CURRICULUM STRUCTURE

SECOND YEAR UG: B. TECH

COMPUTER ENGINEERING

REVISION: FRCRCE-3-26

Effective from Academic Year 2026-27
Board of Studies Approval: 04/03/26
Academic Council Approval 25/06/2025

Dr. Deepak Bhoir Dean Academics	Dr. Sujata P. Deshmukh HOD (Computer)	Dr. Sapna Prabhu Principal

INSTITUTE VISION

Moulding Engineers Who Can Build The Nation

INSTITUTE MISSION

M1: Create an excellent scholastic ambiance for students and faculty, by providing facilities with state-of-the-art technologies and continuously updating based on the needs of user organizations.

M2: Attract, develop and retain teaching faculty of academic excellence, dedication and commitment.

M3: Design the academic administration system to ensure effective teaching-learning process facilitating participation from students and teachers and enabling continuous improvement through evaluation and feedback.

M4: Provide avenues for the holistic development of students to become competent engineers with interpersonal skills, leadership qualities, and social concern.

M5: Maintain economic discipline, continuously work for optimal utilization of resources and resource generation through consultancy to make quality education affordable. Everybody in the organization to be a role model for integrity, upholding ethical values, fairness, and transparency in all dealings.

DEPARTMENT VISION

To be a center of excellence in Computer Engineering education that will produce self-motivated, and globally competent individuals through holistic development.

DEPRATMENT MISSION

M1: Build state-of-the-art infrastructure that can accommodate cutting-edge technology and is constantly updated in response to the needs.

M2: To emphasize on experiential learning and holistic development in order to pursue academic excellence and inculcate research aptitude through high-quality research publications

M3: Enable the students to foster innovative ideas in pace with the emerging technologies

M4: Encourage faculty members to pursue higher education/research and stay abreast with the latest technology.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Apply Computer Science principles and techniques to develop engineering projects in order to achieve client business objectives and/or to conduct fruitful research.

PEO2: Demonstrate excellent interpersonal skills and leadership qualities at their workspace and in the society

PEO3: Successfully work in diverse and multidisciplinary teams, communicate effectively, and find innovative solutions to problems.

PROGRAMME SPECIFIC OUTCOMES

The student will have the ability to

PSO1: Develop Artificial Intelligence and Machine Learning systems.

PSO2: Apply cyber security mechanisms to ensure the protection of information technology assets.

Preamble:

Greetings and congratulations to all the education partners Fr Conceicao Rodrigues College of Engineering for getting autonomous status to the college from the year 2024-25. University Grant Commission vide letter No. F. 2-10/2023(AC-Policy) dated 23rd Nov 2023 conferred the autonomous status to Fr. Conceicao Rodrigues College of Engineering, Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai 400050 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations,2023. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Learner, Indian Society and Industries.

Government of Maharashtra has also directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4th July 2023. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum for 2024-28, a "**H-Tree Model"** of Engineering Education. A unique **"H-Tree Model"** of Engineering Education Curriculum is carefully designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient) and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an **all-rounded** personality with **holistic** approach to education in which learner receives **25% teacher-led learning, 25% peer learning, 25% self-learning and 25% experiential learning**. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science, and mathematics foundation and program core, sequel of electives, Multidisciplinary Minor courses, humanities & management courses and sufficient experiential learning through projects and semester-long industry / research internship along with employable skill-based courses. Learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Learner also gets additional option to choose the kind of degree i.e. Honors or Double Minor or Honors with Research.

Various steps are taken to transform teaching learning process to make learning a joyful experience for students. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units.

Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2024-25

Nomenclature of the courses in the curriculum	
Abbreviation	**Title**
BSESC	Basic Science & Engineering Science Courses
PCPEC	Program Core and Program Elective Courses
MDC	Multidisciplinary Courses
SC	Skill Courses
HSSM	Humanities, Social Sciences and Management
EL	Experiential Learning
LLC	Liberal Learning Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
VSEC	Vocational and Skill Enhancement Course
VSC	Vocational Skill Courses
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
EEMC	Entrepreneurship, Economics and Management Course
IKS	Indian Knowledge System
VEC	Value Education
RM	Research Methodologies
CEFP	Community Engagement or Field Project
ELC	Experiential Learning Courses
PRJ	Project
INT	Internship
CC	Cocurricular Courses
HMM	Honors and Multidisciplinary Minor
DM	Double Minor
BC	Bridge Course

Credit Specification:

- Theory: 1 credit=13 to 15 hrs of teaching
- Lab: 1 Credit=26 to 30 hrs of lab work
- Studio Activities: 1 Credit= 26 to 30 hrs of creative activities
- Workshop Based Activities: 1 Credit=26 to 30 hrs of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit=13 to 15 hrs of participation
- Internship: 1 Credit=Per 2 weeks OR 36 to 40 hrs of engagement
- Field Based Learning/Practices: 1 Credit=26 to 30 hrs of learning activities
- Community Engagement Projects: 1 Credit=26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.

Credit requirements for four different options of the Degrees:

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B.Tech with Multidisciplinary Minor	20	20	22	22	22	22	20	20	168
B.Tech with Double Minor (Multidisciplinary & Specialisation Minor)	20	20 +2*	22 +4 *	22 +4 *	22 +4*	22 +4 *	20 +2$	20 +2$	188
B.Tech with Research and Multidisciplinary Minor	20	20 +2*	22 +4 *	22 +4 *	22 +4*	22 +4 *	20 +2$	20 +2$	188

Optional Credits $ credits (2) to be earned in VII/VIII

Salient Features of Curriculum:

- ✓ Framed as per Government Resolution dated 4th July 2023 in line with National Education Policy (NEP) 2020.
- ✓ Minimum **168** choice-based credit structure with options of Degrees earning additional credits
- ✓ Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning environment having bridge connecting verticals providing unique path for each learner for 3-dimensional growth, Life Long Learning, bridge courses, inclusive model indicating equal distribution of central resources
- ✓ More emphasis on laboratory based and experiential learning
- ✓ More weightage to continuous assessment to reduce examination stress
- ✓ Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework
- ✓ Well balanced curriculum to attain Program Outcomes and skills of 21st century learner
- ✓ Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.
- ✓ Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21st Century

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

UG Computer Engineering Program:

SEM-III

Course Code	Course Vertical	Sub-Vertical	Course Name		Notional Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25BSC12CE05	BSESC	BSC	Discrete Mathematics and Graph Theory	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25PCC12CE05	PCPEC	PCC	Computer Organization and Architecture	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC12CE06	PCPEC	PCC	Data Structures	TH	2	20	30	20	50	100	2	4
				PR	2	50	-	-	-	50	1	
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC12CE07	PCPEC	PCC	Object Oriented Programming with JAVA	PR	2	50	-		-	50	1	1
25OE12CE1X	MDC	OE	1. Law for Engineers 2. Financial Planning, Taxation and Investment	TH	2	100	-		-	100	2	2
				SS/SL	2							
25MDMXX1	MDC	MDM	MDM Course-1	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25MDMXX2	MDC	MDM	MDM Course-2	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25AEC12CE02X	HSSM	AEC	Modern Indian Languages	TH	2	100	--		--	100	2	2
				SS/SL	2							
25VEC12CE01	HSSM	VEC	Human Values and Professional Ethics	TH	1	100	-	--	-	100	1	2
				PR	2						1	
				SS/SL	1							
25CEP12CE01	EL	CEFP	Community Engagement Project	PRJ	4	100	-		-	100	2	2
25DMX1	DM	DM	Double Minor Course	TH	2	20	30	20	50	100	2	4#
				TU	1	50	-	-	-	50	1	
				PR	2	50	-	-	-	50	1	
				SL	2							
25HR02	HR	HR	Honors with Research	SL	8						4	4*
25DM01/25RM01	DM/RM	DM/RM	Introduction to Emerging Technologies	TH	2	100				100	2	2$
Total					**TH:TU:PR:SL 15:0:12:16=43**		**-**		**-**	**1100**	**-**	**22**

/ *- Optional subjects

SEM-IV

Course Code	Course Vertical	Sub-Vertical	Course Name		Notional Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25BSC12CE06	BSESC	BSC	Linear Algebra and Business Statistics	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25PCC12CE08	PCPEC	PCC	Database Management Systems	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC12CE09	PCPEC	PCC	Analysis of Algorithm	TH	2	20	30	20	50	100	2	4
				PR	2	50	-	-	-	50	1	
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC12CE010	PCPEC	PCC	Operating Systems	TH	2	20	30	20	50	100	2	3
				PR	2	50	-		-	50	1	
				SS/SL	2							
25OE12CE2X	MDC	OE	1. Emerging Technology and Law 2. Principles of Management	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25MDMXX3	MDC	MDM	MDM Course-3	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25VSE12CE03	SC	VSEC	Full Stack Development	PR	4	100	-	-	-	100	2	2
25EEM12CE02	HSSM	EEMC	Technology Entrepreneurship	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25VEC12CE02	HSSM	VEC	Technology Innovation for Sustainable Development	TH	1	100	-		-	100	1	2
				PR	2						1	
				SS/SL	1							
25DMX2	DM	DM	Double Minor Course	TH	2	20	30	20	50	100	2	4#
				TU	1	50	-	-	-	50	1	
				PR	1	50	-	-	-	50	1	
				SL	2							
25HR03	HR	HR	Honors with Research	SL	8	-	-	-	-	-	4	4*
BC	BC	BC	MOOC	-	-	-	-	-	-	-	-	2$
Total					**TH:TU:PR:SL 15:0:12:16=43**		**-**		**-**	**1100**	**-**	**22**

SEM-V												
Course Code	Course Vertical	Sub Vertical	Course Name		Notional Hours	Examination Marks					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25PCC13CE19	PCPEC	PCC	Cryptography and System Security	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC13CE21	PCPEC	PCC	Theory of Computer Science	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC13CE22	PCPEC	PCC	Computer Networks	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC13CE14	PCPEC	PCC	Data Warehousing and Mining	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25VSE13CE04	SC	VSEC	Cloud Computing Laboratory	PR	4	100	-	-	-	100	2	2
25PEC13CE1X	PCPEC	PEC	Program Elective Course	TH	2	20	30	20	50	100	2	3
				PR	2	50	-		-	50	1	
				SS/SL	2							
25PECL13CE1X	PCPEC	PEC	Program Elective Laboratory	PR	2	50	-	-	-	50	1	1
25OE13CE3X	MDC	OE	1. Health, Wellness and Psychology 2. Emotional and Spiritual Intelligence	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25MDM4X	MDC	MDM	MDM Course-4	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25DM3X	DM	DM	Double Minor Course	TH	2	20	30	20	50	100	2	4*
				TU	1	50	-	-	-	50	1	
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25HR04	HR	HR	Honors/ with Research	SL	8	-	-	-	-		4	4*
			Total	**TH:TU:PR:SL 14:01:14:15=44**			**-**	**-**		**1100**		**22**

SEM-VI												
Course Code	Course Vertical	Sub-Vertical	Course Name		Notional Hours	Examination Marks					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25PCC13CE15	PCPEC	PCC	Distributed Computing	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC13CE16	PCPEC	PCC	Software Engineering	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PCC13CE17	PCPEC	PCC	Artificial Intelligence Laboratory	PR	2	50	-	-	-	50	1	1
25PCC13CE18	PCPEC	PCC	Mini Project	PRJ	2	50	-	-	-	50	1	1
25PCC13CE23	PCPEC	PCC	Mobile App Development	PR	2	50	-	-	-	50	1	1
25PCC13CE24	PCPEC	PCC	DevOps: Development and Operations Practices Laboratory	PR	2	50	-	-	-	50	1	1
25PCC13CE25	PCPEC	PCC	Advanced Microprocessors	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PEC13CE2X	PCPEC	PEC	Program Elective Course	TH	2	20	30	20	50	100	2	3
				PR	2	50	-	-	-	50	1	
				SS/SL	2							
25PECL13CE2X	PCPEC	PEC	Program Elective Laboratory	PR	2	50	-	-	-	50	1	1
25PCC13CE20	PCPEC	PCC	Competitive Coding	PR	2	50	-	-	-	50	1	1
25OE13CE4X	MDC	OE	Public Relations and Corporate Communication	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25MDM5X	MDM	MDM	MDM Course -5	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25DM4X	DM	DM	Double Minor Course	TH	2	20	30	20	50	100	2	4*
				TU	1	50	-			50	1	
				PR	2	50	-	-	-	50	1	
25HR05	HR	HR	Honors/ with Research	SL	8						4	4*
			Total	**TH:TU:PR:SL 12:0:20:12=44**				**-**	**1100**			**22**

Structure of Credits to be completed in Final Year (SEM-VII and/or SEM-VIII):

SEM-VII/VIII													
Course Code	**Course Vertical**	**Sub-Vertical**	**Course Name**		**Contact Hours**		**Examination Marks (1 Credit=50 Marks)**					**Credits**	
							ISE	**MSE**	**ESE**		**Total**	**Points**	**Total**
									Min	**Max**			
25PEC14CE3X	PCPEC	PEC	Program Elective Course1	TH	2	20	30	20	50	100	2	3	
				PR	2	50	-	-	-	50	1		
25PEC14CE3X	PCPEC	PEC	Program Elective Course2	TH	2	20	30	20	50	100	2	3	
				PR	2	50	-	-	-	50	1		
25PEC14CE3X	PCPEC	PEC	Program Elective Course3	TH	2	20	30	20	50	100	2	3	
				PR	2	50	-	-	-	50	1		
25PEC14CE3X	PCPEC	PEC	Program Elective Course4	TH	2	20	30	20	50	100	2	3	
				PR	2	50	-	-	-	50	1		
25MDM06X	MDC	MDM	MDM Course-6	TH	2	20	30	20	50	100	2	2	
25MDM07X	MDC	MDM	MDM Course-7	TH	2	20	30	20	50	100	2	2	
25RMC14CE01	EL	RM	Essentials of Research Methodology	TH	2	20	30	20	50	100	2	2	
25RMC14CE02	EL	RM	Intellectual Property Rights	TH	2	20	30	20	50	100	2	2	
25PRJ14CE01	EL	PR	Major Project	PRJ	12	300	-	-	-	300	6	6	
25SEM14CE01	PCPEC	PEC	Course Seminar		Online		As per Rubrics for Seminar				2	2	
25INT14CE01	EL	INT	Semester long Internship	PR	36-40 hrs		As Per Internship Manual				12	12	
HXXXCXXX	HMM/DM	HMM/DM	Honors/Minor Degree Course	TH	Online		As Per SWAYAM				8	8*	
HXXXCXXX	HMM/DM	HMM/DM	Honors/Minor Degree Lab (Project)	PR							**2**	**2***	
Total					**TH:TU:PR+PRJ 16:0:8+ 12=36**			**-**		**1200**	**-**	**40+*10**	

@MDM should be **Technical courses** related to **MDM**
Project or Internship is mutually exclusive in SEM-VII or SEM-VIII
Remaining credits can be acquired in SEM-V to SEM-VIII
Online course 1 Credit=4 Week course from SWAYAM can be taken in SEM V to SEM VIII
Online min 8 week course from SWAYAM can be taken in SEM V to SEM VIII to complete 2 credit course (Combination of two 4-week credit courses shall be allowed with prior approval)
* Online min 12 week course from SWAYAM can be taken in SEM V to SEM VIII to complete 3 credit course

List of Program Elective Courses (SEM V and SEM VI):

Sem. V-PCE1 (Th+Pr) Credits 3	Sem.VI-PCE2 (Th+Pr) Credits 3
25PEC13CE11: Blockchain Technology	25PEC13CE21: Decentralized Finance
25PEC13CE12: Deep Learning and Reinforcement Learning	25PEC13CE22: Generative AI
25PEC13CE13: Cyber Security	25PEC13CE23: Digital Forensics
25PEC13CE14: Big Data Analytics	25PEC13CE24: Business Intelligence
25PEC13CE15: Computer Graphics	25PEC13CE25: Augmented Reality and Virtual Reality
25PEC13CE16: Human Machine Interface	25PEC13CE26: UX/UI Design
25PEC13CE17: Geographical Information Systems	25PEC13CE27: Quantum Computing
25PEC13CE18: System Programming with Compiler Construction	25PEC13CE28: Advanced Network Communications

Sem. V- PECL1: (Lab) Credits 1	Sem.VI- PECL2: (Lab) Credits 1
25PECL13CE11: Image Processing Laboratory	25PECL13CE21: Social Media Analytics Laboratory
25PECL13CE12: Natural Language Processing Laboratory	25PECL13CE22: Open-Source Intelligence and Threat Intelligence Laboratory
25PECL13CE13: Industrial IoT Laboratory	25PECL13CE23: Advanced Java Laboratory
25PECL13CE14: Innovative Product Development Laboratory -Phase1 (Start-up)	25PECL13CE24: Innovative Product Development Laboratory -Phase2 (Start-up)
25PECL13CE15: Ethical Hacking Laboratory	25PECL13CE25: Explainable AI Laboratory
	25PECL13CE26: Software Testing and Quality Assurance

List of Modern Indian Language (2 credit) (AEC):

- **25AEC12CE021 Sanskrit for Beginners**
- **25AEC12CE022 Telugu for Beginners**
- **25AEC12CE023 Kannada for Beginners**
- **25AEC12CE024 Tamil for Beginners**

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25BSC12CE05	Discrete Mathematics and Graph Theory	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	20	30	20	50	100		

Pre-requisite Course Codes		BSC11CE01, BSC11CE03
Course Outcomes	CO1	Apply propositional and predicate logic to solve problems and represent mathematical statements
	CO2	Apply algebraic structures of groups, rings, and lattices in the context of discrete mathematics
	CO3	Solve problems with graph algorithms for traversal, shortest paths, and minimum spanning trees
	CO4	Analyze the implications of different types of relations and functions in various mathematical and real-world contexts
	CO5	Apply error-detecting codes to encode and decode binary data.
	CO6	Apply statistics methods to solve real world problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Sets and Propositions:** Finite and Infinite sets, Principle of Inclusion and Exclusion, Proof Templates, Mathematical Induction	1,2,5	4
	1.2	Logic: Logical Connectives, Conditionals and Biconditionals, Well-formed Formulas, Tautologies, Logical Equivalences, Statement functions, Variable and Quantifiers, Free and Bound Variables, Inference Theory of Predicate Calculus, Euclidean Algorithm		
2	2.1	**Relations and functions:** Closure of Relations, Warshall's algorithm, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains and Antichain, Job Scheduling Problem, Relational Databases, and its operations.	1,2,4	4
	2.2	Functions: Composition of Functions, Invertible functions, Recursive functions, , Hashing, Pigeonhole principles		
3	3.1	**Algebraic Structures:** Algebraic structures with one binary operation, Semi group, Monoids, Groups, subgroups, abelian group, Isomorphism	1,2,3	4
	3.2	Algebraic structures with two binary operations: Ring and Field		
4	4.1	**Graph Theory:** The Handshaking Problem, Connectivity and Paths, Matrix representation of graphs, Konigsberg Bridge problem, Eulerian and Hamiltonian graphs, Spanning trees and Minimal spanning trees,	4,5	4
	4.2	Applications: Graph Algorithms, Graph coloring		
	4.3	Case Study: Web Graph, Google Maps		
5	5.1	**Coding Theory**: Encoding, Decoding	4,5	4
	5.2	Discrete Numeric Functions & Generating Functions, Applications in AoA, cryptography, & Optimization		
	5.3	Counting & Combinatorics, Travelling Salesperson's problem		

6	**6.1**	**Statistics**: Role of Statistics in Computer Engineering, Descriptive vs. Inferential Statistics, Types of Data: Categorical and Numerical, Measures of Central Tendency, Measures of Dispersion: Range, Variance, Standard Deviation, Quartiles and Percentiles, Data Visualization Techniques	6	6
	6.2	Probability Distributions, Combinatorics and Permutations, Statistical Inference: Sampling Techniques, Central Limit Theorem, Confidence Intervals		
	6.3	Hypothesis Testing: Null and Alternative Hypotheses, p-values and Significance Levels, Parametric vs. Nonparametric Tests.		
Total				**26**

Module No.	Sr.no	Suggested List of Tutorials/Assignments
1	**1**	Solve question based on set operation, Inference Theory of Predicate Calculus, Euclidean Algorithm
2	**2**	Using innovative teaching method(e.g.think pair share)solve problem based on, Warshall's algorithm, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains and Antichain, Job Scheduling Problem
3	**3**	Discuss real time problems on algebraic structures with one binary operation, Semi group, Monoids, Groups, subgroups, abelian group, Isomorphism
4	**4**	Discuss and solve problem based graph theory such as Web Graph, Google Maps
4	**5**	Explain the adjacency matrix representation of a graph with an example.
5	**6**	Solve questions based on Discrete Numeric Functions & Generating Functions, Counting & Combinatorics
6	**7**	Discuss various applications of statistics with detail mathematical explanation.
6	**8**	Explain Role of Statistics in Computer Engineering.

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. Swapan Kumar Sarkar, "A Textbook of Discrete Mathematics", S. Chand Publishing, Ninth Edition.
2. Gary Haggard, John Schlipf, Sue Whitesides: "Discrete Mathematics for Computer Science, Cengage Learning
3. D.R. Anderson, D.J. Sweeney, T.J Williams, "Statistics for Business and Economics", South-Western, Cengage Learning Publication, 11th Edition.
4. H. K. Dass, "Advanced Engineering Mathematics", S. Chand, 28th Edition.

Course Assessment

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Recommended Books:

1. Rosen Kenneth: "Discrete Mathematics and its applications." , 8th Edition McGraw Hill
2. C L Liu, Mohapatra: "Elements of discrete mathematics: a Computer Oriented approach", 4th Edition, McGraw Hill Education
3. Kolman, Busby, Ross: "Discrete Mathematical Structures", 6th Edition Pearson
4. Doughlas west "Introduction to Graph theory," 2nd Edition Prentice Hall India
5. Gary Haggard, John Schlipf, Sue Whitesides: "Discrete Mathematics for Computer Science", Cengage Learning, 1st Edition
6. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 12th Revised Edition, Sultan Chand & Sons

Suggested CO - PO articulation Matrix

Course Outcomes	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										1	
CO2	3	3										1	
CO3	3	2										1	
CO4	3	2										1	
CO5	3	3										1	1
CO6	3	2										1	1

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Bloom's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
			√		

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
		2	--	2	2	2	--	1	3
25PCC12CE05	Computer Organization and Architecture	Examination Scheme							
			ISE	MSE	ESE			Total	
					Min	Max			
		Theory	20	30	20	50		100	
		Lab	50	--	--			50	

Pre-requisite Course Codes		PCC11CE03
Course Outcomes	CO1	Compare computer architecture models and analyze CPU performance.
	CO2	Represent data in floating point formats and implement algorithms for arithmetic operations.
	CO3	Design control units for microprocessors, considering 8086 architecture as the case study.
	CO4	Classify different types of memory and I/O, and analyze performance of Cache and virtual memory.
	CO5	Analyze performance of parallel processing.
	CO6	Describe enhancements in computer architecture

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Overview of Computer Organization and Architecture**	1	4
	1.1	Introduction of Computer Organization and Architecture, Basic organization of Computer and block level description of the functional units, Von Neumann model, Harvard model, CISC and RISC Processors: Design Philosophy and issues.		
	1.2	CPU Performance measurement: CPI, instruction execution time, MIPS, factor affecting CPU performance		
2		**Data Representation and Arithmetic Algorithms**	2,3,4	4
	2.1	Number representation: Floating point representation, floating point arithmetic, IEEE754 floating point number representation.		
	2.2	Booth's algorithm for multiplication, Restoring and non-restoring division algorithm		
3		**Processor Organization and Control Unit design**	1,2	8
	3.1	CPU Architecture, Register Organization, Instruction formats, basic instruction cycle.		
	3.2	Control unit design: Micro-programmed and Hardwired Control unit, Micro instruction sequencing and execution, micro-operations.		
	3.3	8086 CPU Architecture, Programmer's Model, Memory Segmentation, Memory Banking, addressing modes, instruction set		
4		**Memory Organization and I/O Organization**	1,2,4	6
	4.1	Types of memory: RAM, ROM, Cache Memory hierarchy Cache memory concepts: Principles of locality, Cache mapping,		

		Cache architectures, Cache coherency, Hit ratio, miss ratio, cache memory access time		
	4.2	Virtual Memory: Paging and segmentation, Page tables and translation look aside buffers (TLBs), Page Replacement policies.		
	4.3	I/O interfacing: Parallel port, Serial port, Handshaking, Interrupt handling, Direct memory Access (DMA)		
5		**Introduction to Parallel Processing**	1,2,4	02
	5.1	Introduction to Parallel processing, Flynn's Classification, Amadahl's Law		
	5.2	Pipelining, Pipeline Performance metrics: execution time, speed up, Pipeline Hazards.		
6		**Enhancements in Computer Architecture**	5,6,7	02
	6.1	Superscalar processors, Multi-core processors, GPU Architecture, Clusters		
	6.2	Power efficiency and low Neuro morphic computing and AI accelerators		
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.youtube.com/watch?v=RymIopEDxpI
2. https://www.youtube.com/watch?v=v97HAhwQMj8
3. https://www.youtube.com/watch?v=8Qx6Dr_aKXs
4. https://www.youtube.com/watch?v=PVNAPWUxZ0g
5. https://www.youtube.com/watch?v=-IyB8hBkA9w
6. http://www.digimat.in/nptel/courses/video/106105163/L01.html
7. https://www.geeksforgeeks.org/computer-organization-architecture/arm-processor-and-its-features/
8. https://ebooks.inflibnet.ac.in/csp13/chapter/introduction-to-arm-processor/

Sr.no	Suggested List of experiments
1	Write ALP to Addition of two 8/16/32 numbers
2	Write ALP to for 8/16/32-bit multiplication and division
3	Write ALP based on string instructions (Block transfer using string instructions)
4	Write ALP to sort numbers in ascending/ descending order
5	Write ALP to 3 X 3 Matrix Addition/Multiplication.
6	Assembly language programs using DOS interrupts.
7	Implement Booth's multiplication algorithm.
8	Implement restoring and non-restoring division algorithm.
9	Implement cache mapping techniques using virtual lab.

	(https://share.google/5q5rGIPcKCywzUTOB)
10	Analyse cache performance using simulators. (https://youtu.be/KyVdm6ELKck?si=dN6_AyEWVwDDfsFE)

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Lab:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Recommended Books:

1. Carl Hamacher, Zvonko Vranesic, SafwatZaky,"Computer Organization",Tata McGraw-Hill,5th Edition.
2. William Stallings,"ComputerOrganizationandArchitecture,Pearson,8thEdition.
3. Morris Mano,Computer System Architecture",Pearson,3rdEdition.
4. JohnP.Hayes,"ComputerArchitectureandOrganization",TataMcGraw-Hill,3rdEdition.
5. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI.
6. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer System: The 8086/8088 Family, Architecture, Programming and Design", Prentice Hall
7. Barry B. Brey, "Intel Microprocessors", 8thEdition, Pearson Education India.
8. Douglas Hall, "Microprocessor and Interfacing", Tata McGraw Hill.
9. YanDu,'The Influence and Application of Computer Technologyon Architectural Design", International conference on Network and Information system for computers2022.
10. Yoon Seok Yang, Yongtae Kim, "Recent Trend of Neuromorphic Computing hardware: Intel's Neuromorphic System Perspective", Iternational SoC Design Conference,2020.
11. Mark Barnelli, Courtney Raymond, Lisa Loomis, DarrekI sereau, Daniel Brown, Francesca Vidal, Steven Smiley, "Advanced Ultra Low Power Deep Learning Applications with Neuromorphic Computing", High Performance Extreme Computing,2023

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	--	--	--	--	--	--	--	--	--	--	1	--
CO2	3	2	--	--	3	--	--	--	--	--	--	1	--
CO3	3	--	3	--	--	--	--	--	--	--	--	1	--
CO4	3	--	--	--	3	--	--	--	--	--	--	1	--
CO5	3	--	--	--	--	--	--	--	--	--	--	1	--
CO6	3	--	--	--	--	--	--	2	2	2	2	1	--

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
		2	1	2	3	2	1	1	4
25PCC12CE06	Data Structures	Examination Scheme							
			ISE1	MSE	ESE			Total	
					Min	Max			
		Theory	20	30	20	50		100	
		Lab	50	--	--			50	
		Tutorial	50	--	--			50	

Pre-requisite Course Codes		ESC11CE03
Course Outcomes	CO1	Implement various operations of linear data structures.
	CO2	Implement various operations of non-linear data structures.
	CO3	Implement appropriate searching and hashing techniques on a given problem
	CO4	Apply appropriate data structure to solve different computing problems.

Module No.	Unit No.	Topics	Ref.	Hrs
1	1.1	**Introduction:** Introduction to Data Structures, Concept of ADT, Types of Data Structures: Linear and Nonlinear	1,2,3	3
2	2.1	**Stack and Queue:** **Stack:** Introduction, Stack as ADT, Operations, Implementation using array, Applications of stack: Infix to Postfix conversion, Evaluation of Postfix using stack	1,2,3	5
	2.2	**Queue:** Introduction, Queue as ADT, Operations, Implementation using array, Types of queue - Circular queue, Priority queue, Double ended queue, operations on these queues.	1,2,3	6
3	3.1	**Linked List:** Linked list as an ADT, Types of Linked List: Singly Linked List, Doubly linked list, Circular linked list concept, Operation on Singly and Doubly linked list, Applications of Linked List: Stack and Queue using Linked List. Polynomial representation and addition of two polynomials using Linked List.	1,2,3	8
4	4.1	**Tree:** Basic Terminology, Array and Linked Representation of Binary Tree ADT, Traversal of Binary Tree, Binary Search Tree and operations on it, AVL trees, Rotations, Operations on AVL Tree, Applications of these binary trees. Introduction to B tree and B+ tree.	1,2,3	8
5	5.1	**Graphs:** Basics Terminology, Adjacency List and Adjacency Matrix Representation, Graph traversals BFS and DFS.	1,2,3	5
6	6.1	**Searching Techniques and Hashing:** Linear Search and Binary Search, Hashing: Basic concepts, Hash function, Collision Resolution Techniques.	2,3	4

Total	**39**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.geeksforgeeks.org/dsa/data-structures-and-algorithms-online-quiz/
2. https://leetcode.com/problem-list/linked-list/
3. https://www.geeksforgeeks.org/dsa/real-time-application-of-data-structures/
4. https://www.geeksforgeeks.org/dsa/introduction-to-red-black-tree/
5. https://www.geeksforgeeks.org/dsa/difference-between-min-heap-and-max-heap/
6. https://www.geeksforgeeks.org/dsa/counting-frequencies-of-array-elements/
7. https://www.geeksforgeeks.org/dsa/ternary-search/

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Practical:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Tutorial: Assessment shall be based on five tutorials, with each tutorial carrying 10 marks, evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Exp. No.	Name of the Experiment	CO
1	Implement a given problem using Stack. (Basic and Applications)	CO1
2	Implement a given problem using Queue. (Basic and Applications)	CO1
3	Implement a given problem using Singly Linked List. (Basic and Applications)	CO1
4	Implement a given problem using Doubly Linked List.	CO1
5	Implement a given problem using Binary Search Tree. (Basic and Applications)	CO2
6	Implement Min Heap and Max Heap operations / create a priority queue	CO2,

	using Heap.	CO3
7	Apply graph traversal techniques (BFS and DFS) to solve a given problem.	CO2
8	Implement hash functions with different collision resolution techniques (chaining, open addressing).	CO4
9	Mini Project: Develop a working prototype demonstrating real-life applications of data structures.	CO1, CO2, CO3, CO4

Recommended Books:

1. "Data Structures using C and C++" by Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd edition, Prentice Hall
2. "Data Structures using C", Reema Thareja, Third Edition, Oxford University Press.
3. "Data Structures and Program Design in C++", Robert L. Kruse, Alexander J. Ryba, Prentice-Hall India.
4. "Data Structures and Algorithm in Java", Goodrich and Tamassia, John Wiley and Sons, Sixth Edition 2014. John Wiley & Sons.
5. "Data Structures and Pseudocode approach with C", 2nd Edition by Richard F. Gilberg; Behrouz A. Forouzan, Thomson Publishing.

Online Resources:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://visualgo.net
4. www.leetcode.com
5. www.hackerrank.com
6. www.codechef.com

Suggested CO - PO articulation Matrix

Course Outcomes	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2		2	-	-	2	2	-	2	2	1
CO2	2	2	2		2	-	-	2	2	-	2	2	1
CO3	2	2	2		2	-	-	2	2	-	2	2	1
CO4	2	2	2		2	-	-	3	2	-	2	2	1

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25PCC12CE07	Object Oriented Programming with Java	--	--	2	--	--	1	1
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Lab	50	--	--		50	

Pre-requisite Course Codes		ESC11CE03
Course Outcomes	CO1	Demonstrate Proficiency in Fundamentals of Java
	CO2	Apply Object-Oriented Programming Principles
	CO3	Explore multithreading, File I/O, and exception handling
	CO4	Develop Real world Java Applications

Module No.	Exp. No.	Topics
1	1	Introduction to Java Basics: Overview of Java programming language, setting up the development environment (IDE installation), Writing and executing your first Java program, Understanding variables and data types, Basic input/output operations, Control Structures and Functions **Suggested Experiment List: (Any One)** **Coffee Shop Problem** Develop a program for a coffee shop that calculates the total cost of a customer's order, including taxes and discounts, and prints the receipt. **Temperature conversion tool** Problem Statement: Create a temperature conversion tool that converts Celsius to Fahrenheit and vice versa, based on user input. **Parking Fee Calculator** Problem Statement: Implement a parking fee calculator that calculates the parking charges based on the duration of parking and the type of vehicle.
2	2	Introduction to object-oriented programming (OOP) concepts: Classes and objects in Java, Encapsulation, Association and polymorphism **Suggested Experiment List: (Any One)** **Banking Application** Design a simple banking application that allows users to deposit, withdraw, and check their account balance. **Student Management System** Create a student management system that stores student information (name, roll number, marks) and provides functionality to add, delete, and update student records.
3	3	Inheritance: Types of Inheritance, Interface, Abstract class and methods, super and final keywords **Suggested Experiment List: (Any One)** **Shape Drawing Application** Design a shape drawing application that allows users to draw different shapes (circle, rectangle, triangle) on a canvas and perform operations like resizing and

		rotating. **Employee Payroll Processing** Create a program for managing employee payroll information, including salary calculation, deductions, and tax withholding. Allow HR personnel to add new employees, update salary information, and generate pay stubs.
4	4	Arrays and Vector: Arrays in Java, Vector. **Suggested Experiment List: (Any One)** **Library Management App:** Develop a program for a library that manages book inventory, allowing users to search for books by title or author **Contact Management App:** Build a contact management application that stores contact information (name, phone number, email) and provides features like searching, sorting, and exporting contacts.
5	5	Strings: Introduction to strings and string manipulation **Suggested Experiment List: (Any One)** **String Encoding:** Design a Java application that efficiently compresses a given string using any encoding technique, balancing between compression ratio and computational complexity. **Word Frequency:** Create a Java application for generating word clouds from textual data. Implement algorithms for frequency analysis, word weighting, and layout optimization to produce visually appealing representations of word distributions. **NLP:** Create a Java application for natural language processing that extracts named entities from a text corpus. Implement algorithms for recognizing and categorizing entities such as persons, organizations, locations, and dates.
6	6	Exception Handling: Handling exceptions in Java (try-catch-throw- throws-finally), User defined Exceptions **Suggested Experiment List: (Any One)** **Flight Booking System** Develop a program for a flight booking system that handles exceptions such as invalid input, seat availability, and payment errors. **Transportation Management** Create a Java program for a transportation management system that handles exceptions related to route planning, vehicle breakdowns, traffic congestion, and delivery delays. Implement resilience patterns like circuit breakers and retry mechanisms.
7	7	Multithreading: Introduction to Multithreading- lifecycle, creation of threads. Synchronization and Thread Communication, Handling Thread Interruption and Thread Pools. **Suggested Experiment List: (Any One)** **Chat Application** Develop a real-time chat application that allows multiple users to communicate with each other concurrently using separate threads for sending and receiving messages. **Social Media Platform**

		Build a simple social media platform where users can create profiles, connect with friends, and share posts. Implement features such as news feed, notifications, and privacy settings.
8	8	Introduction to JavaFx: Setting Up a JavaFX Application, Creating UI Elements, Event Handling in JavaFX **Suggested Experiment List: (Any One)** **Inventory management app** Design a simple inventory management system for a retail store that allows employees to add, update, and remove products from inventory using a graphical user interface. **Educational Game:** Create an educational game using JavaFX for teaching complex concepts in mathematics, physics, or computer science. Design engaging gameplay mechanics, interactive tutorials, and challenging puzzles to facilitate learning through exploration and experimentation.
9	9	Database Connection with Java: Setting Up Database Environment (MySQL/PostgreSQL), Establishing Database Connection, Executing SQL Queries, basics of Exception Handling Demonstration-Program on Database Connection and Queries handling
10	10	File Handling: File Input/output with Streams, Serialization and Deserialization, Random Access Files **Suggested Experiment List: (Any One)** **File Master App** Create a file management tool that allows users to organize and manage files and folders on their computer, including operations like creating, deleting, and renaming files. **Weather Forecasting Application** Develop a weather forecasting application that retrieves data from a file and displays current weather conditions and weather stats.
11	11	Mini Project: Defining the problem statement and objectives. Design Class diagram and Implement the idea of Mini Project based on the content of the syllabus(Group of 2-3 students)

Course Assessment:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Recommended Books:

1. Herbert Schildt, "Java: The Complete Reference", Ninth edition, McGraw Hill Education Publication
2. E. Balaguruswamy, "Programming with JAVA", Sixth edition, McGraw Hill Education Publication
3. Kathy Sierra and Bert Bates, "Head First Java: A Brain-Friendly Guide, 2Nd Edition", O'REILLY publication
4. Joshua Bloch, "Effective Java", third edition, Addison-Wesley Professional publication
5. Brian Goetz et al., "Java Concurrency in Practice", first edition, Addison-Wesley Professional publication

6. Mark Heckler, Gerrit Grunwald, José Pereda, Sean Phillips, Carl Dea, "JavaFX 8: Introduction by Example" second edition, Apress publication

Online Repository:

1. Java Course Online for Beginners by Scaler Topics- https://www.scaler.com/topics/course/java-beginners/
2. Object-Oriented Programming in Java by Coursera-https://www.coursera.org/learn/object-oriented-java
3. Java Tutorial for Complete Beginners by Udemy- https://www.udemy.com/course/java-tutorial/
4. Java Programming by Great Learning-https://www.mygreatlearning.com/academy/learn-for-free/courses/java-programming
5. Core Java Basics by UpGrad-https://www.upgrad.com/software-engineering-course/core-java/
6. Practice Java by Building Projects on Udemy-https://www.udemy.com/course/practice-java-by-building-projects/
7. Java for Absolute Beginners by Udemy-https://www.udemy.com/course/java-for-absolute-beginners-learn-java-from-zero/

Suggested CO - PO articulation Matrix

Laboratory Outcomes	**Programme Outcomes (POs)**											**Programme Specific Outcomes* (PSOs)**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	2	-	-	2	-	2	2		
CO2	3	2	2	-	2	-	-	2	-	2	2		
CO3	3	2	2	-	2	-	-	2	-	2	2		
CO4	3	3	3	-	2	2	-	3	3	2	2		

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Level:

Remember	Understand	Apply	Analyse	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE12CE11	Law for Engineers	2	--	--	2	2	--	1	2
		Examination Scheme							
			ISE		MSE	ESE		Total	
		Theory	100		--	--		100	

Pre-requisite Course Codes		--
Course Outcomes	CO1	Explain basic structure of Indian Legal System
	CO2	Demonstrate awareness of principles of contract
	CO3	Describe the legal aspects related to establishment of factory and various legislations related to employees, labours, and workmen's welfare
	CO4	Demonstrate awareness about right to information, intellectual creations from infringement and laws related to energy, food and environment

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Foundation of Legal System**	1,2,3	4
	1.1	Indian Legal System: An Introduction, Human Rights, Fundamental Rights, The Supreme Court of India, Statutory Commissions– NHRC, NCW, NCM, NC-SC/ST etc.,		
	1.2	Representation of Peoples Act 1950, Prevention of Corruption Act, 1988, Understanding the Importance of Stamp Duty		
	1.3	Few Illustrated Cases of Supreme Court of India		
2		**General Principles of Contract: India Contract Act 1872**	2,3	8
	2.1	Contract Law: Agreement and Its Kinds,		
	2.2	Who Can Enter into a Contract, Contract and Its Enforceability, Offer and Acceptance in a Contract,		
	2.3	Essentials of Valid Contract- Lawful Consideration and Lawful Object, Essentials of Valid Contract- Free Consent,		
	2.4	Types of Contract, Contract of Agency, Performance of Contracts, Government Contracts, Standard Form Contracts		
3		**Industrial and Labour Laws**	2,3	8
	3.1	Labour Laws in India: An Overview, Industrial Disputes Act, 1947, Industrial Employment (Standing Orders) Act, 1946		
	3.2	Factories Act, 1948, Industries (Development and Regulation) Act, 1951		
	3.3	Contract Labour (Regulation and Abolition) Act, 1970, Bonded Labour System (Abolition) Act, 1976, Child and Adolescent Labour (Prohibition and Regulation) Act, 1986		
	3.4	Workmens Compensation Act, 1923, Equal Remuneration Act, 1976, Payment of Bonus Act, 1965, Payment of Gratuity Act, 1972, Employees' State Insurance Act, 1948, Employees' Provident Funds and [Miscellaneous Provisions] Act, 1952, Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees' Pension Scheme		

		1995		
	3.5	Apprentices Act, 1961, Maternity Benefit Act, 1961, Fatal Accidents Act, 1855, Trade Unions Act, 1926, Sexual Harassment of Women at Workplace Act, 2013, Collective Bargaining		
4		**Right to Information**	2,3	2
	4.1	Official Secret Act, 1923, Indian Evidence Act, 1872		
	4.2	Right to Information Act, 2005, Impact of Right to Information Act		
5		**Intellectual Property Rights**	2,3	2
	5.1	Types of Intellectual Property, Indian Copyright Act 1957, Indian Trademark Act 1999, Indian Patent Act 1970		
6		**Other Important Laws**	2,3	2
	6.1	Electricity Act 2003, Atomic Energy Act 1962, Motors Vehicle Act 1988, Food Safety and Standards Act 2006, National Food Security Act 2013, Environment Protection Act 1986		
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. N. S. Nappinai, "Technology Laws Decoded," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "Law for Engineers" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "Laws for Engineers", ProCare, 2015.
4. Family Law by Paras Diwan, ALLAHABAD LAW AGENCY, 14th Edition, 2025
5. Avtar Singh's Law of Contract & Specific Relief by Rajesh Kapoor, Eastern Book Company.
6. New Labour and Industrial Laws Bare Act with Short Comments, Diglot Edition 2026 (Law Of Prevention Of Money Laundering) by Whitesmann.
7. Law Relating to Intellectual Property by B L Wadehra, Lexis Nexis.

Self-Learning References:

1. https://www.sci.gov.in**.**
2. https://www.youtube.com/watch?v=skR6Z6TwdcM**.**
3. https://www.youtube.com/watch?v=ZaUePaAuZ4Q
4. https://www.youtube.com/watch?v=cQQHv7mzvHU.
5. https://www.youtube.com/watch?v=eLnXaTCbuAo.
6. https://www.legalserviceindia.com/legal/article-9960-5-types-of-writs-in-indian-constitution**.**
7. https://doe.gov.in/files/inline-documents/DoE_Prevention_sexual_harassment.pdf**.**
8. https://www.greythr.com/notifications/sexual-harassment-of-women-at-workplace-prevention-prohibition-and-redressal-amen.

9. https://cag.gov.in/uploads/cms_pages_files/Vishkha-Guidelines-against-Sexual-Harassment-in-Workplace-061de8308de91c7-65164897.pdf.
10. https://www.mshrc.gov.in › vishakha-guidelines

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	2	3	3	3	3	3	-	-	-
CO2	2	-	-	-	3	2	3	2	2	2	-	-	-
CO3	3	-	-	-	2	2	2	3	3	3	-	-	-
CO4	2	-	-	-	3	2	3	3	2	2	-	-	-

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply	Analyse	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25OE12CE12	Financial Planning, Taxation, and Investment	L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	100	--	--	100			
		Lab	--	--	--	--			

Pre-requisite Course Codes		--
Course Outcomes	CO1	Prepare financial plan by understanding owns need
	CO2	Demonstration awareness of taxation policies and show respect towards government norms and regulations
	CO3	Prepare investment plan by understanding owns futuristic needs
	CO4	Apply financial planning, taxation, and investment strategies to make informed financial decisions.

Financial Planning: It is possible to manage income more effectively through financial planning. Managing income helps to understand how much money is required for tax payments, other expenditures and savings. It increases cash flows by carefully monitoring the spending patterns and expenses. Knowledge of comprehensive financial planning will help students to make right financial decisions in their life. It gives guidance in helping choose the right types of investments to fit needs, personality, and goals of their life. In this activity students need to prepare the financial plan for their life.

Taxation Policies: Taxes are levied in almost every country of the world, primarily to raise revenue for government expenditures, although they serve other purposes as well. The simple fact in economics is that there are certain common public goods and public needs that require some form of government and regulation to provide or promote. Taxation is the way to pay for these common goods. In this activity student will learn various types of taxes like Income tax, Corporate tax, Capital gains, Property tax, Inheritance and Sales tax.

Investments: Investments are important because in today's world, just earning money is not enough. But that may not be adequate to lead a comfortable lifestyle or fulfil our dreams and goals. Money lying idle in the bank account is an opportunity lost. Therefore, students should have a knowledge to invest money smartly to get good returns out of it. This activity will give insight to the students about investment in the form of Stocks, Mutual Funds, Fixed Deposits, Recurring Deposit, Public Provident Fund, Employee Provident Fund and National Saving Schemes.

Methodology: Guest lectures or workshops by professionals shall be arranged on Financial Planning, Taxation and Investments. Invite guest speakers, such as tax professionals or financial advisors, shall conduct a tax planning workshop for students. The workshop can cover topics such as tax-efficient investment strategies, retirement planning, and tax-saving opportunities for individuals and businesses. Students should be engaged in assessment driven activities throughout the course. For better learning outcomes following methods of content delivery via student engagement can be adopted.

Investment Simulation Game: Divide students into groups and have them participate in a simulated investment game. Each group is given a virtual budget to invest in stocks, bonds, mutual funds, or other investment vehicles. Throughout the course, they track the performance of their investments and make decisions based on real-world market trends and economic indicators.
Financial Planning Board Game: Design a board game that simulates the process of financial planning, including setting financial goals, creating budgets, managing debt, and making investment decisions. Students play the game in groups, competing or collaborating to achieve their financial objectives.
Stock Market Simulation: Use online stock market simulation platforms that allow students to buy and sell stocks in a virtual trading environment. They can experiment with different investment strategies, track the performance of their portfolios, and compete against their classmates or other teams.

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.youtube.com/playlist?list=PLU0sI9Xj4NOp1ZlK1h5nPpzSRJ5Y8QSTQ
2. https://srmuniv.digimat.in/nptel/courses/video/110105144/L24.html
   (Structured academic lecture on creating personal financial plans)
3. Search "Budget 2026 India personal finance tax changes" on YouTube for current videos
4. https://digimat.in/nptel/courses/video/110105144/L29.html

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	2	2	2	-
CO2	2	-	-	-	-	-	-	-	-	2	2	2	-
CO3	2	2	-	-	-	-	-	-	-	2	2	2	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply √	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12CE021	Sanskrit for Beginners	2	--	--	2	2	--	--	2

Examination Scheme				
	ISE	MSE	ESE	Total
Theory	100	--	--	100

Pre-requisite Course Codes		Basic Language skills
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Sanskrit Language
	CO2	Apply Vocabulary and grammar skills for day-to-day conversation
	CO3	Developing Speaking and Learning skills
	CO4	Interpret simple Sanskrit sentences, stories, and motivational shlokas with word-by-word meaning.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction: Some Unique characteristics of Sanskrit The Sounds of Sanskrit: Its Alphabet Sentence Construction and Its underlying logic Introduction of Self and Others Basic verbs and some conjugations	1-8	6
2	2.1	Introduction to Genitive (6^{th} Case) Counting and Reading the Time Plural of Pronouns and Nouns Conjugation of Basic Verbs in the Plural Introduction to the Locative (7^{th} Case)	1-8	6
3	3.1	Days of the week, Months, Future Tense Past Tense and More Verbs Introduction to the Accusative (2^{nd} Case) Introduction to the Instrumental (3^{rd} Case)	1-8	6
4	4.1	Introduction to the Ablative (5^{th} Case) Introduction to the Dative (4^{th} Case) Introduction to the Vocative (8^{th} Case)	1-8	6
	4.2	Stories and Motivational Shlok with word by word meaning	1-8	2
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. NCERT – *Sanskrit Textbook (Classical Sanskrit Grammar Basics)*
2. Dr. V. Raghavan – *A Sanskrit Primer*
3. NPTEL / Online Spoken Sanskrit Resources
4. Selected motivational Shlokas from Bhagavad Gita / Subhashitas

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Kumari, S. "Sanskrita Chitrapadakoshah," Mysuru: Bharatiya Bhasha Sansthanam, 1993
2. Samkrita-vyavahaara-sahasri (Samskrit-English), New Delhi: Sanskrita Bharati
3. Sampad, & Vijay, "The Wonder that is Sanskrit" Pondicherry: Sri Aurobindo Society, 2005.
4. Satvlekar, S. D. "Sanskrit Swayam Shikshak," Delhi: Rajpal & Sons, 2013
5. Shastri, V K. "Teach Yourself Samskrit: Prathama Diksha" Delhi: Rashtryia Sanskrita Samsthana, 2012
6. Vishwasa "Abhyāsa-pustakam", New Delhi: Samskrita Bharati, 2014
7. https://onlinecourses.nptel.ac.in/
8. https://www.learnsanskrit.org/

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	–	–	–	–	–	–	–	3	–	3	1	-
CO2	3	–	–	–	–	–	–	–	3	–	3	1	-
CO3	3	–	–	–	–	–	–	–	3	–	3	1	-

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
✓					

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12CE022	Tamil for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		Basic Language skills
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Tamil Language
	CO2	Apply Vocabulary and grammar skills for day to day conversation
	CO3	Developing Speaking and Learning skills
	CO4	Demonstrate conversational skills in Tamil through role-play activities in real-life scenarios.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Tamil Alphabets and Pronunciation** History of Tamil language	1-3	1
	1.2	Learning Tamil Alphabets		1
	1.3	Basic Pronunciation and Oral drills with visual learning		2
	1.4	Greetings and common expressions		2
2	2.1	**Basic Grammar and Sentence Structure** Sentence Construction: Subject, Verb, Object (SVO)	1-3	2
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	**Building Vocabulary for Everyday Conversation** Learning Numerals (Cardinal numbers) 1-20, 100. 200…1000	1-3	2
	3.2	Forming Simple sentences with interactive lessons		3
	3.3	Learning Days of week, Months of the year, Fruit, Food grains, Parts of the Body, Names of Common places like Hospitals, Market place, shops, Saloons...etc.		3
4	4.1	**Daily life and Survival Phrases** Day to day usage of language for daily routines in conversation with Student to Teacher, Vegetable shop vendor, Railway Station, conversation with Auto Drivers, Hospitals …etc.	1-3	3
	4.2	Role Play exercises in common situations		3
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.youtube.com/watch?v=d7QkMiBOZdk&list=PLsRjuO3afXH2oWYCEAXRlQzqtYvcW2rTE
2. https://www.youtube.com/watch?v=1IxAkhSm9pY&list=PL-A5Nigeqt-Urw0dGiFXZv12ghybekVa6
3. https://www.youtube.com/watch?v=Y98WNaJLt8w&list=PLYJDQJC4v7I-v1K50GLAgiNipRs0nlHoo

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Kesav.," A practical course to learn Tamil for Absolute beginners(Standard and Colloquial), Notion Press, 2020
2. Dr. R. Kalidasan, Dr. S. Velayuthan, "English Grammar-An easy way to learn with Tamil Explanation and key, Shanlax publisher, 2019
3. Oxford English-English Tamil Dictionary, Oxford.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	-	–	–	2	–	2	–	–
CO2	–	–	–	–	–	-	–	2	3	–	2	–	–
CO3	–	–	–	–	–	-	–	2	3	–	2	–	–

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12CE023	Kannada for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE		MSE	ESE		Total	
		Theory	100		--	--		100	

Pre-requisite Course Codes		Basic Language skills
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Kannada Language
	CO2	Apply Vocabulary and Grammar skills for day to day conversation
	CO3	Developing Speaking and listening skills
	CO4	Demonstrate conversational skills in Kannada through role-play activities in real-life scenarios.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Kannada Alphabets and Pronunciation** History of Kannada Language	1	1
	1.2	Learning Kannada Alphabets		1
	1.3	Pronunciation and visual learning		2
	1.4	Greetings and Common expressions		2
2	2.1	**Basic Grammar and Sentence Structure with Subject, Verb, Objective (SVO)** Basics of Sentence Formation	1	2
	2.2	Present tense, Past tense, Future tense, and Introduction to Adjectives		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	**Conversation Phrases and Language Vocabulary** Learning Numerals (Cardinal Numbers) 1-20 / 100 -1000	2	2
	3.2	Classified Sentences and Useful expressions		3
	3.3	Learning Days of week, Months of the year, Fruits, Food grains, Parts of the body, Names of common places like Hospitals, markets, shops, saloons, gender, weather, etc.		3
4	4.1	**Developing Language fluency and Proficiency.** Day to day usage of Language for daily routine in conversation with Student to Teacher, vegetable vendor, in Railway station, with Auto driver, in Hospitals, etc.	3	3
	4.2	Role play exercises in common situations		3
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.youtube.com/watch?v=JzMePlfekxw&list=PLOb5Wwt1GhOm5wWhnVT-eP5wTIgkdpDz9
2. https://www.youtube.com/watch?v=MAFZnKkAmKU&list=PLOb5Wwt1GhOmpaOkkCwR8jFwxzbFaerDH
3. https://www.youtube.com/watch?v=RuRmq7VyCaQ&list=PLOb5Wwt1GhOkY5xCbbl_J6Tkd2-YmZ46B

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Upadhaya,U.P & N.K.Krishnamurthy, "Conversational Kannada"Prism Books, 2018 Thomas Hodson, "Grammar of the Kannada or Canarese language", Gyan publishing house, 2020
2. Ramanja Reddy Merugu , "Learn kannada through English" 2021
3. Dr.Prabhu sankara & B.V.Sridhar," Oxford English-English-Kannada dictionary", Oxford Publications.

Suggested CO - PO articulation Matrix:

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	-	–	–	2	–	2	–	–
CO2	–	–	–	–	–	-	–	2	3	–	2	–	–
CO3	–	–	–	–	–	-	–	2	3	–	2	–	–

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels

Remember	Understand	Apply √	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12CE024	Telugu for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	100	--	--	100			

Pre-requisite Course Codes		Basic Language Skills
Course Outcomes	CO1	Demonstrate understanding of the fundamentals of Telugu Language
	CO2	Apply vocabulary and grammar skills for day to day conversation
	CO3	Developing Speaking and Listening skills
	CO4	Demonstrate conversational skills in Telugu through role-play activities in real-life scenarios.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Telugu Alphabets and Pronunciation** History of Telugu language	1	1
	1.2 1.3 1.4	Learning Telugu Alphabets and Symbols Basic Pronunciation Greetings and Common expressions		1 2 2
2	2.1	**Basic Grammar and Sentence Structure** Sentence Structure: Subject , verb, Object (SVO)	2	2
	2.2 2.3	Present tense, Past tense and Future tense Common nouns, Pronouns, Adjectives		2 2
3	3.1	**Conversation Phrases for Daily Situations** Learning numerals (Cardinal Numbers) 1- 20, 100 -1000	3	2
	3.2 3.3	Forming Simple sentences / Listening and Speaking skills Days of week, Months of the year, Gender, Fruits, Parts of the body, Names of common places like hospitals, markets, shops, saloons etc.		3 3
4	4.1	**Common Phrases and Developing Language Fluency and Proficiency** Day to day usage of Telugu language for daily routines in conversation with Student to teacher, Vegetable Shop vendor, Railway passengers, Auto drivers, in Hospitals., etc.	4	3
	4.2	Role Play Exercises in Common situations, presentation on Telugu culture, Telugu scripts, Telugu classical music, Telugu festivals.		3
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Sanjay,D, " Spoken Telugu for Absolute Beginners", Notion Press, 2019.
2. Praveen Ragi, "Learn Telugu Through English .V1" Evincepub Publications, 2020
3. Oxford compact English-English Telugu Dictionary
4. English- Telugu Conversation guide / Aarthi Janyavula , 2018

Suggested CO - PO articulation Matrix:

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	2	–	–	-	–	2	–	–
CO2	–	–	–	–	–	2	–	2	-	–	2	–	–
CO3	–	–	–	–	–	2	–	2	-	–	2	–	–

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25VEC12CE01	Human Values and Professional Ethics [HVPE]	1	--	2	1	1	--	1	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	100	--	--	100			

Pre-requisite Course Codes		
Course Outcomes	CO1	**Explain** the fundamental human rights and values and **demonstrate** their importance in shaping personal and professional behavior.
	CO2	**Describe** the roles and responsibilities of engineering professionals in society.
	CO3	**Analyze** moral and ethical issues in engineering through relevant case studies and **propose** appropriate solutions.
	CO4	**Apply** the principles of human values and professional ethics to contemporary ethical, societal, and global issues.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Background and Approach: Fundamental Rights and Duties**		
	1.1	Fundamental Rights and Duties, Right to Compensation for being Illegally Deprived of one's Right to Life or Liberty, Right to Travel Abroad and Return to one's Country	1	2
	1.2	Promotion of Inter-Religious harmony and inter-faith values, Composite Culture		1
2		**Professional Ethics and Human Values**		
	2.1	Sense of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy Moral dilemmas, Moral Autonomy, Kohlberg's theory Gilligan's theory, Consensus and Controversy, Profession& Professionalism, Models of professional roles, Theories about right action Codes of Ethics, Plagiarism	1-3	3
	2.2	Human Values. Morals, values, and Ethics – Integrity- Academic integrity- Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- Cooperation Commitment Empathy-Self Confidence -Social Expectations.		2
	2.3	Managing conflict- Respect for authority- Collective bargaining- Confidentiality, Role of confidentiality in moral integrity-Conflicts of interest		2
3		**Global Ethical Concerns**		
	3.1	Multinational Corporations- Environmental Ethics- Business Ethics-	4,5	2

		Computer Ethics		
	3.2	Engineers as Expert witnesses and advisors-Moral leadership- case studies		1
Total				**13**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References

1. https://nptel.ac.in/courses/110105097
2. https://nptel.ac.in/courses/109104169
3. https://nptel.ac.in/courses/127106140
4. https://www.coursera.org/learn/work-ethics

Course Assessment:

Activity 1: AICTE & UNESCO's certificate course on Self-directed Emotional Learning for Empathy and Kindness (SEEK) **30 marks**

Link: https://www.framerspace.com/course/seek (Select SEEK self- directed cohort under the category of youth courses)

Activity 2: Quiz and assignments **20 Marks**

Activity 3: AICTE & UNESCO'S certificate course on Social Emotional Learning for Youth Waging Peace (SEL4YWP)- UNESCO **30 Marks**

Link: https://www.framerspace.com/course/ywp?cid=5eaff2c239109c2c12ef8bd3

*Participants need to register themselves in the link https://docs.google.com/spreadsheets/d/1dECtZbAmcPhKKelSEimVv-hzPV7dA_g-Brty2rxC2vE/edit?usp=sharing, before accessing the course content.

Activity 4: Article Discussion, Quiz and Assignments **20 Marks**

Recommended Books:

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United States,2005.
4. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
5. R S Naagarazan, A textbook on professional ethics and human values, New Age International (P) limited,New Delhi,2006.
6. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Suggested CO - PO articulation Matrix

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

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25CEP12CE01	Community Engagement Project	L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Theory	--	--	--		--	
		Lab	100	--	--		100	

Pre-requisite Course Codes		--
Course Outcomes	CO1	Identify and address community needs and challenges which help learners to develop problem-solving skills and creativity in finding innovative solutions.
	CO2	Enhance their cultural competence and ability to work effectively in multicultural settings
	CO3	Analyse complex issues considering multiple view points
	CO4	Demonstrate collaboration, team work, civic engagement, empathy and compassion while engaging directly with community
	CO5	Develop a lifelong commitment to social justice and making a positive impact in the world

This course requires students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

At the end of the course, it is expected that students will have valuable learnings in terms of enhanced communication skills, increased cultural competence, improved critical thinking, leadership skills, collaboration skills, empathy & compassion, civic engagement, problem-solving skills, self-reflection & personal growth and long-term commitment to social justice.

It is expected that 26-30 hours of contact time per credit in a semester (52 to 60 hours in a semester for 2 credits) along with 13-15 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study.

Other Guidelines to students for successful Community Engagement:

Community engagement is the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people It is a powerful vehicle for bringing about environmental and behavioural changes that will improve the health of the community and its members. It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs, and practices.

Community engagement project is different as compared to traditional consultation. It is a regular engagement of community for achieving an identified goal or vision. It recognizes the role of community engagement in its broadest sense in the development of local democracy, while noting that the focus of the report is on the practice of community engagement as it relates to local authority activity.

Communication, diplomacy, patience, and flexibility are essential to engage with a community. For successful engagement conditions include: Shared and defined purpose. Willingness to collaborate. Commitment to contributing. Participation of the right people. Open and credible process. Involvement of a champion with credibility and clout. Ensure that the engagement process is complex but manageable. Initially the team will: Discuss and define the initiative and its potential impact. Set the purpose and goals for community engagement. Define the community. Know and respect the community's characteristics. Develop a relationship with the community, build trust, work with formal and informal leadership, find the community gatekeeper, identify the project champion, meet with the local organizations, and learn the assets and challenges for that community. Find the common interests.

The following four phases provide broad outline for the community engagement process:

Phase-I: Outreach

Go to the community instead of having the community come to you. Invite the stakeholders to a conversation. Create a constructive environment for dialogue allowing time to get to know the participants remembering that the community's time is valuable and must be respected. Identify the person or the organization that has convened the group and will provide initial leadership and organizational management. Outline the purpose and process for the conversation. Use a facilitator when appropriate. Define the issue and why it is important. Outline what is broken and focus on what is working. Is the issue a people problem or a situation problem? Can the problem be solved with technical expertise or will it require something else? Determine the interest and merit in hosting future discussions.

Phase-II: Gather Facts, Brainstorm and Select

Create an environment for discussion where people are comfortable asking questions, expressing doubts, and brainstorming new ideas. Gather the facts related to the issue and its impact. Use a SWOT, appreciative inquire, asset mapping, and other tools during the factfinding stage. Clarify the issue's alignment with the community's values and ethics. Establish the common ground on which conversations will be based. Brainstorm and gather alternative solutions. Ask the "what if" questions. Spend time discussing the options and the potential impact. Allow the process to equip the participants to see the change, feel the change, and then be prepared to change. Select the best practice/solution. If required use decision-making tools to reduce the number of options.

Phase-III: Plan and Review

Write the implementation action plan. Include the evaluation procedure that will answer the question "What will it look like when the change has happened?". Discuss the proposal with the appropriate stakeholders searching for insight and response. Use the feedback to assess and revise the plan. Stay focused on the solution.

Phase-IV: Implement and Evaluate

Implement the plan. Remember, groups want a rapid success. Identify an action that will provide a "meaningful win" within the "immediate reach." Evaluate the impact. Report the status to the community and gather feedback. Revise the plan and evaluate again.

Keep the participants informed through discussion agendas, written summaries of previous discussions, goals/assignments for the next discussion, and progress reports providing accountability for delivering what was promised.

Course Assessment:

ISE:

Activity: Report Submission: 40 Marks

Activity: Report Presentation: 60 Marks

Suggested CO - PO articulation Matrix

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

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
					√

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25BSC12CE06	Linear Algebra and Business Statistics	2	--	--	2	2	--	--	2

Examination Scheme					
	ISE	MSE	ESE		Total
			Min	Max	
Theory	20	30	20	50	100
Lab	--	--	--		--

Pre-requisite Course Codes	BSC11CE01, BSC11CE03 At the end of the course learner will be able to	
Course Outcomes	CO1	Demonstrate basic knowledge about the vector spaces as an algebraic structure.
	CO2	Apply linear programming techniques to solve optimization problems.
	CO3	Analyze and solve optimization problems using appropriate non-linear programming methods.
	CO4	Apply the concept of Correlation and Regression to engineering problems in data science, machine learning, and AI.

Theory:

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Linear Algebra - Vector Spaces**	1,2	**06**
	1.1	Vector spaces		02
	1.2	Subspaces of vector spaces		02
	1.3	Basis and dimension		01
	1.4	The Gram-Schmidt orthogonalization process		01
2		**Linear programming Problems (LPP)**	3,4	**07**
	2.1	Types of solutions, Standard and Canonical of LPP, Basic and Feasiblesolutions, slack variables, surplus variables, Simplex method.		03
	2.2	Artificial variables, Big-M method (Method of penalty)		02
	2.3	Duality, Dual of LPP and Dual Simplex Method		02
3		**Non-linear Programming Problems (NLPP)**	3,4	**06**
	3.1	NLPP with one equality constraint (two or three variables) using themethod of Lagrange's multipliers		02
	3.2	NLPP with two equality constraints		02
	3.3	NLPP with inequality constraint: Kuhn-Tucker conditions		02
4		**Correlation and Regression**	5,6,7	**07**
	4.1	Karl Pearson's Coefficient of correlation (r) and related concepts with problems.		02
	4.2	Spearman's Rank correlation coefficient (R) (Repeated & non		01

		repeated ranks problems)		
	4.3	Lines of regression		02
	4.4	Introduction to multiple linear regression		02
			Total	**26**

Tutorial:

Exp. No.	Suggested List of Tutorials
1	Vector spaces and subspaces
2	Basis and dimension of a vector space
3	LPP: Simplex method and Big M method
4	LPP: Dual of LPP and dual simplex method
5	NLPP: Optimization with equality constraints
6	NLPP: Optimization with inequality constraints
7	Correlation
8	Regression

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Recommended Books:

1. Robert M. Thrall, Leonard Tornheim, "*Vector Spaces and Matrices*", Dover Publications, Inc.
2. Gilbert Strang, "*Linear Algebra for Everyone*", Wellesley Publisher.
3. Prem Kumar Gupta, D. S. Hira, "*Operations Research*", S. Chand and Company Limited, Reprint edition (2017).
4. Hamdy A. Taha, "*Operations Research: An Introduction*", Pearson/Prentice Hall Publisher, 6th edition.
5. Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4nd Edition.
6. H. K. Dass, "*Advanced Engineering Mathematics*", S. Chand, 28th Edition.
7. Erwin Kreysizg, "*Advanced Engineering Mathematics*", John Wiley & Sons, 10th Edition.

Suggested CO - PO articulation Matrix

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

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25PCC12CE08	Database Management Systems	L	T	P	SL	L	T	P	Total
		2	--	2	2	2	--	1	3

Examination Scheme					
	ISE	MSE	ESE		Total
			Min	Max	
Theory	20	30	20	50	100
Lab	50	--	--		50

Pre-requisite Course Codes		25PCC12CE05
Course Outcomes	CO1	Describe various components of DBMS
	CO2	Design ER/EER Model for real life applications and convert it into relational model
	CO3	Apply Relational Algebra operation on a given schema
	CO4	Demonstrate SQL commands for a given task
	CO5	Apply normalization to database design to remove redundancies
	CO6	Describe concurrency control mechanism to achieve Serializability and deadlock Handling

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction Database Concepts**	1,2	02
	1.1	Introduction, Characteristics of databases, File system v/s Database system,		
	1.2	Data abstraction and data Independence, DBMS system architecture, Database Administrator		
2		**Entity–Relationship Data Model**	1,2	04
	2.1	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation,		
	2.2	Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation		
	2.3	Introduction to the Relational Model, ER to relational model rules and problems		
	2.4	Case studies and practice problems		
3		**Relational Algebra**	1,2	04
	3.1	Introduction to relational query language, Role of Relational Algebra in DBMS		
	3.2	Relational Algebra operators and Queries		
	3.3	Conversion of Relational Algebra into SQL		
4		**Structured Query Language (SQL)**	1,2	4
	4.1	Overview of SQL, Data Definition Language Commands, key constraints, Domain Constraints		
	4.2	Data Manipulation commands ,DQL, Aggregate function-group by, having, Views in SQL, joins, Nested and complex		

		queries		
	4.3	Data Control commands, Set and string operations		
	4.4	Triggers, PLSQL		
5		**Relational-Database Design**	1,2	04
	5.1	Pitfalls in Relational-Database designs, Concept of normalization		
	5.2	Function Dependencies, First Normal Form, 2NF, 3NF, BCNF.		
	5.3	Converting Relational Schema to higher normal form		
	5.4	Problems based on Normalization		
6		**Transactions Management and Concurrency and Recovery**	1	04
	6.1	Transaction concept, Transaction states, ACID properties, Transaction Control Commands		
	6.2	Concurrent Executions, Serializability-Conflict and View		
	6.3	Problems based on Conflict and View Serializability		
	6.4	Concurrency Control: Lock-based, Timestamp-based protocols,		
	6.5	Recovery System: Log based recovery, Deadlock handling		
7	**7.1**	NoSQL database concepts: NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system, Replication and sharding, Distribution Models Consistency in distributed data, CAP theorem, Notion of ACID Vs BASE, handling Transactions, consistency and eventual consistency, Types of NoSQL databases: Key-value data store, Document database and Column Family Data store, Comparison of NoSQL databases w.r.t CAP theorem and ACID properties	7	04
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://www.w3schools.com/sql/sql_view.asp
2. https://www.geeksforgeeks.org/sql/sql-views/
3. https://www.hackerrank.com/skills-verification
4. https://www.mongodb.com/resources/basics/databases/nosql-explained
5. https://www.geeksforgeeks.org/dbms/introduction-to-nosql/

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Lab:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Sr.no	Suggested List of experiments
1	Write a problem statement for a selected case study. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model
2	Convert ER/EER model to relational model
3	Create and populate database using Data Definition Language (DDL) and DML Commands for the specified System without integrity constraint.
4	Create and populate database using Data Definition Language (DDL) and DML Commands for the specified System with integrity constraint
5	Perform Simple queries and Date operations
6	Perform Join operations and Complex queries
7	Perform nested sub-queries in SQL
8	To implement PL/SQL and Procedures and Functions
9	To implement Triggers and Cursors
10	To implement Transaction and Concurrency control
11	Mini project based on suggested List of topics

Recommended Books:

1. Korth, Silberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH
4. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning, 5thEdition.
5. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press.
6. G. K. Gupta, Database Management Systems, McGraw Hill, 2012
7. Michael Kaufmann, Andreas Meier, SQL and NoSQL Databases: Modeling, Languages, Security and Architectures for Big Data Management

Online Resources:

1. https://www.db-book.com/db6/slide-dir/index.html- Korth, Slberchatz, Sudarshan, 6th Edition
2. http://www.tutorialspoint.com/sql/
3. https://www.w3schools.com/sql/default.asp
4. http://www.mysqltutorial.org/ or https://www.tutorialspoint.com/postgresql/
5. https://academy.vertabelo.com/course/standard-sql-functions#
6. www.postgresqltutorial.com/postgresql-grouping-sets/
7. www.postgresqltutorial.com
8. https://www.freeprojectz.com/entity-relationship-diagram
9. https://www.w3schools.com/sql/sql_any_all.asp
10. https://www.geeksforgeeks.org/sql-all-and-any/

Further Reading:

1. Pramod Sadalge, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglon Persistence, Addison Wesely/ Pearson
2. Adam Fowler, NoSQL for dummies, John Wiley & Sons, Inc
3. Shashank Tiwari, Professional NOSQL, John Willy & Sons. Inc
4. MongoDB Manual: https://docs.mongodb.com/manual

Suggested CO - PO articulation Matrix

Course Outcomes	**Programme Outcomes (POs)**											**Programme Specific Outcomes* (PSOs)**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	2	-	-	-	-	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	2	2	2
CO3	3	3	2	-	2	-	-	-	-	-	2	2	1
CO4	3	3	2	-	3	-	-	-	-	-	2	2	2
CO5	3	3	3	2	2	-	-	-	-	-	2	1	2
CO6	3	3	2	3	2	2	2	-	-	-	2	1	2

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Level:

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
		2	1	2	3	2	1	1	4
		Examination Scheme							
25PCC12CE09	Analysis of Algorithms		ISE	MSE	ESE			Total	
					Min	Max			
		Theory	20	30	20	50	100		
		Tutorial	50	--	--		50		
		Lab	50	--	--		50		

Pre-requisite Course Codes		25PCC12CS05
Course Outcomes	CO1	Analyze the time and space complexity of algorithms.
	CO2	Apply divide and conquer strategy to solve problems.
	CO3	Apply greedy strategy to solve optimization problems.
	CO4	Apply dynamic programming strategy to solve optimization problems.
	CO5	Apply backtracking and branch and bound strategies to solve problems.
	CO6	Implement various string-matching algorithms to solve pattern matching problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction:** Performance analysis, space and time complexity calculations, Asymptotic notations. **Complexity class**: Solving Recurrence equations using Substitution, Recursion tree and Masters theorem	1,2	10
	1.2	**Divide and Conquer strategy:** General Concept, Quick sort, Merge sort, multiplying long Integers OR Finding minimum and maximum element of an array		
2	2.1	**Greedy Strategy:** General concept, Minimum Coin Change problem, Activity Selection problem. Fractional Knapsack Problem, Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Dijkstra's Algorithm	1,2	8
3	3.1	**Dynamic Programming:** General Method, 0/1 knapsack problem, longest common subsequence, Bellman ford algorithm, Floyd Warshall algorithm, Multistage Graph, Assembly line scheduling	1,2	8
4	4.1	**Backtracking and Branch and bound:** Backtracking: General Method, N-queen problem, Graph coloring Problem, Sum of subsets Branch and Bound: Travelling Salesperson Problem, 15 Puzzle problem	1,2	8
5	5.1	**String Matching Algorithms:** The Naïve string-matching algorithm, The Rabin Karp algorithm, The Knuth-Morris-Pratt algorithm	1,2	5
			Total	**39**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. T. H. Cormen et al., Introduction to Algorithms, PHI.
2. Ellis Horowitz et al., Fundamentals of Computer Algorithms, University Press.
3. Steven S. Skiena, Algorithm Design Manual, Springer.
4. Dasgupta, Papadimitriou, Vazirani, Algorithms, Tata McGraw Hill.
5. S. K. Basu, Design Methods and Analysis of Algorithm, PHI.

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Lab:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Tutorial: Assessment shall be based on five tutorials, with each tutorial carrying 10 marks, evaluated through continuous assessment of analytical thinking, problem-solving skills, logical circuit design, and accuracy of solutions.

Note: i) Programs can be implemented using any programming language.

ii) Time and Space complexity calculation needs to be performed for each algorithm.

Module No.	Exp. No.	Suggested List of experiments
1	1	**Sorting:** Implement and analyze time and space complexity of Modified bubble, Insertion and Selection sort to display exam result of students based on their total marks scored.
	2	**Divide and Conquer:** Implement and analyze time and space complexity of Quick and Merge sort to display records of an employee working in any organization based on their work experience.
	3	**Divide and Conquer: (Any one)** I. Implement and Analyze time and space complexity of multiplying long Integers using divide and conquer strategy.

		II. Implement and Analyze time and space complexity of finding minimum and maximum element of an array using divide and conquer strategy
2	4 5	**Greedy Strategy**: **(Any 2)** I. Identify and implement an algorithm to be used to solve the challenge faced by airline and shipping companies of maximizing revenue while adhering to weight and space constraints when loading cargo onto airplanes or ships. determine the optimal selection and allocation of cargo items based on their values (revenue) and weights, ensuring efficient use of cargo space. II. Identify and implement an algorithm to be used in the construction of communication networks (telephone or internet networks) where a telecommunication company needs to lay down cables to connect several cities to establish a reliable network infrastructure. The company wants to minimize the cost of laying down cables while ensuring that all cities are connected and there is no redundancy in the network. III. Identify and implement an algorithm to be used by vending machines to determine the optimal combination of coins to give as change to customers.
3	6 7	**Dynamic Programming: (Any 2)** I. Identify and implement an algorithm to be used in disaster management and emergency response systems to find the shortest path for emergency vehicles, such as ambulances or fire trucks, to reach affected areas or victims. II. Identify and implement an algorithm to be used to compare DNA /RNA sequences to identify similarities and evolutionary relationships between organisms. III. Identify and implement an algorithm to be used by city planners and urban developers to determine the shortest paths between all pairs of locations, such as residential areas, commercial centers, and public facilities, to improve accessibility, reduce traffic congestion, and enhance urban mobility.
4	8	**Backtracking: (Any 1)** I. Implement N queen problem II. Identify and implement an algorithm to be used for coloring regions on a map such that adjacent regions do not have same color.
5	9	**String Matching:** Identify and implement an algorithm to be used by search engines to quickly locate documents containing specific keywords or phrases, improving search efficiency and response time.

Recommended Books:

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms",PHI Publication, 2nd Edition, 2005.
2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms",2nd Edition, University Press, 2007
3. Steven S. Skiena , "Algorithm Design Manual", Springer Publication, 2nd Edition, 2008

4. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw Hill, 1st Edition, 2006
5. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI, 2nd Edition, 2013.

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.coursera.org/specializations/algorithms
3. https://www.mooc-list.com/tags/algorithms
4. https://www.youtube.com/watch?v=aGjL7YXI31Q&list=PLEbnTDJUr_IeHYw_sfBOJ6gk5pie0yP-0
5. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
6. Algorithm visualization tool https://visualgo.net/
7. LeetCode/ HackerRank platform to solve challenging problems

SUGGESTED CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	2	–	–	–	–	–	–	2	2	–
CO2	3	3	3	2	-	–	–	–	–	–	2	2	–
CO3	3	3	3	2	-	–	–	–	–	–	2	2	–
CO4	3	3	3	2	-	–	–	–	–	–	2	3	–
CO5	3	3	3	2	-	–	–	–	–	–	2	2	–
CO6	3	3	2	2	-	–	–	–	–	–	2	2	1

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Level:

Remember	Understand	Apply	Analyze	Evaluate	Create
			√		

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25PCC12CE010	Operating Systems	L	T	P	SL	L	T	P	Total
		2	--	2	2	2	--	1	3
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	20	30	20	50	100		
		Lab	50	--	--		50		

Pre-requisite Course Codes		
Course Outcomes	CO1	Describe the architecture and functioning of operating systems.
	CO2	Evaluate process scheduling algorithms for efficiency and performance optimization.
	CO3	Apply concurrency and synchronization techniques in software development.
	CO4	Implement and analyze algorithms for memory management and file systems to enhance resource utilization and system performance.
	CO5	Analyze advanced operating system architectures and functionalities through case studies of modern systems

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1	**Overview of Operating Systems-**	1,2, 3,4	4
	1.1	Introduction, Objectives, Functions and Evolution of Operating System		
	1.2	Operating system structures: Layered, Monolithic and Microkernel		
	1.3	Linux Kernel, Shell and System Calls		
2	2	**Process Management-**	1,2, 3,4	6
	2.1	Concept of a Process, Process States, Process Description, Process Control Block		
	2.2	Uniprocessor Scheduling-Types: Preemptive and Non-preemptive scheduling algorithms (FCFS, SJF, SRTN, Priority, RR)		
	2.3	Threads: Definition and Types, Concept of Multithreading		
3	3	**Inter-process Communication and Deadlock Management**	1,2, 3,4	6
	3.1	Concurrency: Principles of Concurrency, Inter-Process Communication, Process Synchronization		
	3.2	Mutual Exclusion: Requirements, Hardware Support (TSL), Operating System Support (Semaphores), Producer and Consumer problem		
	3.3	Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker‟s Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem		

4	**4**	**Memory Management**	1,2, 3,4	6
	4.1	Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation, TLB		
	4.2	Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing		
5	**5**	**File Systems and I/O Management**	1,2, 3,4	6
	5.1	File Systems - File attributes, directory structures, and access methods File allocation techniques: Contiguous, Linked, and Indexed		
	5.2	Disk Scheduling- FCFS, SSTF, SCAN, C-SCAN.		
	5.3	I/O devices, Organization of the I/O Function, Disk Organization, I/O Management and Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK		
	5.4	I/O Management-Device drivers, interrupts, and buffering.		
6	**6**	**Advances in Modern Operating Systems**	5,6, 7,8, 9	2
	6.1	Case Studies- Cloud and Mobile OS, Real-Time and Edge OS, AI and Quantum Computing OS,Modern Linux-Based Systems, Experimental OS		
			Total	**30**

Module No.	**Sr.no**	**Suggested List of experiments**	**Ref.**	**Hrs.**
	1	Implement basic scheduling algorithms	1,2, 3,4	2
	2	Simulate producer-consumer synchronization.	1,2, 3,4	2
	3	Simulate a system with processes and resources to detect and resolve deadlocks using a resource allocation graph.	1,2, 3,4	2
	4	Write a program to simulate page replacement algorithms	1,2, 3,4	2
	5	Write a program to simulate memory allocation techniques.	1,2, 3,4	2
	6	Simulate file allocation techniques	1,2, 3,4	2
	7	Implement disk scheduling algorithms.	1,2, 3,4	2
	8	Implement buffering techniques for a simulated I/O device to manage data streams efficiently.	1,2, 3,4	2
	9	Analyze Linux kernel logs for specific events (e.g., scheduling, I/O operations) using tools like dmesg or syslog.	9	2
	10	Explore OS vulnerabilities using a controlled virtual environment. Analyze patching or mitigation strategies.	1,2, 3,4	2
	11	Simulator based experiments (EduMIPS64, GAIL (General Algorithm Interactive Learning) ,NS-3 etc)	10	2
			Total	**22**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. Distributed Systems: Principles and Paradigms – Andrew S. Tanenbaum & Maarten van Steen
2. Modern Operating Systems – William Stallings
3. Operating System Concepts -Authors: Silberschatz, Galvin & Gagne

Course Assessment:

Theory:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 20 Marks

MSE: 90 minutes 30 Marks written examination based on 50% syllabus

ESE: ESE examination will be written summative examination for 50 marks based on full syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes

Lab:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Recommended Books:

1. Silberschatz A., Galvin P., Gagne G. "Operating Systems Principles", Willey Eight edition
2. Achyut S. Godbole , Atul Kahate "Operating Systems" McGraw Hill Third Edition
3. "Operating System-Internal & Design Principles", William Stallings, Pearson
4. Andrew S. Tanenbaum, "Modern Operating System", Prentice Hall.
5. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
6. "Mobile Operating Systems: Concepts and Practices" by Dr. R. Latha and S. Pavithra
7. "Embedded and Real-Time Operating Systems" by K.C. Wang
8. "Quantum Computing: A Gentle Introduction" by Eleanor Rieffel and Wolfgang Polak
9. "Linux Kernel Development" by Robert Love
10. Official Website of GAIL on GitHub,NS-3 Official Website,EduMIPS64 Official Website

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
2. https://www.scaler.com/topics/course/free-operating-system-course/

Suggested CO - PO articulation Matrix

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

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
		✓			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25OE12CE21	Emerging Technology and Law	L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	100	--	--	100			
		Lab	--	--	--	--			

Pre-requisite Course Codes		--
Course Outcomes	CO1	Recognize the importance of legal technology domain
	CO2	Demonstrate awareness of the laws related to emerging technologies and legal implications of their work
	CO3	Demonstrate understanding of the impact of emerging/contemporary technologies on the legal ecosystem.
	CO4	Demonstrate awareness about company laws, FEMA and few other important acts related to engineering design and consumer protection

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Tech Legal Market**	1	4
	1.1	Legal Marketplace, Impact of Technology on Legal Profession		
	1.2	How technologists can help reshape legal system		
	1.3	Career Development in Legal Tech Domain		
2		**Emerging Technologies and Legal Implications-1**	1	8
	2.1	Cyber Crimes, Cyber Threats and Issues: Information Technology Act 2000		
	2.2	Blockchain and Legal Issues		
	2.3	Legal Implications of Artificial Intelligence		
	2.4	Electronic and Digital Signatures		
	2.5	Implications of Social Media Laws		
3		**Emerging Technologies and Legal Implications-2**	1	6
	3.1	Legal Ecosystem for Autonomous Vehicles and Unmanned Aerial Vehicles (UAV)		
	3.2	Privacy and Data Protection with a Trillion Connected & Cognitive Devices		
	3.3	Legal Ecosystem for 5G		
4		**Company Laws**	2,3	4
	4.1	Companies Act, 1956- Nature and Meaning, Classification of Companies, Incorporation of Companies		
	4.2	Sources of Capital, Board of Directors, Company Meetings		
5		**Regulation and Management of Foreign Exchange**	2,3	2
	5.1	Foreign Exchange Management Act FEMA 1999		
6		**Other Important Laws**	2,3	2
	6.1	Consumer Protection Act, Competition Act 2002, Semiconductor		

		Integrated Circuits Layout-Design Act 2000, Designs Act 2000, Bureau of Indian Standards Act 2016,		
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. N. S. Nappinai, "*Technology Laws Decoded*," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "*Law for Engineers*" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "*Laws for Engineers*", ProCare, 2015.
4. The Information Technology Act, 2000 (21 of 2000) | Bare Act 2026 Edition Paperback – 1 January 2026 by Whitesmann Publishing.
5. 5G and Beyond: Intellectual Property and Competition Policy in the Internet of Things Hardcover – Import, by Jonathan M. Barnett, Cambridge University Press.
6. The LegalTech Book, Editors Akber Datoo, Drago Indjic, Sophia Adams Bhatti, Susanne Chisht by Wiley Publisher.

Self-Learning References:

1. https://www.sci.gov.in.
2. https://www.youtube.com/watch?v=nOquqbljcbU.
3. https://www.youtube.com/watch?v=RRmNJS35T_g.
4. https://www.youtube.com/watch?v=hLqbEG3LQYw.
5. https://www.youtube.com/watch?v=cMqhvJEDDZ8.
6. https://www.youtube.com/watch?v=gVcgD8TNM70.
7. https://www.youtube.com/watch?v=MrW8hiK72Yw.
8. https://www.youtube.com/watch?v=k5jEkTm5GIU.
9. https://www.youtube.com/watch?v=mahDTt_91qc.
10. https://www.indiacode.nic.in/bitstream/123456789/13116/1/it_act_2000_updated.pdf.
11. https://www.youtube.com/watch?v=Ri69oMUGoo4.

Suggested CO-PO-PSO mapping:

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	--	--	--	-	3	2	2	2	3	-	-	-
CO2	2	--	--	--	-	3	2	2	2	3	-	-	-
CO3	3	--	--	--	-	2	2	3	3	3	-	-	-
CO4	3	--	--	--	-	2	2	3	3	3	-	-	-

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level:

Remember	Understand	Apply	Analyse	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25OE12CE22	Principles of Management	L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	100	--	--	100			

Pre-requisite Course Codes	--	
Course Outcomes	After completing the given assignments and experiments, students will be able to:	
	CO1	Explain the evolution of management theories and their relevance today
	CO2	Apply planning tools and techniques to real-world business scenarios
	CO3	Apply effective organizational structures based on business requirements
	CO4	Compare different leadership styles and apply appropriate leadership techniques in various situations.
	CO5	Recognize ethical dilemmas in management and apply responsible decision-making frameworks.
	CO6	Develop critical thinking and problem-solving techniques to organizational issues.

Module No.	Topic	Ref	Hours
1	**Introduction to Management** Definition and Nature of Management: Understanding management as a process and its significance in organizations. Historical Evolution: Exploration of classical management theories, including contributions from Henri Fayol and Frederick Taylor. Managerial Roles and Skills: Analysis of the roles managers play and the skills required at different managerial levels.	1-5	04
2	**Planning** Strategic and Tactical Planning: Differentiating between long-term strategic planning and short-term tactical planning. Decision-Making Processes: Tools and techniques for effective managerial decision-making. Goal Setting and Management by Objectives (MBO): Establishing clear objectives and aligning them with organizational goals	4-7	05
3	**Organizing** Organizational Structure and Design: Examining various organizational structures and their impact on efficiency. Delegation and Authority: Understanding the distribution of authority and responsibility within an organization. Coordination and Communication: Strategies for effective internal communication and	4-7	04

	coordination among departments.		
4	**Leading** Leadership Theories and Styles: Study of different leadership models and their applicability. Motivation Techniques: Exploring theories of motivation and their implementation in the workplace. Team Dynamics and Group Behavior: Insights into managing teams and understanding group behavior.	5-7	05
5	**Control Systems and Processes** Establishing standards and monitoring performance. Financial Controls: Budgeting, financial reporting, and variance analysis. Quality Management: Introduction to quality control techniques and continuous improvement processes.	5-7	04
6	**Contemporary Issues in Management** Ethics and Social Responsibility: The role of ethics in managerial decisions and corporate social responsibility. Globalization and Management: Challenges and strategies in managing international operations. Innovation and Change Management: Managing organizational change and fostering innovation.	5-7	04
	Total		**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://youtu.be/osFplHGCm7U
2. https://youtu.be/d1jOwD-CTLI?si=yCDcWE1X0G8QdZmI
3. https://www.youtube.com/watch?v=kb-D41YUadI
4. https://www.youtube.com/watch?v=DGbayjYs21g
5. https://www.youtube.com/watch?v=iuYlGRnC7J8
6. https://youtu.be/xuGh-jzupzc?si=z70dQZpR00zRRDls
7. https://youtu.be/gnorORQAUzs?si=DxyeXGmVQL_eTFlc
8. https://youtu.be/NY82yptNp5E?si=3u1eqS29j5jAm1oW
9. https://www.youtube.com/watch?v=eG16EmA2Fe0
10. https://www.youtube.com/watch?v=mhkLc0HEtR0
11. https://www.youtube.com/watch?v=x3lWS-M-WWY
12. https://www.youtube.com/watch?v=AdYWkKyKQVE
13. https://www.youtube.com/watch?v=5QJgKCtfAzg
14. https://youtu.be/dItUGF8GdTw?si=go0jnTNywx4n0N0w
15. https://www.youtube.com/watch?v=JGFjkU5ZaSQ
16. https://www.youtube.com/watch?v=PT3BuJTqBAg
17. https://www.youtube.com/watch?v=XTV1aGIn1U4

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks
Note: ISE will be based on Continuous predefined rubrics based evaluation

References:

1. Koontz, H., & Weihrich, H. (2010). Essentials of Management: An International Perspective (8th ed.). McGraw-Hill Education.
2. Robbins, S. P., & Coulter, M. (2017). Management (13th ed.). Pearson Education.
3. Daft, R. L. (2018). Management (13th ed.). Cengage Learning.
4. Stoner, J. A. F., Freeman, R. E., & Gilbert, D. R. (1995). Management (6th ed.). Prentice Hall.
5. Drucker, P. F. (2006). The Practice of Management. HarperBusiness.
6. Academy of Management Journal – Provides peer-reviewed research articles on management theory and practices.
7. Journal of Management Studies – Features cutting-edge research in all fields of management.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2								2	2		
CO2	2	2								2	2		
CO3	2	2						2	2	2			
CO4	2	2					2	2	2	2	2		
CO5	2	2				2	2	2		2	2		
CO6	**2**	**2**					2		2	2	2		

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25VSE12CE03	Full Stack Development Lab	--	--	4	--	--	2	2
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Theory	--	--	--			
		Lab	100	--	--		50	

Pre-requisite Course Codes		ESC11CE03
Course Outcomes	CO1	Demonstrate Foundational Understanding of Web Technologies
	CO2	Develop Proficiency in Frontend Development with React.js
	CO3	Develop Backend Development with Node.js and Express.js
	CO4	Integrate Full-Stack Application Development with MongoDB
	CO5	Deploy Web Applications using MERN Stack

Module No.	Expt. No.	Topics
1		Introduction to Full Stack Development, understanding the client-server architecture. **Static Website Design** Introduction to frontend and backend technologies, HTML5 and CSS3 fundamentals. CSS: web page using CSS (Cascading Style Sheets)
	1	**Suggested Experiments (Any one)** • Build Tourism Website by using HTML5, • CSS3, and Bootstrap. • Personal Portfolio Website • Online Book store
2		**Responsive Website Design** JavaScript Essentials- JavaScript syntax and data types, DOM manipulation and event handling, Functions, closures, and scope.
	2	**Suggested Experiments (Any one)** ● Notes Organizer website ● Build a responsive fitness fuel website by using HTML5, CSS and JavaScript ● Build a Wikipedia Search Application using HTML5, CSS3, JS.
3		**Frontend Frameworks-**MERN stack, Introduction to React.js or Vue.js, Components and props, State management with Redux or Vuex, Routing (Query parameters, Path parameters) and navigation
	3	**Suggested Experiments (Any one)** ● Build an E-commerce application using React JS. ● Food Delivery Application ● Entertainment application like BookMyShow
4		**Backend Frameworks** Development with Node.js or Django or Express.js. Introduction to Node.js or Django framework. Setting up a development environment. Building RESTful

		APIs.
	4	**Suggested Experiments (Any one)** ● Build an E-commerce application using React JS. ● Food Delivery Application ● Entertainment application like BookMyShow
5		Database Management, Relational databases with SQL (MySQL, PostgreSQL), NoSQL databases (MongoDB), Database modelling and design.
	5	**Suggested Experiments (Any one)** ● Content Management System (CMS) ● Task Management Application ● Online Learning Platform (Employ a relational database to manage user accounts, course details, lesson content, user progress, and forum posts.)
6	**6**	**Design Assignment** Add features to any existing web application (e.g., Shopify, WordPress, WooCommerce, Twitter, Drupal, Joomla, Airbnb etc.)
7	**7**	**Mini Project:** Working on a full-stack project from start to finish. Create a GitHub link to showcase a completed project. Peer review and feedback sessions.

Course Assessment:

Lab:

ISE: will be conducted for coding assignments and quizzes, Project development and presentation (Mini Project). Continuous pre-defined rubrics-based evaluation for **100 marks.**

Recommended Books:

1. HTML & CSS: The Complete Reference Thomas A. Powell, Fifth Edition, Tata McGraw Hill
2. WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition, 2019
3. Full-Stack React Projects: Learn Mern Stack Development, Shama Hoque, Second Edition, Packt Publishing Limited, 2020
4. The Full Stack Developer, Chris Northwood, First Edition, Apress publication, 2018
5. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB, AZAT MARDAN, Second Edition, Apress publication.
6. Learning SQL: Generate, Manipulate, and Retrieve Data, Alan Beaulieu, Third Edition
7. O'Reilly publication.
8. MongoDB: The Definitive Guide. Shannon Bradshaw, Kristina Chodorow, and Michael Dirolf, Second Edition, O'Reilly publication

Online Resources:

1. Web links and Video Lectures (e-Resources)
   https://onlinecourses.swayam2.ac.in/aic20_sp11/preview
2. https://www.w3.org/html/
3. http://www.htmlref.com/
4. http://w3schools.org/
5. http://www.tutorialspoint.com/css/

Suggested CO-PO-PSO mapping:

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

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Bloom's Level:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12CE02	Technology Entrepreneurship	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		--
Course Outcomes	CO1	Identify entrepreneurial opportunities through self-discovery and application of effectuation
	CO2	Develop feasible solutions to real-world problems and formulate value propositions using tools such as the Value Proposition Canvas.
	CO3	Design and present a business model using the Lean Canvas by integrating basic concepts of finance, marketing, and operations.
	CO4	Apply the procedures involved in company formation including promoters, capital, directors, registration, and branding.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Opportunity Discovery**	1	6
	1.1	Self-discovery		
	1.2	Effectuation Principle		
	1.3	Identification of problem worth solving		
	1.4	Looking for solutions		
	1.5	Present the problem		
2		**Value Proposition Canvas and Business Model**	2,3	7
	2.1	Craft your value proposition		
	2.2	Presentation of Value Proposition Canvas		
	2.3	Business Model and Lean Approach (Finance, Marketing, Operations)		
	2.4	Presentation of Lean Canvas		
3		**Business Plan**	4	6
	3.1	Creation of Business Plan		
4		**Company Formation**	5	7
	4.1	Promoters, Capital, Shareholders		
	4.2	Directors, DIN		
	4.3	Company Name, Registrations		
	4.4	Branding		
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.

2. Evaluation of the self-learning components is carried out in all the evaluation components.

Self-Learning References:

1. https://youtu.be/2VvvRmqwMrE?si=39QsFVpOVZK7gh2m
2. https://effectuation.org/the-five-principles-of-effectuation
3. https://youtu.be/aAg3pw9Z358?si=K6NwpjtfB8yhUzds
4. https://youtu.be/3aHj-RQn3SI?si=Na2wUEbsAHUACaFf
5. https://www.deckrooster.com/
6. https://youtu.be/VTS3yyWN3zA?si=CaiwP-atSI-YA4MM
7. https://youtu.be/iBAvFEKPCNo?si=WPH5hsJ0luBgZ5vB
8. Management of Tech Key to Wealth Creations
9. EBusiness eCommerce Management – dave Chaffey
10. Principles of Effectuation – Dr Saras Saraswathy

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Sarasvathym "Elements of Entrepreneurial Expertise (New Horizons in Entrepreneurship Series)" Edward Elgar Publishing.
2. Alexander Osterwalder "Business Model Generation :A Handbook for Visionaries, Game Changers, and Challengers"
3. Alex Osterwalder, Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadakos "Value Proposition Design: How to create Products and Services Customers Want"
4. Garrett Sutton "Writing Winning Business Plans"
5. M.C. Bhandari "Company Law Procedures" LexiNexis, 2018

Suggested CO - PO articulation Matrix

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

Legends:- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms's Levels:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25VEC12CE02	Technology Innovation for Sustainable Development	L	T	P	SL	L	T	P	Total
		1	--	2	1	1	--	1	2
		Examination Scheme							
			ISE	MSE	ESE	Total			
		Theory	--	--	--	--			
		Lab	100	--	--	100			

Pre-requisite Course Codes		--
Course Outcomes	CO1	Demonstrate a broad and coherent knowledge of United Nations Sustainable Development Goals (SDGs)
	CO2	Build the vocabulary and develop a nuanced understanding of the SDG themes: people, planet, prosperity, peace and partnership
	CO3	Identify technological solutions to address challenges of SDGs
	CO4	Build the vision to explain how to create a technological solution for sustainability

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**What are SDGs**	1,2,3	3
	1.1	Concept of Sustainability. The Role of UN and the Need for SDGs. Why SDGs are important.		
	1.2	Introduction to 17 SDGs		
2		**People Theme**	4,5	4
	2.1	Sustainable development goals 1-5		
	2.2	Technological Solutions to advance people theme		
3		**Planet Theme**	4,5	6
	3.1	Sustainable development goals 6, 12-15		
	3.2	Technological Solutions to advance planet theme		
4		**Prosperity Theme**		7
	4.1	Sustainable development goals 7-11		
	4.2	Technological Solutions to advance prosperity theme		
5		**Peace Theme**	4,5	3
	5.1	Sustainable development goal 16		
	5.2	Technological Solutions to advance peace theme		
6		**Partnership Theme**	4,5	3
	4.1	Sustainable development goals 17		
	4.2	Technological Solutions to advance partnership theme		
			Total	**26**

Course Assessment:

ISE: Quiz: 20 Marks
Activity: Case Study Presentation: 40 Marks
Activity: Short Film Creation and Presentation: 40 Marks

Recommended Books:

1. Himanshu Sharma, Tina Sobti "An Introduction to Sustainable Development Goals" 2018
2. Henrik Skaug Sætra "Technology and Sustainable Development" Routledge, 2023
3. Sinan Kufeoglu "Emerging Technologies: Value Creation for Sustainable Development", Springer International Publishing, 2022

Web Resources:

1. https://sdgs.un.org/goals
2. https://sdgs.un.org/tfm

Suggested CO - PO articulation Matrix

Course Outcomes	**Programme Outcomes (POs)**											**Programme Specific Outcomes* (PSOs)**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	--	--	--	--	2	3	2	--	--	--	--	--
CO2	2	--	--	--	--	2	3	2	--	--	--	--	--
CO3	2	2	3	--	2	2	3	2	2	2	2	2	--
CO4	2	2	3	--	2	2	3	2	2	2	2	2	--

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level:

Remember	Understand	Apply	Analyze	Evaluate	Create
		√			