select efficient, scalable, and sustainable computing solutions.

PLO5: Conduct basic research and investigative studies using appropriate methods, data analysis techniques, and digital resources to address computing problems.

PLO6: Communicate technical concepts, project outcomes, and digital solutions effectively through written, oral, and visual presentations in professional contexts.

PLO7: Collaborate effectively in multidisciplinary teams to plan, develop, and implement technology solutions while demonstrating cooperation and shared responsibility.

PLO8: Apply ethical principles, professional responsibilities, and societal values while developing and deploying computing technologies.

PLO9: Demonstrate the ability to learn emerging technologies independently and adapt to evolving professional and technological environments.

PLO10: Reflect on professional practices and societal impacts of technology to promote inclusive, responsible, and sustainable digital development.

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PLOs with Bloom's Levels, Assessment Methods, and Graduate Attribute Mapping

PLO No	Programme Learning Outcome	Bloom's Level	Assessment Methods	Mapped GAs
PLO1	Apply fundamental concepts of computing, programming, and information technology to develop effective digital solutions for real-world applications.	K3	CIA, ESE, Practical	GA1, GA10
PLO2	Analyze computational problems and system requirements using logical, analytical, and critical thinking skills to design appropriate technology-based solutions.	K4	CIA, Case Study, ESE	GA3, GA5
PLO3	Design and develop software applications and digital systems by integrating suitable tools, technologies, and development methodologies.	K5	Project, Practical, Viva	GA4, GA10
PLO4	Evaluate technological alternatives and system performance to select efficient, scalable, and sustainable computing solutions.	K5	CIA, Case Study, Seminar	GA4, GA8
PLO5	Conduct basic research and investigative studies using appropriate methods, data analysis techniques, and digital resources to address computing problems.	K4	Project, Seminar, Viva	GA6, GA8
PLO6	Communicate technical concepts, project outcomes, and digital solutions effectively through written, oral, and visual presentations in professional contexts.	K3	Seminar, Viva, Project	GA2
PLO7	Collaborate effectively in multidisciplinary teams to plan, develop, and implement technology solutions while demonstrating cooperation and shared responsibility.	K3	Project, Internship, Viva	GA7, GA14
PLO8	Apply ethical principles, professional responsibilities, and societal values while developing and deploying computing technologies.	K3	Case Study, Seminar, Field Work	GA13, GA12
PLO9	Demonstrate the ability to learn emerging technologies independently and adapt to evolving professional and technological environments.	K4	Internship, Project, Seminar	GA11, GA15
PLO10	Reflect on professional practices and societal impacts of technology to promote inclusive, responsible, and sustainable digital development.	K4	Field Work, Case Study, Seminar	GA9, GA12

Programme Specific Outcomes (PSOs)

(Expected knowledge, skills, and competencies that graduates will acquire by the end of the programme)

PSO1: Develop structured and object-oriented software solutions using appropriate programming paradigms and modern development tools.

PSO2: Design and implement efficient data management and computational solutions using suitable algorithms and database technologies.

PSO3: Analyse and implement computer system components and communication technologies for efficient computing and networking environments.

PSO4: Apply software engineering principles and modern frameworks to develop scalable, secure, and reliable web-based and enterprise applications.

PSO5: Utilize emerging technologies and data-driven approaches to build intelligent and innovative digital solutions.

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PSO Alignment with Core Courses and Skill Competencies

PSO No	Programme Specific Outcome	Supporting Core Courses	Skill Competency
PSO1	Develop structured and object-oriented software solutions using appropriate programming paradigms and modern development tools.	Programming in C, OOPs with C++, Java Programming, Python Programming, Computer Graphics and Multimedia	Programming and Software Development
PSO2	Design and implement efficient data management and computational solutions using suitable algorithms and database technologies.	Data Structures and Algorithms, Database Management System, R Programming, Robotic Process Automation	Algorithm Design and Data Management
PSO3	Analyze and implement computer system components and communication technologies for efficient computing and networking environments.	Operating Systems Fundamentals, Digital Logic and Circuits, Computer Networks, Wireless Sensor Networks	System and Network Management
PSO4	Apply software engineering principles and modern frameworks to develop scalable, secure, and reliable web-based and enterprise applications.	Software Engineering and Testing, Full Stack Development, Python Programming, Natural Language Processing , Blockchain Technology	Software Engineering and Web Development
PSO5	Utilize emerging technologies and data-driven approaches to build intelligent and innovative digital solutions.	Machine Learning, Internet of Things, Data Visualization Tools, Bio Inspired Computing	Artificial Intelligence and Emerging Technologies

SCHEME OF EXAMINATION

Sem	Part	Course Code	Course Title	Course Type	Hours/ Week	Credits	Examination			
							Duration in Hours	Maximum Marks		
								CA	ESE	TOTAL
I	I	TAM2601A	Tamil Paper I	AEC	4	3	3	25	75	100
		HIN2601A	Hindi Paper I							
		FRE2601A	French Paper I							
	II	ENG2601A	English Paper I	AEC	4	3	3	25	75	100
	III	CY26C01	Core I: Problem Solving Techniques in C	DSC	5	4	3	25	75	100
		AP26C02	Core II: Operating System	DSC	5	4	3	25	75	100
		IN26CP1	Core Practical I : Programming in C and LINUX Lab	DSC	4	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A03	Generic Elective I: Numerical and Statistical Techniques	MDC	6	5	3	25	75	100
	IV	NME26B1	Basic Tamil I	AEC	2	2	-	100*		100
		NME26A1	Advanced Tamil I							
		NME26ES	Introduction to Entrepreneurship	VAC						
I - II	VI	NM26GAW	General Awareness	VAC	SS	-	-	-	-	-
I - II		COM26SER	Community Services 30 Hours	VAC	-	-	-	-	-	-
I - V		26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester I Total					30	23				650
II	I	TAM2602A	Tamil Paper II	AEC	4	3	3	25	75	100
		HIN2602A	Hindi Paper II							
		FRE2602A	French Paper II							
	II	ENG2602A	English Paper II	AEC	4	3	3	25	75	100
	III	IN26C03	Core III : OOPs with C++	DSC	5	4	3	25	75	100
		IN26C04	Core IV: Data Structures and Algorithms	DSC	4	3	3	25	75	100
		IN26CP2	Core Practical II : OOPs with C++ Lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A11	Generic Elective II: Discrete Mathematics	MDC	6	5	3	25	75	100
	IV	NME26B2	Basic Tamil II	AEC	2 [€]	Gr.		100*	-	100 [£]

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		NME26A2	Advanced Tamil II							
		NM26UHR	Universal Human Values and Human Rights	VAC	2	2	-	100*	-	100
I - II		NM26GAW	General Awareness	VAC	SS	Gr.	-	100*		100 [£]
I - II		COM26SER	Community Services 30 Hours	VAC	-	St.	-	-	-	-
I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester II Total					30	23				650
III	I	TAM2603A	Tamil Paper III	AEC	4	3	3	25	75	100
		HIN2603A	Hindi Paper III							
		FRE2603A	French Paper III							
	II	ENG2603A	English Paper III	AEC	4	3	3	25	75	100
	III	IN26C05	Core V : Database Management System	DSC	5	4	3	25	75	100
		IN26C06	Core VI : Digital Logic and circuits	DSC	5	4	3	25	75	100
		IN26CP3	Core Practical III : DBMS lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A20	Generic Elective III : Optimization Techniques	MDC	4	3	3	25	75	100
	IV	NM26DRM	Disaster Risk Reduction and Management	SEC	3	3	-	100*	-	100
		NM26HAW	Health and Wellness	VAC	SS	1	-	100*	-	100
I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester III Total					30	24				750
IV	I	TAM2604A	Tamil Paper IV	AEC	4	3	3	25	75	100
		HIN2604A	Hindi Paper IV							
		FRE2604A	French Paper IV							
	II	ENG2604A	English Paper IV	AEC	4	3	3	25	75	100
	III	IN26C07	Core VII : Computer Networks	DSC	4	3	3	25	75	100
		IN26C08	Core VIII: Java Programming	DSC	5	4	3	25	75	100
		IN26CP4	Core Practical IV: Java Programming Lab	DSC	4	2	2	15 ^{\$\$}	35 ^{\$\$}	50
		AP26A01	Generic Elective IV : Digital Marketing (OR)	MDC	4	3	3	25	75	100
		CS26A02	Generic Elective IV : M-Commerce							

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			(OR)							
		BP26A05	Business Accounting							
		IN26SECE	R Programming	SEC	3	3	-	100*	-	100
		NM26EII	Entrepreneurship and Innovation (IgniteX)	VAC	2	2	-	100*	-	100
		NM26EVS	Environmental Studies	VAC	SS	Gr.	-	100*	-	100 [£]
	V	26COACT	Co-Curricular Activities	VAC	-	1	-	100*	-	100
I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester IV Total					30	24				850
V	III	IN26C09	Core IX: Machine Learning	DSC	5	4	3	25	75	100
		IN26C10	Core X: Python Programming	DSC	5	4	3	25	75	100
		IN26C11	Core XI : Software Engineering and Testing	DSC	5	4	3	25	75	100
		IN26CP5	Core Practical V : Python Programming Lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50
		IN26E01	Elective I : Cloud Computing (OR)	DSE	5	4	3	25	75	100
		IN26E02	Elective I : Wireless Sensor Networks (OR)							
		IN26E03	Elective I: Computer Graphics and Multimedia							
		IN26AC1	Advance Learner Course I : Data Mining (OR)	ACC	SS	5 [^]	3	25	75	100 [^]
		IN26AC2	Advance Learner Course I : Bio-Inspired Computing							
	IV	IN26SEP1	Computer Networks lab	SEC	3	3	-	100*	-	100
		NM26CS1	Cyber Security I	VAC	2	Gr.	-	100*	-	100 [£]
		IN26INST	Field work/ Institutional Training (21 Days)	VAC	-	2	-	100*	-	100
	VI	IN26COM	Comprehensive Examination	DSC	-	Gr.	-	100*	-	100 [£]
I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	Cr. ^ /St.	-	-	-	-
Semester V Total					30	24				650
VI	III	IN26C12	Core XII : Full Stack Development	DSC	5	4	3	25	75	100

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		IN26C13	Core XIII: Internet of Things	DSC	5	3	3	25	75	100
		IN26CP6	Core Practical VI:: Full Stack Development and IoT Lab	DSC	5	3	6	15 ^{\$\$}	35 ^{\$\$}	50
		IN26E04	Elective II : Natural Language Processing (OR)	DSE	5	4	3	25	75	100
		IN26E05	Elective II :Blockchain Technology							
	IV	IN26SEP2	Data Visualization Tools Lab	SEC	3	3	-	100*	-	100
		IN26PROJ	Project and Viva-voce	DSE	7	5	3	25	75	100
	III	IN26AC3	Advance Learner Course II : Robotic Process Automation (OR)	ACC	SS	5 [^]	3	25	75	100 [^]
		IN26AC4	Advance Learner Course II : Big Data Analytics							
Semester VI Total					30	22				550
I - VI	Total					140 + Addit ional Credits				4100 + Marks for Addition al Credit Courses

Hours of Instructions is inclusive of lectures, seminars, presentations, case-studies, etc

Symbols and Notations

Symbols	Notations
*	Course assessed through Internal Assessment (CIA) only
Gr.	Grade awarded based on CBCS grading system
St.	Course Status (Completed/Not Completed)
^	Advanced Learner Course, Online Courses – Additional Credit Courses
@	Course assessed through End Semester Examination (ESE) only
#	Open Book Examination
\$	Evaluation Pattern converted from 25:75:100 to 20:55:75 (CIA:ESE:Total) structure
\$\$	Evaluation Pattern converted from 25:75:100 to 15:35:50 (CIA:ESE:Total) structure
€	Hours per Week Outside Class Hours
£	Marks not considered for total; grade will be awarded

Abbreviation	Course Type
DSC	Discipline Specific Core Courses
DSE	Discipline Specific Elective Courses
MDC	Multidisciplinary Courses
AEC	Ability Enhancement Course
SEC	Skill Enhancement Course
VAC	Value Added Courses
ACC	Additional Credits Courses
SS	Self-Study

Assessment and Evaluation Framework**Continuous Internal Assessment (CIA) – 25%**

Component	Activities Included
Internal Tests	Periodic written tests
Assignments / Case Studies	• Written assignments • Case analysis reports • Article reviews • Literature review tasks • Data interpretation exercises • Policy analysis (Arts & Humanities) • Business case studies (Commerce & Management) • Lab-based analytical reports (Science)
Seminars / Presentations	• PowerPoint presentations • Poster presentations • Panel discussions • Group seminars • Viva voce • Digital presentations using multimedia tools • Peer evaluation rubrics
ICT-based Tasks	• Spreadsheet analysis • Accounting software / statistical software • Online quizzes • Simulation tools • E-content creation • Coding platforms (for relevant disciplines)
Projects / Field Reports	• Field surveys • Industry visits • Internship reports • Mini-projects • Laboratory experiments • Community-based research • Data collection & statistical analysis • Reflective journals

End Semester Examination (ESE) – 75%

Component	Description
Written Examination	3-hour written examination covering all CLOs
Cognitive Levels	Questions aligned with multiple Bloom's Taxonomy (K-levels)
Professional Conduct	Ethical and professional conduct during examination
Academic Compliance	Timely submission and participation as per regulations

Assessment Components Aligned with Blooms Levels

EXAMINATION SYSTEM

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester. Marks for ESE and CA with reference to the maximum marks for the courses will be as follows:

Max. Marks	CA	ESE
100	25	75
75	20	55
50	15	35

A. Bloom's levels are followed in question papers and aligned with CLOs and CA components.

Remember	-	K1
Understand	-	K2
Apply	-	K3
Analyze	-	K4
Evaluate	-	K5
Create	-	K6

B. Continuous Internal Assessment CA

The weightage assigned to various components of the CA is as follows

Undergraduate Programmes

a. Theory

AEC (Language, English), DSC (Core, Elective) & MDC (GE-Allied)

CA Components	Marks	K level
CIA Test	5 Marks (Conducted for 45 marks after 50 days – 3 units)	K1 to K6 as per QP Pattern
Model Exam	7 Marks (Conducted for 75 marks after 85 days - Each Unit 15 Marks)	
Seminar	4 Marks	K6
Assignment	4 Marks	K5
ICT (Quiz)	2 Marks	K2
Attendance	3 Marks (Attendance 75% - 80% - 1 Mark, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)	
Total	25 Marks	

For Science allied courses with theory as 75 marks, the split-up is 20 marks as internal and 55 as external. Internal conducted for 25 and converted to 20 marks and external conducted for 75 and converted to 55 marks.

b. Practical

CA Components	Marks	K level
Lab Performance	7 Marks	K4
Internal Viva Voce	5 Marks	K4
Model Exam	10 Marks	K5
Attendance	3 Marks	
Total	25 Marks	

For practical courses with 50 marks as ESE, the split-up is 15 marks as internal and 35 as external. Internal conducted for 25 and converted to 15 marks and external conducted for 75 and converted to 35 marks.

c. Skill Enhancement Courses

Theory courses

CA Components	Marks	K level
Test I	30 Marks (Conducted for 45 marks and converted to 30 Marks – 3 Units)	K2 to K6 as per QP Pattern
Test II	50 Marks (Conducted for 75 marks after 85 days - Each Unit 15 Marks)	
Assignment	10 Marks	K5
Seminar	10 Marks	K6
Total	100 Marks	

Practical Courses

CA Components	Marks	K level
Practical exam	80 Marks (Practical Execution: 65 Marks, Record : 15 Marks)	K5
Lab Performance	10 Marks	K4
Internal Viva Voce	10 Marks	K4
Total	100 Marks	

Theory and Practical

CA Components	Marks	K level
Test I (Theory)	30 Marks (Conducted for 45 Marks and converted to 30 Marks)	K2 – K6
Test II (Practical)	50 Marks (Practical Execution: 40 Marks, Record : 10 Marks)	K5
Lab Performance	10 Marks	K4
Internal Viva Voce	10 Marks	K4
Total	100 Marks	

Theory and Project

CA Components	Marks	K level
Test I (Theory)	30 Marks (Conducted for 45 Marks and converted to 30 Marks)	K2 – K6
Project Examination	30 Marks	K5
Internal Viva Voce	40 Marks	K4
Total	100 Marks	

d. Project: Individual / Group Project

Components	Marks	K level
Continuous Internal Assessment (CA)	25 Marks	K3, K4, K6
End Semester Examination	75 Marks	K5, K6
Total	100 Marks	

Continuous Internal Assessment (CA)

CA Components	Marks	K level
I Review - Project Proposal Presentation	5 Marks	K3
II Review - Periodic Review-Progress Evaluation	10 Marks	K4
III Review - Project Report Draft Submission	10 Marks	K6
Total	25 Marks	

End semester examination

Components	Marks	K level
Evaluation of the Project Report	25 Marks	K6
Viva Voce	50 Marks	K5
Total	75 Marks	

e. Introduction to Entrepreneurship / Women Studies / Universal Human Values and Human Rights / Environmental Studies / Cyber Security I

CA Components	Marks	K level
ICT (Quiz)	50 Marks	K2
Assignment	25 Marks	K5
Project / Case study / Poster	25 Marks	K6
Total	100 Marks	

f. Entrepreneurship and Innovation (IgniteX)

CA Components	Marks	K level
ICT (Quiz)	50 Marks (3 Quizzes each quiz 25 marks, 75 marks converted to 50 marks)	K2
ICT (Pitch Deck Presentation)	20Marks	K6
Assignment	30 marks (30 Venture Activities)	K5
Total	100 Marks	

g. Advanced Tamil & Basic Tamil

Components	Marks	K level
CIA	25 Marks (conducted for 45 marks after 50 days)	K1 to K6 as per QP Pattern
Model	50 marks (conducted for 75 marks after 85 days)	
ICT (Quiz)	15Marks	K2
Assignment	10 Marks	K5
Total	100 Marks	

h. General Awareness / Comprehensive Examination / Co-Curricular Activities / Community Services

Course Title	Marks	K level
General Awareness	100	K3
Comprehensive Examination	100	K3
Co-Curricular Activities	100	K6
Community Services	St.	K6

i. Field Work / Institutional Training:

CA Components	Marks	K level
Work diary	15 Marks	K3
Report	50 Marks	K6
Viva Voce	25 Marks	K5
Attendance	10 Marks	
Total	100 Marks	

j. Advance learner Course:

CA Components	Marks	K level
Test 1	10 Marks (conducted for 45 marks after 50 days – 3 units)	K1 to K6 as per QP Pattern
Model Exam	15 Marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))	
Total	25 Marks	

Postgraduate Programme**a. Core and Elective (Including Course with Open Book Examination)**

CA Components	Marks	K Level
CIA Test	5 Marks (conducted for 45 marks after 50 days – 3 units)	K2 to K6 as per QP Pattern
Model Exam	7 Marks (Conducted for 75 marks after 85 days) (Each Unit 15 Marks)	
Seminar	4 Marks	K6
Assignment	4 Marks	K5
ICT (Quiz)	2 Marks	K2
Attendance	3 Marks (Attendance 75% - 80% - 1 Mark, 81% - 90 % - 2 Marks, 91% - 100% - 3 Marks)	
Total	25 Marks	

b. Coursera in combination with Core Course:

CA Components	Marks	K Level
Coursera	25 Marks (100 marks from Coursera converted to 25 marks)	K4
CIA Test	25 Marks (conducted for 45 marks from Coursera converted to 25 marks)	K2 to K6 as per QP Pattern
Model Exam	30 Marks (conducted for 75 marks from Coursera converted to 30 marks)	
Assignment	10 Marks	K5
Seminar	10 Marks	K6
Total	100 Marks	

c. Practical

CA Components	Marks	K Level
Lab Performance	7 Marks	K4
Internal Viva-Voce	5 Marks	K4
Model Exam	10 Marks	K5
Attendance	3 Marks	
Total	25 Marks	

For practical courses with 50 marks as ESE, the split-up is 15 marks as internal and 35 as external. Internal conducted for 25 and converted to 15 marks and external conducted for 75 and converted to 35 marks.

d. Cyber Security II

CA Components	Marks	K Level
ICT (Quiz)	50 Marks	K2
Assignment	25 Marks	K5
Project / Case Study / Poster	25 Marks	K6
Total	100 Marks	

e. Advance Learner Course

CA Components	Marks	K Level
Test 1	10 Marks (conducted for 45 marks after 50 days – 3 units)	K2 to K6 as per QP Pattern
Model Exam	15 Marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))	
Total	25 Marks	

f. Comprehensive Examination

Course Title	Marks	K level
Comprehensive Examination	100	K3

g. Project and Viva voce

Components	Marks	K level
Continuous Internal Assessment (CA)	25 Marks	K3, K4, K6
End Semester Examination	75 Marks	K5, K6
Total	100 Marks	

Continuous Internal Assessment (CA)

CA Components	Marks	K Level
I Review - Project Proposal Presentation	5 Marks	K3
II Review - Periodic Review-Progress Evaluation	10 Marks	K4
III Review - Project Report Draft Submission	10 Marks	K6
Total	25 Marks	

End Semester Examination

Components	Marks	K level
Evaluation of the Project Report	25 Marks	K6
Viva Voce	50 Marks	K5
Total	75 Marks	

h. Summer Internship / Field Work / Institutional Training

CA Components	Marks	K Level
Work diary	15 Marks	K3
Report	50 Marks	K6
Viva Voce	25 Marks	K5
Attendance	10 Marks	
Total	100 Marks	

C. Schedule for CA Tests

One test for Continuous Assessment (3 Units) will be conducted on pre-determined date i.e., commencing on the 50th day from the date of reopening. The model exam (5 units) will be conducted after completing 85th working day.

D. Question Paper Pattern and Distribution of Marks for CA – UG

UG : Language, English, Core, Elective, Allied, ALC, Basic Tamil and Advanced Tamil - (First 3 Units)

Description	Marks	Number of questions in K level					
		K1	K2	K3	K4	K5	K6
<i>Questions from each unit comprising of</i>							
One question with a weightage of 2 Marks	3 X 2 = 6	1	2				
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	3 X 5 = 15			1	1	1	
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	3 X 8 = 24			1	1		1
Total	45 Marks						

Skill Enhancement Courses - UG

Description	Marks	Number of questions in K level					
Questions from each unit comprising of		K1	K2	K3	K4	K5	K6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	3 x 5 =15		1	1	1	1	1
One question with a weightage of 10 Marks (Internal Choice at the same CLO level)	3 x 10 = 30			2	1	1	1
Total	45 Marks						

E. Model /End Semester Examination – Question Paper Pattern and Distribution of Marks**UG : Language, English, Core, Elective, Allied, ALC, Basic Tamil & Advanced Tamil**

Description	Marks	Number of questions in K level					
Questions from each unit comprising of		K1	K2	K3	K4	K5	K6
One question with a weightage of 2 Marks	5 x 2 = 10	2	3				
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	5 x 5 =25			2	2	1	
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	5 x 8 =40			2	1	1	1
Total	75 Marks						

ESE Practical Pattern (UG)

The End Semester Examination will be conducted for a maximum of 75 marks with a maximum 15 marks for the record and other submissions if any.

Practical Components	Marks	K level
Practical Execution	60 Marks	K5
Record	15 Marks	K2
Total	75 Marks	

Submission of Record note books for Practical Examinations

Submission of bonafide record note books is mandatory to appear for the practical examination. If a candidate is unable to submit the record note book on valid grounds, she may be permitted to appear for the practical examinations, provided the head of the department certifies that the candidate has performed the experiments prescribed for the course and she will be awarded zero (0) marks for record note book.

Rubrics for Assessments

Rubrics for Assessment

Standard 4-Level Performance Scale

Level	Descriptor	Score Range (Illustrative)
Level 4	Excellent	80–100% of component marks
Level 3	Good	60–79%
Level 2	Satisfactory	40–59%
Level 1	Needs Improvement	Below 40%

1. Theory

End Semester Examination (ESE)

Section	K-Level	Criteria	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
SEC A (Theory / Knowledge)	K1–K2	Knowledge recall & understanding	Thorough understanding across all required cognitive levels	Good understanding, minor gaps	Basic understanding, limited depth	Inadequate or incorrect understanding
SEC B (Application & Analysis)	K3–K5	Problem-solving, application of concepts, analytical reasoning	Accurately applies concepts, strong logical reasoning, handles problems independently	Mostly correct application, minor errors, reasonable reasoning	Partial application, procedural errors, limited reasoning	Unable to apply concepts, incorrect, poor reasoning
SEC C (Comprehensive / Higher-Order Tasks)	K3–K6	Analytical reasoning, creation, problem-solving, innovation	Clear logical reasoning, structured solutions, innovative or optimized solutions	Reasonable logic with minor gaps, mostly correct solutions	Limited reasoning, basic attempt at solution	Poor or no reasoning, incorrect or missing solutions

Continuous Internal Assessment (CIA)

Section	K-Level	Criteria	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
SEC A (Theory / Knowledge)	K1–K2	Knowledge recall & understanding	Thorough understanding across all required cognitive levels	Good understanding, minor gaps	Basic understanding, limited depth	Inadequate or incorrect understanding
SEC B (Application & Analysis)	K3–K5	Problem-solving, application of concepts, analytical reasoning	Accurately applies concepts, strong logical reasoning, handles problems independently	Mostly correct application, minor errors, reasonable reasoning	Partial application, procedural errors, limited reasoning	Unable to apply concepts, incorrect, poor reasoning
SEC C (Comprehensive / Higher-Order Tasks)	K3, K4, K6	Analytical reasoning, creation, problem-solving, innovation	Clear logical reasoning, structured solutions, innovative or optimized solutions	Reasonable logic with minor gaps, mostly correct solutions	Limited reasoning, basic attempt at solution	Poor or no reasoning, incorrect or missing solutions

2. Internal Components – Other Activities

Component	K-Level	Criteria	Level 4	Level 3	Level 2	Level 1
Assignment	K5	Application & Problem Solving	Strong solutions, accurate	Mostly correct	Partial	Incorrect / missing
Seminar / Presentation	K6	Creation, Communication & Analysis	Insightful, professional, confident	Good, minor gaps	Basic	Poor / incomplete
ICT Quiz	K2	Knowledge & Application	Accurate & confident	Mostly correct	Basic	Incorrect
Attendance	—	Participation & Punctuality	Full attendance, punctual	Mostly present	Occasional	Poor / frequently absent

3. Practical

Continuous Internal Assessment (CIA)

Component	Bloom's Level	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
Model Practical (Converted to 10)	K5	Independent execution, accurate results, strong analysis, handles unexpected issues confidently	Minor errors, mostly accurate, guided problem-solving	Performs with guidance, partial understanding, limited analysis	Unable to perform, inaccurate results, no reasoning
Internal Viva	K4	Strong conceptual knowledge, clear reasoning, confident troubleshooting	Good understanding, minor gaps, can handle problems with guidance	Basic understanding, limited problem-solving	Weak knowledge, unable to respond or reason
Lab Performance	K4	Active participation, consistent improvement, skillfully applies concepts	Mostly regular participation, moderate improvement	Irregular, minimal improvement	Rarely participates, no skill growth
Attendance	—	Full attendance, punctual	Mostly present	Occasionally absent	Frequently absent

End Semester Practical Examination (ESE)

Component	Bloom's Level	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
Practical Execution	K5	Accurate execution, proper procedure, precise results, handles unexpected issues confidently	Minor errors, mostly correct, can handle problems with help	Multiple errors, partial results, limited troubleshooting	Incorrect procedure, unable to execute, fails completely
Record Verification	K2	Complete experiments, accurate results, correct interpretation, neat & structured	Minor omissions, minor errors, mostly clear	Incomplete, errors present, basic clarity	Very incomplete, incorrect, untidy
External Viva	K4	Strong theoretical knowledge, clear understanding & application, confident reasoning	Good understanding, minor gaps, partial application	Basic knowledge, limited linkage to experiment	Weak knowledge, unable to explain or apply concepts

4. Projects

Continuous Internal Assessment (CIA)

Component	Bloom's Level	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
Project Proposal Presentation	K3	Clear, focused problem definition; well-defined objectives; feasible plan; confident presentation	Minor gaps in clarity or planning; mostly clear	Broad or partially defined problem; basic objectives; basic presentation	Vague/unclear problem; objectives missing; poor presentation
Periodic Review / Progress Evaluation	K4	Consistent, timely progress; correct application; identifies & resolves issues independently; systematic documentation; proactive	Minor delays, minor guidance needed, mostly updated documentation; moderately proactive	Irregular progress, partial application, needs support, basic documentation	Very limited progress, incorrect application, passive, poor documentation
Project Report Draft Submission	K6	Well-structured report; accurate understanding; adequate data; logical analysis; proper referencing & presentation	Minor structural or conceptual gaps; minor data issues; reasonable analysis; minor formatting issues	Basic structure; partial understanding; limited data; basic analysis; basic formatting	Poorly organized; incorrect understanding; insufficient data; no analysis; poor presentation

End Semester Examination (ESE)

Component	Bloom's Level	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Satisfactory)	Level 1 (Needs Improvement)
Final Project Report Evaluation (External)	K6	Topic relevant & meaningful; accurate application of concepts; adequate & relevant data; logical analysis; effective problem-solving; professional formatting	Mostly relevant; minor conceptual errors; minor gaps in data; mostly logical; reasonable solutions; minor formatting issues	Moderately relevant; basic application; limited data; basic analysis; basic problem-solving; basic formatting	Poor relevance; incorrect application; insufficient data; weak analysis; no solution; poor formatting
External Viva Voce	K5	Thorough understanding; strong linkage to project; logical reasoning; confident & accurate responses; professional communication	Minor gaps in understanding or reasoning; mostly correct answers; acceptable communication	Basic understanding; limited linkage; basic reasoning; limited answers; basic communication	Weak understanding; no linkage; no reasoning; unable to respond; poor communication

SYLLABUS
FIRST SEMESTER

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
CY26C01	Core I: Problem Solving Techniques in C	75	70	5	4

Preamble

- Introduces fundamental problem-solving approaches and programming concepts using the C language.
- It emphasizes algorithmic thinking, logical reasoning, and structured programming techniques required for developing efficient programs.
- Students learn to translate computational problems into algorithms, flowcharts, and C programs using variables, control structures, arrays, functions, pointers, and file handling mechanisms.
- The course also develops analytical abilities required for debugging and optimizing programs. It provides a strong foundation for advanced programming and cyber security-related computing applications.

Prerequisite

Students should possess **basic knowledge of computer fundamentals, logical reasoning, and elementary mathematical concepts** to understand problem-solving approaches and programming logic.

Course Learning Outcomes (CLOs)

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

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall fundamental concepts of problem solving, including algorithms, flowcharts, and basic C constructs such as arrays, functions, pointers, and file handling.	K1
CLO2	Explain key programming concepts in C, including data types, operators, control structures, arrays, pointers and structures and demonstrate problem solving using algorithms and flowcharts.	K2

CLO3	Apply structured programming techniques to develop C programs using control statements, arrays, functions, pointers and file handling mechanism.	K3
CLO4	Analyze problems and design suitable algorithms and modular programs using functions, structures, pointers, and file handling operations.	K4
CLO5	Evaluate and optimize programming solutions using Arrays, functions, pointers, structures, and dynamic memory management techniques.	K5
CLO6	Develop complete C-based applications for real-world problems using modular design, file operations, and dynamic memory allocation.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Problem solving concepts, algorithms, flowcharts, pseudo code	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit II	C basics, data types, operators, input/output, decision and looping	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit III	Arrays, multidimensional arrays, strings, string functions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit IV	Functions, recursion, structures and unions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit V	Pointers, dynamic memory allocation, file handling	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	1	1	1	1	1	1	1	1	1
CLO2	2	2	1	1	1	1	1	1	1	1
CLO3	3	2	2	1	1	1	1	1	1	1
CLO4	2	3	2	1	1	1	1	1	1	1

CLO5	2	2	3	1	1	1	1	1	–	1
CLO6	3	2	3	1	1	1	1	1	1	1

Core I: Problem Solving Techniques in C (CY26C01) (70 Hrs)**Unit I (14 hrs)**

Introduction: Introduction to problem solving Concept – Steps for problem solving - Problem solving techniques — Algorithms – flowcharts – Types of Algorithms – Use flowcharts to represent algorithms – Pseudo code.

Unit II (14 hrs)

Overview of C - Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations -Sulba Sutras-Decision Making and Branching - Decision Making and Looping.

Unit III (14 hrs)

Shloka Arrays: One-Dimensional - Two Dimensional - Multidimensional Arrays-Character Arrays and Strings: Declaring and Initializing String Variables - Reading Strings from Terminal - Writing Strings to Screen - String Handling Functions.

Unit IV (14 hrs)

Chandas -User-Defined Functions: Need - Return Values and Types - Function Calls – Function declaration - Category of Functions - No Arguments and No Return Values - Arguments but No Return Values - Arguments with Return Values - Recursion - Scope Visibility and Life time of Variables Structures and Unions - Definition: Structure Initialization - Comparison of Structure Variables - Arrays of Structures - Arrays within Structures - Unions.

Unit V (14 hrs)

Pointers: Understanding Pointers - Accessing the Address of a Variable - Declaring and Initializing Pointers - Accessing a Variable through its Pointers - Pointers and Arrays. File Management in C: Defining and Opening a File - Closing File - I/O Operations on Files - Dynamic Memory allocation MALLOC, CALLOC, REALLOC.

*** Course Alignment with SDGs: 4**

Text Books

S.No.	Authors	Title	Publisher	Year & Edition
1	Yashwvant Kanetkar	Let Us C: Authentic Guide To C Programming Language	BPB Publications	2020, 17 th Edition

Reference Books

S.No.	Authors	Title	Publisher	Year & Edition
1	Byron Gottfried	Programming with C	Tata McGraw Hill	2018, 4 th Edition
2	E.Balagurusamy	Programming In ANSI C	Tata Mc Graw Hill	2019, 8 th Edition

Related Online References

1. Problem Solving techniques in C – studocu - <https://www.studocu.com/in/document/bengaluru-north-university/bca/problem-solving-techniques-using-c/16264070>

Pedagogy

The course will be delivered using a combination of traditional and learner-centered teaching methods, including:

- Lecture - Chalk and Talk
- PowerPoint presentations
- E-content and digital learning resources
- Numerical problem-solving exercises
- Group discussions
- Assignments
- Quizzes
- Peer learning activities
- Student seminars

Module No.	Topic	CLO Level	K Level	No. of Hours	Content Delivery Methods	Learning Methods
Unit – 1 (14 Hrs)						
1	Introduction: Introduction to problem solving Concept	CLO1, CLO2, CLO3	K1, K2, K3	2	Lecture / Brainstorming	Participatory Learning
2	Steps for problem solving	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Discussion	Experiential Learning
3	Problem solving techniques	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Brainstorming / Lecture	Problem Based Learning
4	Algorithms	CLO1, CLO2	K1, K2	2	Chalk and talk / PPT	Participatory Learning
5	Flowcharts	CLO1, CLO2, CLO3	K1, K2, K3	1	Group Discussion / Lecture	Experiential Learning
6	Types of Algorithms	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Seminar / Quiz	Participatory Learning
7	Use flowcharts to represent algorithms	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT	Experiential Learning
8	Pseudo code	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Quiz	Blended Learning
Unit – 2 (14 Hrs)						
9	Overview of C	CLO1, CLO2, CLO3	K1, K2, K3	2	Discussion / Lecture	Participatory Learning
10	Constants, Variables and Data types	CLO1, CLO2, CLO3	K1, K2, K3	2	Lecture / Peer teaching	Participatory Learning

		CLO4, CLO5, CLO6	K4, K5, K6			
11	Operators and Expressions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Brainstorming / Lecture	Participatory Learning
12	Managing Input and Output Operations	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Chalk and talk / Seminar / PPT	Problem Based Learning
13	Decision Making and Branching	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Chalk and talk / PPT	Participatory Learning
14	Sulba Sutras	CLO1, CLO2, CLO3	K1, K2, K3	2	Lecture	Participatory Learning
15	Decision Making and Looping	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Role Play / PPT	Experiential Learning
Unit – 3 (14 Hrs)						
16	Shloka Arrays: One- Dimensional	CLO1, CLO2, CLO3	K1, K2, K3	1	Flipped classroom / One - Minute Presentation	Participatory Learning
17	Two Dimensional	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Brainstorming	Problem-based Learning
18	Multidimensional Arrays	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Role-Play / Model Making	Experiential Learning
19	Character Arrays and Strings	CLO1, CLO2, CLO3,	K1, K2, K3,	2	Peer Teaching / Flipped Classroom	Participatory Learning

		CLO4, CLO5, CLO6	K4, K5, K6			
20	Declaring and Initializing String Variables	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Demonstration / Peer Teaching	Participatory Learning
21	Reading Strings from Terminal	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Case Thinking/ Presentation	Problem- Based Learning
22	Writing Strings to Screen	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Chalk and talk / PPT	Problem- based Learning
23	Writing Strings to Screen String Handling Functions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Student Seminar / Group Discussion	Participatory Learning
24	String Handling Functions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Class Lecture / PPT	Participatory Learning
Unit – 4 (14 Hrs)						
25	Chandas - User-Defined Functions: Need - Return Values and Types	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / PPT	Experiential Learning
26	Function Calls - Function declaration- Category of Functions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Chalk and Talk / PPT	Participatory Learning
27	No Arguments and No Return Values	CLO1, CLO2, CLO3, CLO4,	K1, K2, K3, K4,	1	Lecture / PPT	Experiential Learning

		CLO5, CLO6	K5, K6			
28	Arguments but No Return Values - Arguments with Return Values	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Discussion / Chalk and Talk	Participatory Learning
29	Recursion	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / PPT	Problem- based Learning
30	Scope Visibility and life of Variables	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Chalk and Talk / PPT	Experiential Learning
31	Structures and Unions - Definition	CLO1, CLO2	K1, K2	1	Chalk and Talk / Assignment	Problem- based Learning
32	Structure Initialization	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Chalk and talk	Experiential Learning
33	Comparison of Structure Variables	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / PPT	Participatory Learning
34	Arrays of Structures - Arrays within Structures	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Group Discussion / PPT	Experiential Learning
35	Unions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Seminar / PPT	Experiential Learning
	Unit – 5 (14 Hrs)					
36	Pointers: Understanding	CLO1, CLO2	K1, K2	1	Demonstration	Experiential Learning

	Pointers					
37	Accessing the Address of a Variable	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	PPT / Chalk and talk	Experiential Learning
38	Declaring and Initializing Pointers	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Discussion	Experiential Learning
39	Accessing a Variable through its Pointers	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Demonstration	Experiential Learning
40	Pointers and Arrays	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Seminar / PPT	Participatory Learning
41	File Management in C: Defining and Opening a File	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Assignment	Participatory Learning
42	Closing File	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Seminar	Participatory Learning
43	I/O Operations on Files	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Discussion	Problem Based Learning
44	Dynamic Memory Allocation	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture	Experiential Learning
45	MALLOC,	CLO1,	K1,	1	Lecture /	Participatory

	CALLOC	CLO2, CLO3, CLO4, CLO5, CLO6	K2, K3, K4, K5, K6		PPT	Learning
46	REALLOC	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / PPT	Participatory Learning

Course Designers & Teaching–Learning Strategies

Course Code & Title	CY26C01, Core I: Problem Solving Techniques in C
Course Designers	Dr. G. Sophia Reena, Dr. K. Geethalakshmi, M. Selvanayaki
Teaching–Learning Strategies	Participatory Learning : 40.91 %
	Experiential Learning : 36.37 %
	Problem-based Learning : 22.72 %

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
AP26C02	Core II: OPERATING SYSTEM	75	70	5	4

Preamble

- Introduces the fundamental concepts and functions of operating systems and their role in managing computer hardware and software resources.
- Emphasizes core operating system mechanisms such as process management, CPU scheduling, synchronization, deadlock handling, and memory management techniques.
- Students learn how operating systems coordinate processes, allocate system resources efficiently, and ensure reliable program execution.
- The course also introduces the Linux operating system environment, focusing on shell usage, command execution, and file system navigation through command-line tools.
- It develops analytical skills required to understand system-level operations and provides a foundation for advanced studies in systems programming, networking, and distributed computing.

Prerequisite

Students should possess basic knowledge of computer fundamentals, system components, and logical reasoning to understand operating system concepts and command-line computing environments.

Course Learning Outcomes (CLOs)

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall the fundamental concepts of operating systems, process scheduling and synchronization, memory management strategies, Linux shell operations, and file system navigation commands	K1
CLO2	Explain OS concepts, interpret scheduling and synchronization, describe memory strategies, understand Linux shell operations, and illustrate file system navigation.	K2
CLO3	Apply OS concepts in process scheduling and synchronization, implement memory management techniques, use Linux shell commands for administration, and perform file system operations in practical case studies.	K3
CLO4	Evaluate scheduling, synchronization, and memory management techniques, assess Linux shell efficiency, and judge file system operations for reliability and performance.	K4
CLO5	Analyze operating system functions, differentiate scheduling and	K5

	synchronization methods, examine memory and virtual memory techniques, compare Linux shell operations, and evaluate file system commands through case studies	
CLO6	Integrate scheduling, IPC, and synchronization for efficient performance and deadlock handling while designing memory management, Linux scripts, and file systems for practical solutions.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Introduction to Operating Systems, System Architecture, Process Concept, Process Scheduling, Interprocess Communication	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit II	CPU Scheduling Algorithms, Synchronization, Critical Section Problem, Semaphores, Deadlocks	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit III	Memory Management, Contiguous Allocation, Paging, Virtual Memory, Page Replacement Algorithms	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit IV	Linux Fundamentals, Shells, Terminal Commands, Command History, Shell Variables, System Administration Case Studies	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit V	Linux File System Navigation, File Management Commands, Meta Characters, File Organization and Storage Management	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	–1	1	1	1	1	1	1	2	1–
CLO2	2	3	1	1	1	1	1	1	1	1
CLO3	1	2	3	1	1	1	1	1	1	1
CLO4	1	3	1	2	1	1	1	1	1	1
CLO5	2	1	1	3	1	1	1	1	1	1
CLO6	1	1–	3	–1	–	1	1	1	2	–1

Core II: OPERATING SYSTEM (AP26C02) (70 Hrs)**UNIT I****14 hrs**

Introduction: Importance and role of operating systems - Computer System Architecture – Operating System Operations. Process Management: Process Concept - Process Scheduling - Interprocess communication.

UNIT II**14 Hrs**

Process Scheduling: Basic Concepts- Preemptive and Non-Preemptive Scheduling - Scheduling Algorithms (FCFS, SJF & Round Robin only). Synchronization: Back ground-The Critical Section Problem-Peterson's Solution- Semaphores- Deadlock: Deadlock Characterization - Methods Handling Deadlocks - Recovery from Deadlock.

UNIT III**14 Hrs**

Memory Management Strategies: Background-Contiguous Memory Allocation-Paging. Virtual Memory Management: Demand Paging - Page Replacement - Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement.

UNIT IV**14 Hrs**

Understanding Linux Is – Becoming a Linux Power User : About Shells and Terminal Windows-Choosing your shell - Running Commands - Recalling Commands Using Command History - Connecting and Expanding Commands -Using Shell Variables.

Case Studies:

Developer Productivity: Evaluating which shell (Bash, Zsh, Fish, etc.) improves workflow efficiency.

System Administration: Performing administrative tasks without relying on a graphical interface.

Command History Utilization: Reducing wasted effort by recalling and reusing commands instead of retyping.

Single Command Execution: Completing tasks efficiently using one well-structured command.

Storage Management : Addressing student complaints about full server storage using shell tools and commands.

UNIT V

14 Hrs

Moving Around the File system : Using Basic File system Commands - Using Meta characters and Operators - Listing Files and Directories - Moving, Copying, and Removing Files.

Case Studies:

Student Navigation Challenge: Evaluating how a student can learn to move between directories in the Linux file system using commands like cd and pwd.

Administrator File Audit: Performing administrative tasks such as checking file permissions, size, and ownership using ls -lh and stat.

Developer File Safety: Ensuring safe modification of files by creating a copy before editing with cp.

File Organization Task: Moving files to the correct directory using mv to maintain proper structure.

Storage Cleanup: Deleting unwanted files safely using rm or safer alternatives like trash-cli to free up storage space.

*** Course Alignment with SDGs: 4**

Text Books

S. No	Authors	Title of the Book	Publisher	Year & Edition
1	Abraham Silberschatz, Peter Baer Galvin, G Gagne	OPERATING SYSTEMS CONCEPTS	Wiley Publishers,	2018,10 th Edn
2	Christopher Negus	LINUX BIBLE	Wiley Publishers,	2010,10 th Edn

Reference Books

S. No	Authors	Title of the Book	Publisher	Year & Edition
1	Archer J harries	Operating System	Tata Mc Graw Hill	2011,2 nd Edn
2	Williams E. Shotts	The Linux Command Line: A Complete Introduction	John Wiley & Sons	2019,2 nd Edn
3	Jason Cannon	Linux for Beginners	Create space Independent Pub	2014,1 st Edn

Related Online References

CASE STUDIES:

1. <https://labex.io/tutorials/shell-how-to-switch-between-bash-and-zsh-shells-in-the-webide-414823>
2. <https://computing.stat.berkeley.edu/tutorial-using-bash/>
3. <https://www.geeksforgeeks.org/linux-unix/cd-command-in-linux-with-examples/>
4. <https://www.penguintutor.com/linux/useful-command-reference>
5. <https://kalitut.com/linux-commands-for-beginners-course/>

Pedagogy

The course will be delivered using a combination of traditional and learner-centered teaching methods, including:

- Lecture - Chalk and Talk
- PowerPoint presentations
- E-content and digital learning resources
- Numerical problem-solving exercises
- Group discussions
- Assignments
- Quizzes
- Peer learning activities
- Student seminars

Course Designers & Teaching–Learning Strategies

Course Code & Title	AP26C02, Core II: Operating System
Course Designers	Dr.V.Deepa, Dr. R.Sivaranjani
Teaching–Learning Strategies	Participatory Learning : 45 %
	Experiential Learning : 36 %
	Problem-based Learning : 19 %

Module No.	Topic	CLO level	K Level	No. of Hrs	Content delivery method	Learning Methods
Unit I 14 Hrs						
1	Introduction: Importance and role of operating systems	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Discussion/ Lecture / Brain storming	Participatory Learning
2	Computer System Architecture	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture /Visual diagrams	Participatory Learning
3	Operating System Operations	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT	Problem-based Learning
4	Process Management:	CLO1, CLO2,	K1, K2,	2	Chalk and talk/ Seminar/ Roleplay/ Discussion	Experiential Learning

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		CLO3, CLO4, CLO5, CLO6	K3, K4, K5, K6			
5	Process Concept	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Discussion/ Lecture	Experiential Learning
6	Process Scheduling	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT//Peerteaching	Problem-based Learning
7	Inter process communication	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / Examples	Experiential Learning
	Unit II (14 Hrs)					

8	Process Scheduling: Basic Concepts-	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT / Discussion	Participatory Learning
9	Preemptive and Non preemptive Scheduling -	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture – Chalk and Talk	Participatory learning
10	Scheduling Algorithms (FCFS)	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture/PPT	Experiential Learning
11	Scheduling Algorithms (SJF)	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / Demonstration	Problem-based Learning
12	Scheduling Algorithms (Round	CLO1,	K1,	1	Chalk and Talk / Seminar/PPT	Problem-Based

	Robin)	CLO2, CLO3, CLO4, CLO5, CLO6	K2, K3, K4, K5, K6			Learning
13	Synchronization – Background	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / PPT	Experiential Learning
14	The Critical Section Problem	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / Demonstration	Experiential Learning
15	Peterson’s Solution	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture/ Chalk & Talk	Problem-based Learning
16	Semaphores	CLO1, CLO2,	K1, K2,	1	Lecture / PPT/ demonstration	Experiential Learning

		CLO3, CLO4, CLO5, CLO6	K3, K4, K5, K6			
17	Deadlock Characterization	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture - Chalk & Talk	Participatory Learning
18	Methods for Handling Deadlocks	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / Case study	Experiential Learning
19	Recovery from Deadlock	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Lecture / Case study	Experiential Learning
	Unit III (14 Hrs)					
20	Memory Management Strategies: Background	CLO1, CLO2,	K1, K2,	2	Lecture / PPT	Participatory Learning

		CLO3, CLO4, CLO5, CLO6	K3, K4, K5, K6			
21	Contiguous Memory Allocation-Paging.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture/ videos	Participatory Learning
22	Virtual memorymanagement - Demand paging -	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Discussion / Video	Participatory Learning
23	Page Replacement	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT	Problem-based Learning
24	Basic Page Replacement	CLO1, CLO2, CLO3,	K1, K2, K3,	2	Lecture / PPT	Participatory Learning

		CLO4, CLO5, CLO6	K4, K5, K6			
25	FIFO Page Replacement	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / PPT	Participatory Learning
26	Optimal Page Replacement	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture using PPT/ Live demonstration	Experiential Learning
	Unit IV (14 Hrs)					
27	Understanding Linux Is	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Video / Observation	Experiential Learning
28	Becoming a Linux Power User : About Shells and Terminal Windows	CLO1, CLO2, CLO3,	K1, K2, K3,	2	Lecture/PPT/ Demonstration	Participatory Learning

		CLO4, CLO5, CLO6	K4, K5, K6			
29	Choosing your shell	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture PPT	Experiential Learning
30	Running Commands	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture/PPT/ Demonstration	Participatory Learning
31	Recalling Commands Using Command History	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture PPT/ Demonstration	Participatory Learning
32	Connecting and Expanding Commands	CLO1, CLO2, CLO3, CLO4,	K1, K2, K3, K4,	2	Lecture/PPT	Experiential Learning

		CLO5, CLO6	K5, K6			
33	Using Shell Variables.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture / Demonstration	Problem- based Learning
	Unit V (14 Hrs)					
34	Moving Around the File system	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture PPT	Experiential Learning
35	Using Basic File system Commands	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Seminar /PPT	Participatory Learning
36	Using Meta characters	CLO1, CLO2, CLO3, CLO4,	K1, K2, K3, K4,	2	Lecture/PPT/ Demonstration	Participatory Learning/

		CLO5, CLO6	K5, K6			
37	Using Operators	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture/PPT/ Demonstration	Participatory Learning/
38	Listing Files and Directories	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Lecture PPT	Problem- based Learning
39	Moving Files.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	1	Video/ Demonstration	Experiential Learning
40	Copying Files	CLO1, CLO2, CLO3, CLO4, CLO5,	K1, K2, K3, K4, K5,	1	Video/ Demonstration	Experiential Learning

		CLO6	K6			
41	Removing Files	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6	K1, K2, K3, K4, K5, K6	2	Video/ Demonstration	Experiential Learning/

Course Code	Course Title	Hours			Credits
		Total	Practical	Examination	
IN26CP1	Core Practical I : Programming in C and LINUX Lab	60	57	3	2

Preamble

- This practical course provides hands-on experience in developing programs using the C programming language.
- It enables students to implement basic programming constructs and structured programming techniques through laboratory exercises.
- The course emphasizes the use of control structures, arrays, functions, structures, pointers, and file operations to solve computational problems. Students gain experience in program development, debugging, and logical reasoning.
- The laboratory activities strengthen problem-solving abilities and practical programming competence.

Prerequisite

- Students should possess basic knowledge of computer operations and introductory programming concepts.

Course Learning Outcomes (CLOs)

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

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall the syntax, structure, data types, and basic programming constructs used in C programs and Linux.	K1
CLO2	Explain the working principles of control structures, arrays, strings, structures, and functions in Linux and C programming.	K2
CLO3	Implement C programs and Linux using control statements, arrays, functions, and string handling techniques to solve simple problems.	K3

CLO4	Analyze program logic and debug errors in Linux and C programs involving structures, pointers, and arrays.	K4
CLO5	Evaluate alternative programming approaches to improve the correctness and efficiency of programs in C and Linux.	K5
CLO6	Develop structured C and Linux programs integrating functions, structures, and file operations to solve computational tasks.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Program 1	Basic Operators	CLO1,CLO2
Program 2	Control Structures	CLO1,CLO2, CLO3
Program 3	Arrays	CLO1,CLO2,CLO3,CLO4
Program 4	Structure	CLO1,CLO2, CLO3,CLO4
Program 5	Arrays within Structure	CLO1,CLO2,CLO3,CLO4
Program 6	String Handling Functions	CLO1,CLO2,CLO3,CLO4, CLO5
Program 7	User Defined Functions	CLO1,CLO2,CLO3,CLO4, CLO5, CLO6
Program 8	Pointers	CLO1,CLO2,CLO3,CLO4, CLO5, CLO6
Program 9	File Operations	CLO1,CLO2,CLO3,CLO4, CLO5, CLO6
Program 10	Install Linux and exercise Linux basic Commands	CLO1,CLO2,CLO3,CLO4, CLO5
Program 11	Exercise Shell variables and environments	CLO1,CLO2,CLO3,CLO4
Program 12	Exercise a shell script to list all of the directory files in a directory	CLO1,CLO2,CLO3,CLO4, CLO5,CLO6
Program 13	Exercise a shell script to find the factorial of a given number.	CLO1,CLO2,CLO3,CLO4, CLO5,CLO6
Program14	Exercise a shell script to find area and	CLO1,CLO2,CLO3,CLO4,

	perimeter	CLO5,CLO6
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Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	1	1	1	1	1	1	1	1	1
CLO2	2	2	1	1	1	1	1	1	1	1
CLO3	3	2	2	1	1	1	1	1	1	1
CLO4	2	3	2	1	1	1	1	1	1	1
CLO5	2	2	3	1	1	1	1	1	1	1
CLO6	3	2	3	1	1	1	1	1	1	1

Core Practical I : Programming in C and LINUX Lab - IN26CP1 57 Hrs**Program List**

- Basic Operators.
- Control Structures.
- Arrays.
- Structure.
- Arrays within structure
- String handling functions.
- User defined functions.
- Pointers.
- File operations.

LINUX PROGRAMMING

- Install Linux and exercise Linux basic Commands
- Exercise Shell variables and environments
- Exercise a shell script to list all of the directory files in a directory
- Exercise a shell script to find the factorial of a given number.
- Exercise a shell script to find area and perimeter

*** Course Alignment with SDGs: 9**

Module No.	Topic	CLO level	K Level	No. of Hours	Content delivery Methods	Learning Methods
1	Basic Operators	CLO1,CLO2	K1,K2	5	Demo, Lab	Participatory Learning
2	Control Structures	CLO1,CLO2, CLO3	K1,K2,K3	5	Demo, Lab	Experiential Learning
3	Arrays	CLO1,CLO2, CLO3,CLO4	K1,K2,K3, K4	6	Demo, Lab	Experiential Learning
4	Structure	CLO1,CLO2, CLO3,CLO4	K1,K2,K3, K4	4	Demo, Lab	Experiential Learning
5	Arrays within Structure	CLO1,CLO2, CLO3,CLO4	K1,K2,K3, K4	4	Demo, Lab	Participatory Learning
6	String Handling Functions	CLO1,CLO2, CLO3,CLO4, CLO5	K1,K2,K3, K4,K5	4	Demo, Lab	Participatory Learning
7	User Defined Functions	CLO1,CLO2, CLO3,CLO4, CLO5, CLO6	K1,K2,K3, K4,K5,K6	4	Demo, Lab	Experiential Learning
8	Pointers	CLO1,CLO2, CLO3,CLO4, CLO5, CLO6	K1,K2,K3, K4,K5,K6	4	Demo, Lab	Problem Based Learning
9	File Operations	CLO1,CLO2, CLO3,CLO4, CLO5, CLO6	K1,K2,K3, K4,K5,K6	4	Demo, Lab	Participatory Learning
			61			

10	Install Linux and exercise Linux basic Commands	CLO1,CLO2, CLO3,CLO4, CLO5	K1,K2,K3 ,K4,K5	3	Demo, Lab	Problem Based Learning
11	Exercise Shell variables and environments	CLO1,CLO2, CLO3,CLO4	K1,K2,K3, K4	4	Demo, Lab	Experiential Learning
12	Exercise a shell script to list all of the directory files in a directory	CLO1,CLO2, CLO3,CLO4, CLO5,CLO6	K1,K2,K3, K4,K5,K6	3	Demo, Lab	Problem Based Learning
13	Exercise a shell script to find the factorial of a given number.	CLO1,CLO2, CLO3,CLO4, CLO5,CLO6	K1,K2,K3, K4	4	Demo, Lab	Experiential Learning
14	Exercise a shell script to find area and perimeter	CLO1,CLO2, CLO3,CLO4, CLO5,CLO6	K1,K2,K3, K4,K5,K6	3	Demo, Lab	Participatory Learning

Pedagogy

- Demonstration of working environment/Tools/Software/Program

Course Designers & Teaching–Learning Strategies

Course Code & Title	IN26CP1, Core Practical I : Programming in C and LINUX Lab
Course Designers	Dr. R. Jeevitha
Teaching–Learning Strategies	Participatory Learning : 20 %
	Experiential Learning : 60 %
	Problem-based Learning : 20 %

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
TH26A03	Generic Elective: Numerical and Statistical Techniques	90	85	5	5

Preamble

- This course introduces fundamental numerical and statistical techniques used for solving mathematical and real-life problems.
- It covers numerical methods for solving linear simultaneous equations, interpolation, differentiation and integration.
- The course also provides a foundation in statistical concepts such as correlation, regression and probability.
- In addition, students learn theoretical probability distributions including binomial, Poisson and normal distributions.
- The course develops analytical and computational skills required for quantitative analysis in various academic disciplines.

Prerequisite

Basic knowledge of elementary algebra, functions, and introductory statistics studied at the higher secondary level.

Course Learning Outcomes (CLOs)

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

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Define the fundamental concepts of numerical methods, correlation, probability and theoretical distributions.	K1
CLO2	Explain the principles of interpolation, numerical differentiation, numerical integration and correlation techniques.	K2
CLO3	Apply numerical methods and statistical techniques to solve simple	K3

	mathematical and statistical problems.	
CLO4	Analyze relationships between variables using correlation, regression and probability concepts.	K4
CLO5	Evaluate suitable numerical or statistical methods for solving given quantitative problems.	K5
CLO6	Develop simple models or solutions using numerical and statistical techniques for real-world situations.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Solution of linear simultaneous equations (Gauss elimination, Gauss Jordan, Gauss Seidel, Gauss Jacobi methods) and interpolation methods (Newton forward and backward).	CLO1, CLO2, CLO3, CLO4, CLO5
Unit II	Numerical differentiation, numerical integration (Newton–Cotes formulas, trapezoidal rule, Simpson’s rules) and Taylor series method.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit III	Skewness, correlation analysis, Karl Pearson’s coefficient, rank correlation, regression analysis.	CLO1, CLO2, CLO3, CLO4, CLO5
Unit IV	Probability concepts, probability calculation, theorems of probability and mathematical expectation.	CLO1, CLO2, CLO3, CLO4, CLO5
Unit V	Theoretical distributions: Binomial, Poisson and Normal distributions.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	1	1	1	1	1	1	1	1	1
CLO2	2	3	1	1	1	1	1	1	1	1
CLO3	3	2	2	1	1	1	1	1	1	1
CLO4	1	3	1	2	1	1	1	1	1	1
CLO5	1	2	1	3	2	1	1	1	1	1
CLO6	1	1	3	2	3	1	1	1	2	1

Generic Elective: Numerical and Statistical Techniques (TH26A03) (85Hrs)**Unit I (17 Hrs)**

Solution of Linear Simultaneous Equations: Gauss elimination - Gauss Jordan - Gauss Seidel and Gauss Jacobi methods -simple problems. Interpolation: Newton Forward and Backward Interpolation Formulae.

Unit II (17 Hrs)

Numerical Differentiation, Formulae for Derivatives: Newton's Forward Difference - Newton's Backward Difference, Numerical Integration: Introduction, Newton-Cotes Quadrature formulas: trapezoidal rule, Simpson's 1/3 and 3/8 rules, Taylor's series method.

Unit III (17 Hrs)

Skewness - Correlation analysis: Introduction - Significance of the study of correlation - correlation and causation - Types of correlation - Methods of studying correlation - Graphic method - Karl Pearson's coefficient of correlation - Coefficient of correlation and probable error - Coefficient of determination - Properties of the coefficient of the correlation - Rank correlation coefficient - Features of Spearman's correlation coefficient, Regression analysis.

Unit IV (16 Hrs)

Probability: Introduction - probability defined - Importance of the concept of probability - Calculation of probability - Theorems of probability (statements only) – Mathematical expectation- Simple problems.

Unit V (18 Hrs)

Theoretical Distributions: Binomial distribution - Poisson distribution and normal distribution (without derivations & proof).

Text Books

S.No.	Authors	Title	Publisher	Year & Edition
1	B.S. Grewal	Numerical Methods in Engineering and Science with Programs in C & C++	Khanna Publishers	2014 & 11 th edition
	Unit I: Chapter III &VII: 3.3, 3.4, 3.5 &7.1-7.3			
	Unit II: Chapter VIII& X: 8.1, 8.2:(1,2),8.4, 8.5:(I, II, III),10.3			
2	S.P.Gupta	Statistical methods	Sultan Chand & Sons Publications	2005 & 43 rd Edition
	Unit III: Volume I: Chapter 9(till measures of skewness),10,11. (pg: 329-341, 377-412, 435-454)			
	Unit IV: Volume-II Chapter 1(till Baye’s theorem) (pg: 751-771)			
	Unit V : Volume-II Chapter2 (pg:805-824, 826-834, 836-856)			

Reference Books

S.No.	Authors	Title	Publisher	Year & Edition
1	P.A.Navanitham	Business Mathematics And Statistics	Jai Publishing Company	2014
2	S.C Gupta and V.K. Kapoor	Fundamentals of Mathematical Statistics	Sultan Chand & Sons Publications	2001 & 10 th revised edition
3	P.Kandasamy, K.Thilagavathy and K.Gunavathy	Numerical Methods	S.Chand and company LTD	Reprint 2007
4	V.K.Kapoor	Fundamentals of Applied Statistics	Sultan Chand & Sons	2020 & 12 th revised edition

Related Online References

<https://nptel.ac.in/courses/111/107/111107105/>

(Lectures by Prof.Ameeya Kumar Nayak and Prof. Sanjeev Kumar,
Department of Mathematics, Indian Institution of Technology
Roorkee)Lecture 02 Gaussian elimination with partial pivoting
Lecture 04 Jacobi and Gauss Seidel methods

Lecture 20 Newton's Forward Difference & Newton's
Backward Difference Lecture 34 Simpsons 1/3rd rule and 3/8
rule <https://nptel.ac.in/courses/111/106/111106112/>

(6 Lectures by Prof.G.Srinivasan, Department of Management Studies,
Indian Institution of Technology Madras)

Lecture 12 Probability

Lecture 13 Rules of probability Lecture 19 Binomial distribution Lecture 20 Poisson
distribution

Module No.	Topic	CLOs	K Level	No. of Hours	Content delivery methods	Learning Methods
		UNIT – I (17 Hrs)				
1	Solution of Linear Simultaneous Equations Introduction	CLO1	K1	1	Lecture – Chalk and Talk/ Group readings	Problem-based Learning
2	Gauss elimination Method	CLO1 CLO2 CLO3	K1 K2 K3	2	Spotters / Lecture Discussion	Experiential Participatory Learning
3	Gauss Jordan Method	CLO1 CLO2 CLO3	K1 K2 K3	3	Lecture – Chalk and Talk ,OER,Spotters	Problem-based Learning,Participatory,Experiential Learning

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4	Gauss Seidel Method	CLO1 CLO3 CLO4	K1 K3 K4	3	Chalk and Talk ,Lecture , spotters	Experiential Learning, Participatory Learning
5	Gauss Jacobi method	CLO3 CLO4 CLO5	K3 K4 K5	2	Lecture – Chalk and Talk/Discussion	Participatory Learning ,Problem-based
6	Interpolation	CLO1 CLO2	K1 K2	1	OER	Participatory Learning
7	Newton Forward Interpolation Formulae	CLO2 CLO3 CLO4 CLO5	K2 K3 K4 K5	2	Lecture – Chalk and Talk/ Group readings	Problem-based Learning ,Participatory Learning
8	Newton Backward Interpolation Formulae	CLO2 CLO3 CLO4 CLO6	K2 K3 K4 K6	3	Lecture – Chalk and Talk , Spotters	Participatory Learning ,Problem based , Experiential Learning
	UNIT – II (17 Hrs)					
9	Numerical Differentiation: Formulae for Derivatives	CLO1 CLO2	K1 K2	1	Lecture – Chalk and Talk/ Group readings	Problem-based Learning
10	Newton’s Forward Difference	CLO2 CLO3 CLO4	K2 K3 K4	2	Lecture – Chalk and Talk ,Spotters	Participatory Learning ,Experiential Learning
11	Newton’s Backward Difference	CLO2 CLO3 CLO4	K2 K3 K4	2	Lecture – Chalk and Talk ,PPT , OER	Participatory Learning

12	Numerical Integration Introduction	CLO1	K1	2	Lecture – Chalk and Talk	Participatory Learning , Problem-based Learning
13	Newton-Cotes Quadrature formulas	CLO1 CLO2	K1 K2	2	Lecture – Chalk and Talk , Spotters	Problem-based Learning , Experiential Learning
14	Trapezoidal rule	CLO2 CLO3 CLO4 CLO5	K2 K3 K4 K5	2	Lecture – Chalk and Talk/ Group readings , OER	Problem-based , Experiential Learning
15	Simpson's 1/3 rules	CLO2 CLO3 CLO4	K2 K3 K4	2	Lecture – Chalk and Talk , Spotters , Seminar	Problem-based , Experiential Learning
16	Simpson's 3/8 rule	CLO2 CLO3 CLO4	K2 K3 K4	2	Lecture / Seminar	Experiential , Problem-based Learning
17	Taylor's series method	CLO2 CLO3 CLO4, CLO6	K2 K3 K4 K6	2	Lecture / OER	Experiential , Problem-based Learning
UNIT – III (18 Hrs)						
18	Skewness	CLO1 CLO2 CLO4	K1 K2 K4	1	Lecture – Chalk and Talk	Participatory Learning
19	Correlation analysis: Introduction	CLO2	K2	1	Lecture PPT	Participatory Learning
20	Significance of the study of correlation	CLO2	K2	1	Video / Observation	Experiential Learning

21	correlation and causation	CLO2	K2	1	Video / Observation	Experiential Learning
22	Types of correlation	CLO2 CLO3	K2 K3	1	Seminar / PPT	Participatory Learning
23	Methods of studying correlation	CLO2 CLO3	K2 K3	1	Lecture – Chalk and Talk	Problem-based Learning
24	Graphic method	CLO3 CLO4	K3 K4	2	Lecture – Chalk and Talk , Spotters	Participatory ,Experiential Learning
25	Karl Pearson's coefficient of correlation	CLO3 CLO4	K3 K4	2	Lecture – Chalk and Talk , Group readings	Participatory ,Problem-based Learning
26	Coefficient of correlation and probable error	CLO2 CLO3 CLO5	K2 K3 K5	1	Lecture PPT	Participatory Learning
27	Coefficient of determination	CLO2 CLO3	K2 K3	1	Demonstration	Experiential Learning
28	Properties of the coefficient of the correlation	CLO2	K2	1	Lecture – Chalk and Talk/ Group readings	Problem-based Learning
29	Rank correlation coefficient	CLO3 CLO4	K3 K4	1	Lecture – Chalk and Talk/ Group readings	Problem-based Learning
30	Features of Spearman's correlation coefficient	CLO3 CLO4	K3 K4	2	Lecture – Chalk and Talk/ Group readings	Problem-based Learning

31	Regression Analysis	CLO2 CLO3 CLO4 CLO6	K2 K3 K4 K5	2	Lecture / Seminar ,PPT	Participatory ,Problem-based Learning
UNIT – IV (17 Hrs)						
32	Probability: Introduction, probability defined	CLO1 CLO2	K1 K2	3	Lecture – Chalk and Talk/ Group readings	Problem-based Learning
33	Importance of the concept of probability	CLO2	K2	1	Research article reading	Problem-based Learning
34	Calculation of probability	CLO2 CLO3	K2 K3	4	Lecture / Seminar ,Group readings , Demonstration	Participatory Learning, Problem-based , Experiential Learning
35	Theorems of probability (statements only)	CLO2 CLO3 CLO4 CLO5	K2 K3 K4 K5	7	Spotters / Lecture - Chalk and Talk ,Group readings ,PPT	Experiential Learning , Problem-based Learning , Participatory Learning
36	Mathematical expectation	CLO2 CLO3 CLO6	K2 K3 K6	2	Lecture – Chalk and Talk/ Group readings , PPT	Problem-based Learning
UNIT – V (19 Hrs)						
37	Theoretical Distributions Introduction	CLO1	K1	1	Lecture – Chalk and Talk/ Group readings	Problem-based Learning

38	Binomial distribution	CLO1 CLO2 CLO3 CLO4 CLO5	K1 K2 K3 K4 K5	5	Lecture /PPT , Demonstration ,Spotters	Participatory , Experiential Learning , Problem-based Learning
39	Poisson distribution	CLO1 CLO2 CLO3 CLO4	K1 K2 K3 K4	4	Discussion ,Demonstration ,Lecture – Chalk and Talk/ Group readings	Participatory Learning, Experiential , Problem- based Learning
40	Normal distribution	CLO1 CLO2 CLO3 CLO4 CLO6	K1 K2 K3 K4 K6	9	Research article reading ,Lecture – Chalk and Talk/ Group readings , Spotters ,Demonstration	Problem-based Learning , Experiential Learning

Pedagogy

The course will be delivered using a combination of traditional and learner-centered teaching methods, including:

- Lecture - Chalk and Talk
- PowerPoint presentations
- E-content and digital learning resources
- Numerical problem-solving exercises
- Group discussions
- Assignments
- Quizzes
- Peer learning activities
- Student seminars

Course Designers & Teaching–Learning Strategies

Course Code & Title	TH26A03, & Generic Elective :Numerical and Statistical Techniques
Course Designers	Dr.J.RejulaMercy , Dr.S.Deepa
Teaching–Learning Strategies	Participatory Learning : 31 %
	Experiential Learning : 26 %
	Problem-based Learning : 43 %

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
NME26ES	Introduction to Entrepreneurship	30	30	-	2

Preamble

- To introduce the basic concepts and importance of entrepreneurship in economic and social development.
- To familiarize students with entrepreneurial traits, types of entrepreneurs, and the process of starting small enterprises.
- To provide awareness about entrepreneurship development programmes, institutional support, and financial assistance available for entrepreneurs.

Prerequisite

- Basic awareness of business activities, economic environment, and interest in entrepreneurial initiatives.

Course Learning Outcomes (CLOs)

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Define the fundamental concepts, characteristics, and types of entrepreneurship and entrepreneurs.	K1
CLO2	Explain the role of entrepreneurship development programmes, institutional support systems, and government incentives for entrepreneurs.	K2
CLO3	Apply creative thinking and innovation techniques to identify entrepreneurial opportunities and solve business problems.	K3
CLO4	Analyze the significance of intellectual property rights and institutional support in promoting entrepreneurial ventures.	K4
CLO5	Evaluate different project ideas and assess their feasibility using basic project appraisal concepts.	K5
CLO6	Develop a basic project report for a small entrepreneurial venture based on identified opportunities.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit –CLO Mapping

Unit	Coverage	Mapped CLOs
Unit 1	Introduction to Entrepreneurship, factors, barriers, entrepreneurial traits and types, steps for starting small industries, MSMEs, social entrepreneurship	CLO1, CLO2
Unit 2	Entrepreneurship Development Programmes, institutional framework (IFCI, ICICI, IDBI, IRBI, EXIM Bank, NSIC, SIDBI, SFC, SIPCOT, TIIC), incentives and subsidies	CLO1, CLO2, CLO3, CLO4
Unit 3	Innovation, types of innovation, creative problem solving, incubators, angel investors, venture capital	CLO1, CLO2 CLO3, CLO4
Unit 4	Intellectual Property Rights – copyright, patents, trademarks, design and registration procedures	CLO1, CLO2, CLO3, CLO4
Unit 5	Project identification and classification, project formulation, project appraisal, project report presentation	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	1	1	1	1	1	1	2	1	1
CLO2	3	2	1	1	1	1	1	2	1	1
CLO3	2	3	2	1	1	1	1	1	1	1
CLO4	1	3	1	2	2	1	1	2	1	1
CLO5	1	2	1	3	2	2	1	2	1	2
CLO6	1	2	2	1	2	3	2	1	2	1

INTRODUCTION TO ENTREPRENEURSHIP - NME26ES (30 HRS)

Unit 1 (6hrs)

Entrepreneurship-Introduction-Factors-Barriers-Entrepreneurial Traits and Types-Steps for starting a Small Industry- MSMEs – Social entrepreneurship.

Unit 2 (6hrs)

Entrepreneurship Development Programmes-Institutional Framework (IFCI, ICICI, IDBI, IRBI, EXIM Bank, NSIC, SIDBI, SFC, SIPCOT AND TIIC) - Role of Incentives and Subsidies

Unit 3 (6hrs)

Innovation - Types –Role- Creative Problem Solving -Incubators - Angel Investors - Venture Capital.

Unit 4 (6hrs)

Intellectual Property- Meaning- Copy Right Registration- Patents- Trademark- Design and Procedure for registration.

Unit 5 (6hrs)

Project Preparation

Project identification and Classification - Project Formulation- Project Appraisal- Project Report Presentation.

Text Books

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication & Edition
1.	Gupta. C.B and Srinivasan.N. P	Entrepreneurial Development	Sultan Chand and Sons	2020
2	Sauhari Vinnie and Bhushan Sudhashu	Innovation Management	Oxford	2014

Reference Books

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication & Edition
1.	KolbBonitaM	Entrepreneurship for the creative and cultural industries	Routedge	2015
2.	P.T.Vijayashree & M.Alagammai	Entrepreneurship and Small Business Management	Margham	2020