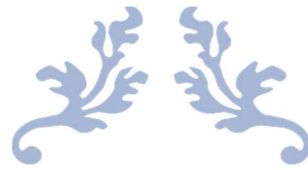




Society of St. Francis Xavier, Pilar's
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Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)



CURRICULUM STRUCTURE

SECOND YEAR UG: B.E.

ELECTRONICS AND COMPUTER SCIENCE

REVISION: FRCRCE-2-25

Effective from Academic Year 2025-26

Board of Studies Approval: 05/03/26

Academic Council Approval 27/03/2026



Dr. Deepak Bhoir
Dean Academics

Dr. Swapnali Makdey
HOD (Electronics and Computer Science)

Dr. Sapna Prabhu
Principal



INSTITUTE VISION

To be a leading institution in education, transforming students into globally competent professionals with strong ethical values, innovation capabilities, and a commitment to sustainable societal development.

INSTITUTE MISSION

- M1:** Develop industry-ready engineers with strong academic foundations, practical skills, and an entrepreneurial mindset capable of addressing industry and societal needs.
- M2:** Cultivate a culture of innovation and research to address real-world challenges through interdisciplinary approaches and sustainable practices
- M3:** Foster a vibrant industry–academia ecosystem by actively engaging faculty and students in knowledge exchange, collaborative learning and professional skill development.

DEPARTMENT VISION

Creating globally competent engineers with strong fundamentals and good learning ability to empower Digitalization and Innovation.

DEPARTMENT MISSION

- M1:** To enrich the competence in Electronics and Computer Science through knowledge, skills, and commitment to lifelong learning.
- M2:** To nurture effective solution providers having a practical knowledge base equipped with a multi-disciplinary approach.
- M3:** To cultivate an ambience to encourage innovation, research and entrepreneurship skills
- M4:** To improve employability by creating competitive engineers, with an ethical and professional attitude.

PROGRAM EDUCATIONAL OBJECTIVES

- PEO1:** Graduates will have the ability to utilize their technical knowledge and professional skills for building successful careers while maintaining ethical standards.
- PEO2:** Graduates will have the ability to pursue higher studies and research activities in Electronics and Computer Science.
- PEO3:** Graduates will have the ability to become entrepreneurs and professionals in multi-disciplinary roles and take up leadership positions in global organizations

PROGRAM SPECIFIC OUTCOMES



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Engineering Graduates will be able to

- PSO1:** Design and implement cost-effective hardware/software systems for real-life applications.
- PSO2:** Adapt to new generation technologies in Electronics & Computer Science domains with an innovative approach.

Preamble:

Fr. Conceicao Rodrigues College of Engineering an autonomous institute 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



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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. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit. Government of Maharashtra has directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4th July 2023. Accordingly, degree options are given to the students admitted from academic year 2024-25 based on UGC circulars and DTE guidelines ref no. 17/DTE/NEP-2020/2024/111 dated 4th June 2024 related to implementation of NEP.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum, 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 learner 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. **Built in Multidisciplinary minor or Double Minor in emerging field or Honors with Research.**

The curriculum is designed to give a glimpse of trends in the industry under vocational and enhanced skill practices, the pool is offered to nurture and develop creative skills in contemporary industrial practices. Criteria met in the structure is the opportunity for learners to choose the course of their interest in all disciplines. Program Core Course Cover Electronics and Computer Engineering based core courses. (Department Specific)

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. 2025-26

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	Co-curricular Courses
HMM	Honors and Multidisciplinary Minor
DM	Double Minor
HR	Honors with Research
BC	Bridge Course

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.
- ❖ Notional hours include Theory, practical, tutorials and self-learning for each student per week.



Credit requirements for four different options of the Degrees:

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B.Tech (Multidisciplinary Minor)	20	20	22	22	22	22	20	20	168
B.Tech with Double Minor (Multidisciplinary & Specialization Minor)	20	20	22 +4 *	22 +4*	22 +4*	22 +4*	20 +2\$	20	186
B.Tech with Honors with Research (Multidisciplinary Minor)	20	20	22 +4 *	22 +4*	22 +4*	22 +4*	20 +2\$	20	186

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

*Optional Credits \$ optional 2 credits can be earned either in VII or VIII Semester

- 1) Learners who earn a minimum of total 168 credits will be awarded “B.Tech in Engg. /Tech. with Multidisciplinary Minor (MDM)” degree.
- 2) Learners will have the following options to earn B. Tech. in Engg. /Tech. degree in
 - a. Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor)
 - b. Honors with Research and Multidisciplinary Minor
 - i) Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor) (additional 18 credits): 168 +18 (SEM-II)=186 Min Credits.
There will be four courses (4 credits each), one in each semester starting from the 3rd semester which will be from emerging areas of specialisation. In 7th or 8th semester, students will complete 2 credits seminar/project.
Admission eligibility min CGPA=7.5 after First year
 - ii) B.Tech in Engg./ Tech.- Honors with Research and Multidisciplinary Minor (additional 20 credits by research): 168 +18+2 (SEM-II)=188 Min Credits. (Admission eligibility min CGPA=7.5 after First and should maintain CGPA=7.5 after Third year)
- 3) Learner can earn the certificate/Diploma/Degree based on his/her exit from the program as follows. College shall explore feasibility to offer NSDC aligned skill-based courses to the learners:
 - a. UG Certificate: After a one-year (40 credits to be earned) and 8-credits summer workshop/vocational courses/internship.
 - b. UG Diploma: After two-years (80 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project.
 - c. B. Voc.: After three-years (120 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project.

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, multiple entry-exit, inclusive model indicating equal distribution of central resources



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- 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

SEM	Course Verticals																	Total Credits
	BSESC		PCPEC		MDC		SC	HSSM				EL				LLC	BC	
	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC	EEMC	IK S	VEC	RM	CEFP	PRJ	INT	CC	BC	
I	6	4	5				1			2						2	--	20
II	6	7					1	4								2	--	20
III	3		11		3	2					2		1					22
IV	3		11		3	2	2				1						2*	22
V			12	3	3	2	2											22
VI			14	3	3	2												22
VII & VIII				15	3							4		6	12		--	40
Total Credits as per Fr CRCE	18	11	53	21	15	8	6	4		2	3	4	1	6	12	4	2*	168
Total Credits as per GR	14	12	44	20	14	8	8	4	4	2	4	4	2	4	12	4		160

- Bridge course is only for second year direct admission students.



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SEMESTERWISE CURRICULUM STRUCTURE
UG ECS Program: (S.E ECS 2026-2027)

SEM-III												
Course Code	Course Vertical	Sub-Vertical	Course Name	Mode	Notional Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25PCC12EC05	PCPEC	PCC	Electronic Devices and Application	TH	2	20	30	20	50	100	2	3
					PR	2	50	-	-	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC06	PCPEC	PCC	Computer Organization and Architecture	TH	2	20	30	20	50	100	2	3
					PR	2	20	-	30	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC07	PCPEC	PCC	Database Management System	TH	2	20	30	20	50	100	2	3
					PR	2	50	-	-	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC08	PCPEC	PCC	Object Oriented Programming with JAVA	PR	2	50	-	-	50	1	1	
					SS/SL	2	-	-	-	-		-
25OE1X	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	-	-	-	-	-	
25EEM12EC1X	HSSM	EEMC	Modern Indian Language	TH	2	100	-	-	100	2	2	
					SS/SL	2	-	-	-	-		-
25VEC12EC01	HSSM	VEC	Human Values and Professional Ethics	TH	1	100	-	-	100	1	2	
					PR	2	-	-	-	-		
					SS/SL	1	-	-	-	-		-
25CEP12EC01	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	2	50	-	-	50	2	
25HR02	HR	HR	Honors with Research	PR	-	-	-	-	-	4	4*	
Total						TH:TU:PR:SL=15:0:14:15				1100		22

SEM-IV												
Course Code	Course Vertical	Sub-Vertical	Course Name	Mode	Notional Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE		Total	Points	Total
								Min	Max			
25BSC12EC05	BSESC	BSC	Mathematics and Numerical Methods	TH	2	20	30	20	50	100	2	3
					TU	1	50	-	-	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC09	PCPEC	PCC	Analog Electronics Circuits	TH	2	20	30	20	50	100	2	3
					PR	2	50	-	-	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC10	PCPEC	PCC	Discrete Structures and Automata Theory	TH	2	20	30	20	50	100	2	3
					TU	2	50	-	-	50	1	
					SS/SL	2	-	-	-	-	-	
25PCC12EC11	PCPEC	PCC	Web Technologies Lab	PR	2	50	-	-	50	1	1	
25OE2X	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	-	-	-	-	-	
25VSE12EC03	SC	VSEC	Data Structures	TH	2	20	30	20	50	100	3	4
					PR	2	30	-	-	50	1	
					TU	1	50	-	-	-	-	
25EEM12EC02	HSSM	EEMC	Technology Entrepreneurship	TH	2	100	-	-	100	2	2	
					SS/SL	2	-	-	-	-		-
25VEC12EC02	HSSM	VEC	Technology Innovation for Sustainable Development	TH	1	100	-	-	100	1	2	
					PR	2	-	-	-	1		
					SS/SL	2	-	-	-	-		-
25DMX2	DM	DM	Double Minor Course	TH	2	20	30	20	50	100	2	4*
					TU	2	50	-	-	50	2	
25HR03	HR	HR	Honors with Research	-	-	-	-	-	-	4	4*	
25BC	BC	BC	MOOC	-	-	-	-	-	-	-	2\$	
Total						TH:TU:PR:SL=12:1:18				1100		22

\$ DM/HR 2 credits for Later Entry Students in second year



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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC05	Electronic Devices & Applications	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	Basic Electrical and Electronics Engineering, Fundamentals of Electromagnetics & Semiconductor Devices
After the successful completion students should be able to:	
Course Outcomes	CO1 Demonstrate the working of different semiconductor devices.
	CO2 Interpret the characteristics of semiconductor devices.
	CO3 Implement and verify different applications of semiconductor devices
	CO4 Analyze different amplifier parameters
	CO5 Compare the performance of different devices as an application

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Diode circuits Diode full-wave rectifiers– center-tapped transformer & bridge type with circuit diagram, operation & working, derivation of the average(DC) output voltage, AC (RMS) output voltage & ripple factor (γ)	1,2	5
	1.2	Filter circuits– capacitor (C), inductor (L), inductor-capacitor (L-C) & C-L-C (π) filter with circuit diagram, operation & working, ripple factor expression (γ)		
	1.3	Diode clipper circuits & diode clamper circuits with circuit diagram, input & output waveforms, transfer characteristics		
2	2.1	Bipolar Junction Transistors: Structure, symbol, construction & working/operation of NPN & PNP BJT, basic configurations of BJT (common base, common collector & common emitter)	1,3	6
	2.2	Input & output characteristics of NPN BJT in common emitter (CE) configuration, regions/modes of operation, concept of leakage current & introduction to thermal stability		
	2.3	Concept of DC load line & Q point, need & importance of biasing, analysis of fixed base bias, modified fixed base bias & voltage divider biasing circuits for NPN BJT with numerical examples		



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3	3.1	Basic BJT Amplifiers: Mathematical modelling & small-signal (AC) representation of BJT by hybrid parameter (h-parameter) model and high frequency π model.	1,3	6
	3.2	Small signal amplifiers using BJT in the common emitter (CE) configuration– input resistance(R_i), output resistance(R_o), current gain (A_i) & voltage gain(A_v) using hybrid parameter (h-parameter) model		
4	4.1	Field Effect Transistors: JFET construction, working and V-I characteristics	1,2, 3	4
	4.2	Enhancement MOSFET: MOS capacitor, threshold voltage, C-V characteristics, I-V characteristics, AC Equivalent circuit for the MOSFET.		
5	5.1	MOS Transistor: MOS Transistor biasing circuits: Self, voltage divider, feedback bias (numerical and graphical analysis). Introduction to secondary Effects	1,2	5
	5.2	SPICE Models for MOS Transistor, Technology Scaling		
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- Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Suggested List of Experiments			
Sr. No.	Title	Ref.	Hrs.
1	Implementation of center-tapped full-wave rectifier & bridge type diode full-wave rectifier (FWR)	1, 2	2
2	Implementation of various diode clipper circuits	1, 2	2
3	Implementation of various diode clamper circuits	1, 2	2



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4	Implementation of rectifier output smoothing filters.	1,2	2
5	Input & output characteristics of CE-BJT configuration	1, 2	2
6	Graphical determination of hybrid parameters (h-parameters) from BJT characteristics	1, 2	2
7	Analysis of DC biasing circuits for BJT	1, 2	2
8	Implementation of common emitter (CE) BJT small signal amplifier	1, 2	2
9	JFET V-I characteristics & transfer characteristics	1, 2	2
10	Analysis of DC biasing circuits for JFET	1, 2	2
11	Simulation of MOSFET Transfer & Output Characteristics	1,2,3	2
12	Simulation of Channel Length Modulation for MOSFET (Secondary Effects)	1,2,3	2
Total			24

Course Assessment: - Lab

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

Recommended Books:

- [1] Donald A. Neamen, “Electronic Circuits: Analysis and Design”, Tata McGraw Hill, 2007.
- [2] Robert. L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson
- [3] Donald.A.Neamen, “Semiconductor Physics and Devices: Basic Principles”, 4th Edition, McGraw Hill Higher Education, 2011.
- [4] M.H.Rashid, “Power Electronics: Circuits, Devices & Applications”, 4th Edition, Pearson India Education Service Pvt. Ltd, 2017.

Online Repository:

1. <https://www.youtube.com/playlist?list=PL350612601E2DBFDE>
2. <https://www.youtube.com/playlist?list=PLF178600D851B098F>
3. <https://www.youtube.com/playlist?list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP>

Suggested CO - PO Articulation Matrix



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

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

Blooms level

Remember✓	Understand✓	Apply✓	Analyze✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC06	Computer Organization and Architecture	2	--	2	2	2	--	1	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
Practical		50	--	--	--	50			

Pre-requisite Course Codes	PCC11EC03 (Digital Electronics)	
After the successful completion students should be able to:		
Course Outcomes	CO1	Analyze design considerations of architectural units of a processor
	CO2	Explain concepts related to cache memory and Virtual memory management in Computer systems
	CO3	Contrast different types of I/O data transfers and I/O buses used in Computer systems
	CO4	Evaluate the advantages and limitations of Parallelism in systems.
	CO5	Explain the architectural enhancements in modern processors

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Overview and Data Representation	1,2,5	4
	1.1	Basic Building blocks of a Computer, Evolution of x86 Computers, Von Neumann model, Harvard Model, Performance measures		
	1.2	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	1,2,5	
	1.3	Booth's Multiplier, Restoring and Non-Restoring Division	1	
2		Processor Organization		6
	2.1	Instruction format, Instruction cycle, Instruction set types, Addressing Modes, Multi-Data path Organization	1,2,5	
	2.2	Control Unit Design: Hardwired and Microprogrammed	1,2,5	
	2.3	CISC vs RISC: Design philosophy and issues	1,2,5	
	2.4	Case study: 8086 processor architecture and Instruction Set	3,8	
3		Memory Organisation		6
	3.1	Types of memories, Performance of Memory system, Memory Hierarchy	1,2,5	
	3.2	Cache memory concepts: Principles of locality, Cache mapping, Cache architectures, Cache coherency	1,2,5	
	3.3	Virtual management concepts: Paging, Segmentation, Page Replacement policies	1,2,5	



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	3.4	Case Study: Virtual Memory management in Pentium processor	1,2,7	
4		I/O Organization		
	4.1	I/O interfacing: Handshaking, Interrupt handling, Direct memory Access (DMA)	1	3
	4.2	I/O Buses: Protocols, Arbitration	1	
5		Parallel Processing		
	5.1	Introduction to Parallel processing, Flynn's Classification, Amdahl's Law	4,5	3
	5.2	Pipelining, Pipeline Performance metrics, Pipeline Hazards	2,4,5	
6		Advanced Processor Architectures		
	6.1	Superscalar processors, GPU, Clusters, Multi-core processors	1,5,8	4
	6.2	NVIDIA GPU Case study and Programming Model	9	
			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- Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Suggested List of Experiments			
Sr. No.	Title	Ref.	Hrs.
1	Design of a Booth Multiplier	1	2
2	Implement Restoring and Non-Restoring Division Algorithm.	1	2
3	Implementation of Arithmetic/Logical operations using 8086 (Assembly language)	3,8	2
4	Block transfer using 8086 (String instructions)	3,8	2
5	Implementation of subroutines and macros using 8086	3,8	2
6	Implementation of various cache mapping techniques to measure cache hit rate.	1,2,5	2



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7	Implement various page replacement policies (LRU, FIFO, LFU)	1,2,5	2
8	Simulate various data hazards in a pipeline (for a given program segment).	2,5	2
Total			16

Course Assessment- Lab:

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

Recommended Books:

- [1] Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Tata McGraw-Hill, 5th Edition.
- [2] William Stallings, “Computer Organization and Architecture: Designing for Performance”, Pearson, 8th Edition.
- [3] Douglas V Hall, “Microprocessor and Interfacing: Programming & Hardware”, Tata-McGraw Hill, 3rd Edition.
- [4] Andrew S. Tanenbaum, “Structured Computer Organization”, Pearson, 6th Edition.
- [5] D. A. Patterson and J. L. Hennessy, “Computer Organization and Design – A Quantitative Approach”, Morgan Kaufmann, 6th Edition
- [6] B. Govindarajulu, “Computer Architecture and Organization: Design Principles and Applications”, McGraw Hill, 2nd Edition.
- [7] Don Anderson, Tom Shanley, “Pentium Processor System Architecture”, Addison Wesley Professional, 2nd Edition.
- [8] Douglas V Hall, “Microprocessor and Interfacing: Programming & Hardware”, Tata-McGraw Hill, 3rd Edition.
- [9] Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General-Purpose GPU Programming”, Addison-Wesley, 1st Edition.

Suggested CO - PO Articulation Matrix

Course Outcomes	Program Outcomes (POs)											Program 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	--	--	--	--	--	--	--	--	--	--	1	--
CO5	3	--	--	--	--	--	--	--	--	--	--	1	--

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

Blooms level

Remember✓	Understand✓	Apply✓	Analyze✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC07	Database Management Systems	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

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Course Outcomes	CO1	Describe the fundamental concepts of database systems, including data independence, 3-tier architecture, and different data models
	CO2	Apply Entity-Relationship (E-R) modelling to transform real-world requirements into conceptual schemas and map them to relational database designs.
	CO3	Construct structured queries using SQL (DDL, DML, DCL) and Relational Algebra to retrieve and manipulate data from a relational database.
	CO4	Apply normalization techniques (1NF, 2NF, 3NF, and BCNF) to evaluate and refine database designs by minimizing data redundancy and preventing anomalies.
	CO5	Explain the ACID properties and implement protocols for transaction management, concurrency control, and database recovery to ensure data integrity.
	CO6	Develop and deploy a working database application using a modern RDBMS (like MySQL or PostgreSQL) to solve a specific domain problem.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction to Database Systems	1,4	2
	1.1	Characteristics of the database approach, Advantages over File Systems, Data models (high level)		1
	1.2	Three-schema architecture and Data Independence (Physical & Logical), Client-Server Architecture, Centralized vs. Distributed Systems Overview. Database Users and Administrators (DBA).	1,4	1
2		Structured Query Language (SQL)	1,4	7
	2.1	DDL commands: CREATE, ALTER, DROP, TRUNCATE, Defining Constraints (Not Null, Unique, Check).		1
	2.2	DML commands: INSERT, basic SELECT queries, WHERE	1,4	1
	2.3	Aggregate functions (Sum, Avg., Count), Group By, and Having clauses.	1,4	1
	2.4	Joins in SQL (Inner, Left, Right, Full) and Nested/Subqueries.	1,4	2
	2.5	Views and Indexes	1,4	1
	2.6	PL/SQL and Triggers, UPDATE and DELETE	2,4	1
3		Relational Database Design and Normalization		4



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	3.1	Pitfalls in Relational Database Designs, different types of keys, purpose of Normalization	1,2,4	1
	3.2	Functional Dependencies, Closure of Attribute Sets, and Armstrong's Axioms.	1,2,4	1
	3.3	1 st Normal Form (1NF), and 2 nd Normal Form (2NF).	1,4	1
	3.4	3 rd Normal Form (3NF), Boyce-Codd Normal Form (BCNF)		1
		Relational Model and Algebra		3
4	4.1	Unary operations: Select σ , Project π and Rename ρ		1
	4.2	Set Theory operations: Union, Intersection, and Set Difference.		1
	4.3	Cartesian Product, Natural Join, Outer Joins, and the Division Operator.		1
		Conceptual Modelling and Design		5
5	5.1	Entities, Entity Sets, Attributes, Relationship Sets		1
	5.2	Types of Relationships (Unary, Binary, Ternary), Roles		1
	5.3	Structural Constraints (Cardinality, Participation).		1
	5.4	Weak Entity sets, Advanced ER Modelling: Specialization, Generalization, and Aggregation.		1
	5.5	Converting E-R diagrams into tabular schemas		1
		Transaction and Concurrency Management		5
6	6.1	Concept, States, and ACID properties (Atomicity, Consistency, Isolation, Durability).		1
	6.2	Conflict and View Serializability; Testing for Serializability.		1
	6.3	Introduction to Concurrency Control: Lock-based protocols, Timestamp-based protocols, Deadlock handling.		2
	6.4	Log-based recovery, Checkpoints, and Shadow Paging.		1
			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- Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.



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Module No	Sr. No	Suggested List of Experiments	Ref.
1	1	To study the basic CREATE TABLE and INSERT statements	[1], [2]
2	2	To study basic SQL queries	[1], [2]
2	3	To study basic SQL aggregate functions (SUM, AVG, COUNT) with GROUP BY, ORDER BY and HAVING clause.	[1], [2]
2	4	To write SQL queries using nested sub-queries, joins and UPDATE.	[1], [2]
2	5	To write SQL queries using ALTER and DELETE.	[1], [2]
2	6	To write SQL queries using various constraints such as UNIQUE and CHECK.	[1], [2]
2	7	Write stored procedures for business logic and triggers to automate tasks (e.g., updating stock levels after a sale).	[1], [2]
4	8	Write relational algebra queries using Relax: https://dbis-uibk.github.io/relax/landing	[1], [2]
1-5	9	Design and implement a complete database application (Mini-Project)	-

Course Assessment-Lab:

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

Recommended Books:

- [1] Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw Hill, 6th Edition.
- [2] Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education, 5th Edition.
- [3] Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, Tata McGraw Hill Education.
- [4] Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning, Course Technology Inc., 5th Edition.
- [5] ORACLE reference:
<https://docs.oracle.com/en/database/oracle/oracle-database/19/sqlrf/Basic-Elements-of-Oracle-SQL.html>
- [6] Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services by Brendan Burns. An essential industry guide for understanding Database Sharding and distributed architectures (Burns, 2025).



- [7] <https://learn.mongodb.com/>
- [8] <https://aws.amazon.com/whitepapers/>
- [9] https://www.youtube.com/watch?v=AVheZFI_3Wc
- [10] <https://www.youtube.com/watch?v=8KrTO9bS91s>

Online Repository:

- [1] W3Schools: https://www.w3schools.com/sql/sql_intro.asp
- [2] Geeks for Geeks: <https://www.geeksforgeeks.org/sql-all-and-any/>
- [3] Tutorials Point: <http://www.tutorialspoint.com/sql/>
- [4] PostgreSQL Manual: <https://www.postgresql.org/docs/>
- [5] NPTEL Certification link: https://onlinecourses.nptel.ac.in/noc22_cs91/preview
- [6] Online SQL Compiler: <https://aiven.io/tools/pg-playground>

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyze ✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC08	Object Oriented Programming with Java	--	--	4	--		--	2	1
		Examination Scheme							
				ISE	MSE	ESE		Total	
				Min	Max				
		Theory		--	--	--	--	--	
Lab		100	--	--	--	100			

Pre-requisite Course Codes		--
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.	Topics	Ref.							
Module 1	<p>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.</p> <p>Suggested Experiment List: (* marked experiments are compulsory and must be implemented in the lab)</p>								
	*1. Program to demonstrate input using Scanner, Buffered Reader and command line arguments.	3							
	<p>2. Electricity Bill Generator : Electricity Bill Calculation using Java</p> <p>Design and develop a Java program to calculate the electricity bill of a household based on the number of electricity units consumed. The program must accept the total units consumed from the user and compute the bill according to the following slab rates:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Units Consumed</td> <td>Rate per Unit</td> </tr> <tr> <td>0 – 100 units</td> <td>₹5 per unit</td> </tr> <tr> <td>101 – 300 units</td> <td>₹7 per unit</td> </tr> <tr> <td>Above 300 units</td> <td>₹10 per unit</td> </tr> </table>	Units Consumed	Rate per Unit	0 – 100 units	₹5 per unit	101 – 300 units	₹7 per unit	Above 300 units	₹10 per unit
Units Consumed	Rate per Unit								
0 – 100 units	₹5 per unit								
101 – 300 units	₹7 per unit								
Above 300 units	₹10 per unit								



	After calculating the total energy charge, the program must add 18% GST to the bill and display a well-formatted electricity bill.	
	<p>*3. Design and implement a Java program that simulates a Number Guessing Game between the computer and the user.</p> <p>The program should generate a random integer between 1 and 100. The user must repeatedly guess the number until the correct number is found.</p> <p>After each guess, the program must guide the user by displaying whether the guessed number is:</p> <p>Too High → if the guess is greater than the generated number Too Low → if the guess is smaller than the generated number Correct → when the guess matches the generated number</p> <p>The program must also keep track of the total number of attempts made by the user and display it when the user successfully guesses the number.</p>	3
	4. To write a Java program that determines whether a given number is a prime number using a user-defined function.	
Module 2	<p>Introduction to object-oriented programming (OOP) concepts: Classes and objects in Java, Encapsulation, and polymorphism(method overloading)</p> <p>(Any Two in Lab and remaining two as Postlab)</p>	
	*1. Create a Student class with private data members: Roll Number, name, marks. Provide public getter and setter methods to access and modify data. Display student details using a separate method.	
	* 2. Program to demonstrate constructor overloading	
	3. Program on passing and returning objects as argument.	
	<p>4. Area Calculation using Overloading.</p> <p>Create overloaded methods:</p> <p>area(int side) → square area(int length, int breadth) → rectangle area(double radius) → circle</p>	
Module 3	<p>Inheritance: Types of Inheritance, Interface, Abstract class and methods, super and final keywords , Polymorphism(method overriding)</p>	
	*1. Create a base class named Vehicle that represents general vehicle properties and behaviors. Then create a derived class named Car that inherits from the Vehicle class and adds specific features related to cars.	



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	<p>*2. Write a Java program to demonstrate multilevel inheritance by creating three classes: Animal, Mammal, and Dog, where Mammal inherits from Animal and Dog inherits from Mammal. Implement methods in each class and create an object of Dog to access all inherited and own methods.</p>	
	<p>3. Create an abstract class Shape that contains an abstract method calculateArea (). Create subclasses Circle and Rectangle that extend the Shape class and implement the abstract method to calculate their respective areas.</p>	
	<p>4. Write a Java program to demonstrate multiple inheritance using interfaces by creating two interfaces, Engine and Music System, each with different methods. Create a class Car that implements both interfaces and demonstrates all functionalities using an object in the main method.</p>	
Module 4	<p>Strings: Introduction to strings and string manipulation</p>	
	<p>*1. Given a sentence containing leading/trailing spaces and multiple spaces between words, reverse the order of words while keeping each word's characters unchanged. Output must contain exactly one space between words and no leading/trailing spaces.</p> <p>Example: "Java is powerful" → "powerful is Java"</p>	
	<p>*2. Implement string compression using run-length encoding: replace consecutive repeated characters with char + count. If the compressed string is not shorter than the original, return the original.</p> <p>Example: "aaabbc" → "a3b2c1", "abcd" → "abcd"</p>	
	<p>3. Given a sentence with punctuation attached to words (commas, periods, question marks), reverse the order of words but keep punctuation attached to the same word it originally belonged to.</p> <p>Example: "Hello, world! Java is powerful." → "powerful. is Java world! Hello,"</p>	
Module 5	<p>Arrays: Introduction to arrays, Declaration and initialization of an array, Operations on Arrays, Array of objects, Passing array to methods, returning array from methods, Vectors</p>	3
	<p>1. Develop a Java program to store marks of 10 students in an array and calculate average marks, highest and lowest marks and number of students scoring above average.</p>	
	<p>*2. Write a Java program to develop a banking application. Store account balance of 20 customers. Write methods for the following:</p> <ul style="list-style-type: none"> - To implement deposit and withdraw function. - To identify customers with balance below 1000 rs. - Calculate total banks holdings 	



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	<p>*3 Write a Java program to develop a library book inventory. Use Vector to maintain book titles. Write methods for the following:</p> <ul style="list-style-type: none"> - Add new book - Issue a book - Return a book - Check availability of the book 	
Module 6	<p>Exception Handling (try-catch-throw-throws, finally), User defined Exceptions</p>	3
	<p>*1. Write a Java program for validating student age. If age is less than 18, throw InvalidAgeException. Handle invalid numeric input using NumberFormatException.</p>	
	<p>*2. Design a Java-based E-Commerce Order Processing System. Create a Product class that store: Product ID, Product Name, Price, and Available Stock. The system should allow customers to place orders.</p> <p>The program must validate the order using custom exceptions:</p> <ol style="list-style-type: none"> 1. If requested quantity is negative or zero throw InvalidQuantityException 2. If requested quantity is greater than available stock OR stock is zero throw OutOfStockException 3. If order is valid reduce stock and display order summary 	
Module 7	<p>Multithreading: thread lifecycle, creating threads, starting the thread, joining the thread, naming thread, thread scheduler</p>	3
	<p>*1. Design a Traffic Signal Control System using Java Multithreading. Three threads will represent traffic lights: Red, Yellow and Green. Only one light must be active at a time. Lights must follow the sequence Red→Green→ Yellow→Red.</p>	
	<p>*2. Design a Chat Application Simulation using Java Multithreading.</p> <p>The system should simulate communication between two users using two threads:</p> <ul style="list-style-type: none"> • Sender Thread – sends messages • Receiver Thread – receives messages 	
Module 8	<p>File Handling: File Input/output with Streams, Serialization and Deserialization, Random Access Files</p>	3
	<p>*1. Design and implement a Student Record Management System using Java File Handling.</p> <p>The system must:</p> <ol style="list-style-type: none"> 1. Store student details (Roll No, Name, Marks) in a text file. 	



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	2. Append new student records without overwriting existing data. 3. Read and display all student records. 4. Search and display a student record by Roll Number. 5. Handle file-related exceptions properly.	
Module 9	Mini Project: Defining the problem statement and objectives. Implement the idea of Mini Project based on the content of the syllabus (Group of 2-3 students)	

Course Assessment- Lab:

ISE: Laboratory ISE is divided into two components: 50 marks for performance and submission of experiments and 50 marks for oral/practical evaluation.

Recommended Books:

- [1] Herbert Schildt, “Java: The Complete Reference”, 9th Edition, McGraw Hill Education publication
- [2] E. Balaguruswamy, “Programming with JAVA”, 6th 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”, 3rd Edition, Addison-Wesley Professional publication
- [5] Brian Goetz et al., “Java Concurrency in Practice”, 1st Edition, Addison-Wesley Professional publication
- [6] Mark Heckler, Gerrit Grunwald, José Pereda, Sean Phillips, Carl Dea, “JavaFX: Introduction by Example”, 2nd Edition, Apress publication

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE13EC11	Law for Engineers	2	--	--	2	2	--	1	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
	Theory	100	--	--	--	100			

Pre-requisite Course Codes		--
Course Outcomes	CO1	To demonstrate awareness of basic structure of Indian Legal System
	CO2	To demonstrate awareness of principles of contract
	CO3	To demonstrate awareness of legal aspects related to establishment of factory and various legislations related to employees, labours, and workmen's welfare
	CO4	To 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., Writs in Indian constitution.		
	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		



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	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		
		Right to Information	2,3	2
4	4.1	Official Secret Act, 1923, Indian Evidence Act, 1872 and Bharatiya Sakshya Adhinyam, 2023 (BSA)		
	4.2	Right to Information Act, 2005, Impact of Right to Information Act		
		Intellectual Property Rights	2,3	2
5	5.1	Types of Intellectual Property, Indian Copyright Act 1957, Indian Trademark Act 1999, Indian Patent Act 1970		
		Other Important Laws	2,3	2
6	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:

Quiz: 40 Marks

Activity: Debating Session: 20 Marks

Activity: Poster Making: 10 Marks

Activity: Client Counselling: 20 Marks

Activity: Animation Making: 10 Marks



Recommended Books:

Textbooks:

- [1] N.S.Nappinai, “*Technology Laws Decoded*”, Lexis Nexis, 2017
- [2] Vibha Arora and Kunwar Arora, “*Law for Engineers*”, Central Law Publications, 2017
- [3] Vandana Bhatt and Pinky Vyas, “*Laws for Engineers*”, Pro Care, 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.

Online Repository:

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.greylhr.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>



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Suggested CO - PO Articulation Matrix

Course Outcomes	Program Outcomes (POs)											Program Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	1	3	3	3	3	3	-	-	-
CO2	2	-	-	-	3	2	3	2	1	1	-	-	-
CO3	3	-	-	-	1	1	1	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	Analyze✓	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE13EC12	Financial Planning, Taxation and Investment	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	--	--	--	--	--		
Lab	100	--	--	--	100				

Pre-requisite Course Codes	None	
Course Outcomes	CO1	To prepare financial plan by understanding owns need
	CO2	To demonstration awareness of taxation policies and show respect towards government norms and regulations
	CO3	To prepare investment plan by understanding owns futuristic needs

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.



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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.

Course Assessment:

ISE:

Quiz: 20Marks

Activity: Presentation on Financial Instruments: 10 Marks

Activity: Preparing Investment Portfolio (20 Marks): Assign each student or group of students to create a hypothetical investment portfolio based on specific criteria such as risk tolerance, time horizon, and financial goals. They research different investment options, analyze their potential returns and risks, and justify their portfolio allocations in a written report or presentation.

Quiz: 20 Marks

Activity: Tax Return Case Studies (*Pre-requisite: Pan Card (if not available, student should immediately apply and get pan card)*) (10 Marks): Consider case study of fictional individuals or families and prepare tax returns based on their financial situations. This hands-on activity allows students to apply their knowledge of taxation laws and regulations in a practical context.

Activity: Financial Literacy Podcast (10 Marks): Have students create their own podcasts or audio recordings discussing key concepts related to financial planning, taxation, and investments. They can *interview experts*, share personal finance tips, or discuss current events and trends in the financial industry.

Activity: Personal Finance Blog (10 Marks): Students create their own personal finance blogs or websites where they share articles, tutorials, and resources related to financial planning, taxation, and investments. This activity helps them develop their writing and research skills while sharing valuable information with their peers.



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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.

Suggested CO - PO articulation Matrix

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

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

Blooms level

Remember✓	Understand✓	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12EC11	Sanskrit for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		100	--	--	--	100	
		Lab		--	--	--	--	--	

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

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.



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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 and two formative Assessment activities for 50 Marks each.

Recommended Books:

- [1] Kumari, S. “*SanskritaChitrapadakashah*”, Mysuru: BharatiyaBhashaSansthanam, 1993
- [2] *Samkrita-vyavahaara-sahasri* (Sanskrit-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	Program Outcomes (POs)											Program Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	-	-	-	-	-	-	-	2	3	-	1	-	-

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

Blooms level

Remember	Understand	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12EC12	Tamil for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	100	--	--	--	100		
Lab	--	--	--	--	--				

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

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Tamil Alphabets and Pronunciation History of Tamil language	1	1
	1.2	Learning Tamil Alphabets		1
	1.3	Basic Pronunciation and Oral drills with visual learning	1	2
	1.4	Greetings and common expressions		2
2	2.1	Basic Grammar and Sentence Structure Sentence Construction: Subject, Verb, Object (SVO)	2	2
	2.2	Present tense, Past tense and Future tense	2	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	3	2
	3.2	Forming Simple sentences with interactive lessons 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	3
	3.3			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.	3	3
	4.2	Role Play exercises in common situations	1	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 and two formative Assessment activities for 50 Marks each.

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

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

Blooms level

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12EC13	Kannada for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		100	--	--	--	100	
		Lab		--	--	--	--	--	

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

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	2	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	3	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=PLOb5Wwt1GhOkY5xCbb1_J6Tkd2-YmZ46B

Course Assessment:

ISE: based on self-learning and two formative Assessment activities for 50 Marks each.

Recommended Books:

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

Suggested CO - PO articulation Matrix:

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

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

Blooms level

Remember	Understand	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12EC14	Telugu for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		100	--	--	--	100	
		Lab		--	--	--	--	--	

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

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Telugu Alphabets and Pronunciation History of Telugu language	1	1
	1.2	Learning Telugu Alphabets and Symbols		1
	1.3	Basic Pronunciation		2
	1.4	Greetings and Common expressions		2
2	2.1	Basic Grammar and Sentence Structure Sentence Structure: Subject, verb, Object (SVO)	2	2
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common nouns, Pronouns, Adjectives		2
3	3.1	Conversation Phrases for Daily Situations Learning numerals (Cardinal Numbers) 1- 20, 100 -1000	3	2
	3.2	Forming Simple sentences / Listening and Speaking skills		3
	3.3	Days of week, Months of the year, Gender, Fruits, Parts of the body, Names of common places like hospitals, markets, shops, saloons etc.		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.	3	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: Activities and Assignments: 20 Marks

Oral Examination: 30 Marks

Activities and Assignments: 20 Marks

Oral Examination: 30 Marks

Recommended Books:

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

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25VEC12EC01	Human Values and Professional Ethics [HVPE]	1	--	2	1	1	--	1	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	100	--	--	--	100		
Lab	--	--	--	--	--				

Pre-requisite Course Codes		
Course Outcomes	CO1	Adhere to the core rights and shape one's values.
	CO2	Display the role and responsibility of Engineering professionals
	CO3	Holds moral and Ethical solutions to problems through case studies.
	CO4	Apply the knowledge of human values to contemporary ethical 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	2
	1.2	Promotion of Inter-Religious harmony and inter-faith values, Composite Culture	1,2,3	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	3,4	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.	1,2,3	2
	2.3	Managing conflict- Respect for authority- Collective bargaining- Confidentiality, Role of confidentiality in moral integrity-Conflicts of interest	3,4	2
3		Global Ethical Concerns		
	3.1	Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics	2,3,4	2



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	3.2	Engineers as Expert witnesses and advisors-Moral leadership- case studies	1,2,3 ,4	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.

Course Assessment:

ISE:

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: Quiz and assignments **20 Marks**

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: 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.



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[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	Program Outcomes (POs)											Program Specific Outcomes (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
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 level

Remember	Understand	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEP12EC01	Community Engagement Project	--	--	4	--	--	2	2
		Examination Scheme						
			ISE	MSE	ESE		Total	
			Min	Max				
		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	Critically think on 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 behavioral 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 fact-finding 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: 20 Marks

Activity: Report Presentation: 30 Marks

Activity: Report Submission: 20 Marks

Activity: Report Presentation: 30 Marks

Suggested CO - PO articulation Matrix

Course Outcomes	Program Outcomes (POs)											Program 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 level

Remember	Understand	Apply	Analyze	Evaluate	Create✓
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25BSC12EC05	Mathematics and Numerical Methods	2	--	2	2	2	--	1	3
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
Tut		50	--	--	--	50			

Pre-requisite Course Codes	BSC11EC01 (Matrices and Differential Calculus), BSC11EC03 (Integral Calculus and Probability Theory)	
Course Outcomes	CO1	Apply probability distributions of Poisson and Normal to some of the real-life situations.
	CO2	Apply the concept of sampling distribution in hypothesis testing of small samples using sampling theory.
	CO3	Demonstrate basic knowledge about the vector spaces as an algebraic structure.
	CO4	Execute numerical methods to solve a system of linear equations, root of an equation

Module No.	Unit No.	Topics	Ref.	Hrs
1		Probability Distribution and Sampling Theory-I	1,2,3	8
	1.1	Probability Distribution: Poisson and Normal distribution		
	1.2	Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		
	1.3	Students't-distribution (Small sample). Test the significance of single sample mean and two independent sample means and paired t- test)		
2		Sampling Theory-II	1,2,3	6
	2.1	Chi-square test: Test of goodness of fit and independence of attributes (Contingency table) including Yate's Correction.		



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	2.2	Analysis of variance: F-test (significant difference between variances of two samples)		
3		Linear Algebra - Vector Spaces	4,5	8
	3.1	Vector spaces		
	3.2	Subspaces of vector spaces		
	3.3	Basis and dimension		
	3.4	The Gram-Schmidt orthogonalization process		
4		Numerical Solutions of transcendental equations and system of linear equations	6,7	4
	4.1	Solution of Transcendental Equations: Solution by Newton Raphson method, and Regula-Falsi method.		
	4.2	Solution of system of linear algebraic equations by Gauss-Jacobi method, Gauss-Seidel method		
			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-Theory:

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.



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Tutorials:

Exp. No.	Tutorial Details	Marks
1	Probability distributions	06
2	Testing of hypothesis	08
3	Chi-square test	06
4	F-Test	06
5	Vector spaces and subspaces	06
6	Basis and dimension of a vector space	06
7	Numerical solutions of transcendental equations	06
8	Numerical solutions of the system of linear equations	06
Total Marks		50

Tutorial:

ISE:

- a. It will be conducted for three tutorials. Continuous pre-defined rubrics-based evaluation for 20 marks.
- b. It will be conducted for five tutorials. Continuous pre-defined rubrics-based evaluation for 30 marks.

Recommended Books:

- [1] Dr B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications, 42nd Edition.
- [2] H. K. Dass, “Advanced Engineering Mathematics”, S. Chand, 28th Edition.
- [3] Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition.
- [4] Robert M. Thrall, Leonard Tornheim, “Vector Spaces and Matrices”, Dover Publications, Inc.
- [5] Gilbert Strang, “Linear Algebra for Everyone”, Wellesley Publisher.
- [6] James F. Epperson, “An Introduction to Numerical Methods and Analysis”, Wiley, Revised Edition.
- [7] Dr. J. S. Chitode, “Numerical Techniques”, Technical Publication, 1st Edition.
- [8] Ramana, B. V. (2006). *Higher Engineering Mathematics*. Tata McGraw-Hill. ISBN 978-0-07-063419-0.



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[9] Bali, N. P., & Goyal, M. (2019). *A Textbook of Engineering Mathematics: Volume II* (14th ed.). Laxmi Publications / University Science Press. ISBN 978-93-80386-78-2.

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyze ✓	Evaluate ✓	Create
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Course Code	Course Name	Teaching Scheme (Hours/ Week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC09	Analog Electronic Circuits	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		ESC11EC02
Course Outcomes	CO1	Analyse various differential amplifier configurations
	CO2	Evaluate the performance of operational amplifiers
	CO3	Implement practical electronic circuits using operational amplifiers
	CO4	Design electronic applications for a given problem specification
	CO5	Troubleshoot given electronic circuits for fault-finding

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Differential Amplifiers		5
	1.1	Introduction to differential amplifiers, the types of differential amplifier configurations, parameters of differential parameters	1,2	
	1.2	DC analysis of BJT differential amplifiers with calculation of DC load line & Q point (numerical examples included)		
	1.3	AC (small signal) analysis of differential amplifiers using the BJT 'r _e ' model, derivation of differential mode gain (A _d), the common mode gain (A _c) & common mode rejection ratio (CMRR)		
2		The Operational Amplifier		4
	2.1	Block diagram of operational amplifier & description of each stage with characteristics/parameters, the concept of ideal & practical op-amp with transfer characteristics, concept of virtual ground & virtual short	1,2	
	2.2	Concept of positive feedback & negative feedback in op-amp		
3		Linear Applications of Operational Amplifier		6
	3.1	Inverting amplifier, non-inverting amplifier, buffer/voltage follower with derivation of small signal voltage gain (A _v)	1,2,5	
	3.2	Mathematical applications of weighted adder, summing amplifier, adder, averaging circuit, subtractor, difference amplifier, integrator & differentiator		
	3.3	Sinusoidal oscillators (waveform generators)		



4	4.1	Non-linear Applications of Operational Amplifier Various zero crossing detectors (ZCD) & comparator circuits	1,2,3,4	6
	4.2	Non-sinusoidal waveform generators – astable multivibrator (square wave generator) & triangular waveform generators, Schmitt Trigger		
5	Special Purpose Integrated Circuits		3,4	5
	5.1	IC 555 Timer – internal block diagram & pin configuration, astable & mono stable multivibrator applications with numerical analysis for duty cycle (D), time period (T) & frequency (f)		
	5.2	Voltage regulators 78XX, 79XX, LM 317 & LM 337, applications as fixed & variable voltage regulators		
Total				26

Recommended Books:

- [1] Donald A. Neamen, “Electronic Circuit Analysis & Design”, TATA McGraw Hill, 2nd Edition
- [2] Robert Boylestead & Louis Nashelsky, “Electronic Devices & Circuit Theory”, Pearson Education, 10th Edition
- [3] D. Roy Choudhury & S. B. Jain, “Linear Integrated Circuits”, New Age International Publishers, 4th Edition
- [4] Sergio Franco, “Design with Operational Amplifiers & Analog Integrated Circuits”, Tata McGraw Hill, 3rd Edition
- [5] Muhammad H. Rashid, “Microelectronics Circuits Analysis & Design”, Cengage Learning, 4th Edition

Course Assessment-Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

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.



Laboratory Experiments:

Sr. No.	Title of Experiment	References
1.	Determine parameters of BJT differential amplifier	1,2
2.	Design & implementation of zero crossing detectors & comparators for op-amp open loop configuration	1,2
3.	Design & implementation of op-amp inverting amplifier, non-inverting amplifier & unity gain voltage follower (buffer)	1,2
4.	Design, implementation & simulation of mathematical applications using op-amp (linear application)	1,2
5.	Design & implementation of sinusoidal waveform generators	1,2
6.	Design & implementation of astable multivibrator (square wave generator) using op-amp	1,2
7.	Design & implementation of astable multivibrator using IC 555 timer for given duty cycle (D) & frequency (f)	3,4
8.	Design & implementation of DC voltage regulator for given values/specifications	3.4

Course Assessment-Lab:

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

Suggested CO - PO Articulation Matrix

Course Outcomes	Program Outcomes (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	1	-	-	-	-	-	-
CO2	3	3	1	2	2	-	-	-	-	-	-
CO3	3	2	3	2	3	-	-	-	-	-	-
CO4	3	2	3	2	2	1	1	-	1	1	1
CO5	3	3	2	2	3	1	-	1	1	-	-

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

Blooms level

Remember	Understand ✓	Apply ✓	Analyze ✓	Evaluate ✓	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC10	Discrete Structures and Automata Theory	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	Apply the concepts of relations, functions, lattices and recurrence relations to solve problems.
	CO2	Apply the concepts of graph and trees for traversal, shortest path algorithms.
	CO3	Design finite automaton for a regular expressions and languages.
	CO4	Design Context free grammar, pushdown automata to recognize the language

Module No.	Unit No.	Topics	Ref.	Hrs.	
1	1.1	Relations, Functions Lattices	1,2	5	
		Sets, Product Sets and Partitions, Function, Paths in relations and Diagraphs, Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations, Warshall's Algorithm,			
2	2.1	Lattice	1,2	4	
		Partially Ordered Sets, External Elements of Partially Ordered Sets, Hasse Diagram			
3	2.2	Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice	2,3,4	5	
		Graph Theory			
5,	3.1	Concepts and terminologies, Graphs as Model, Isomorphism, Bipartite Graphs, Directed Graphs	5,6,7	4	
		3.2			Definitions, Paths and circuits: Eulerian and Hamiltonian, Planner Graph. Isomorphism of graphs, Dijkstra Shortest Path Algorithm
		4.1			Regular languages and regular expressions
5,	4.2	Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with ϵ -transitions, NFA to DFA Conversion	5,6,7	4	
		4.3			Finite Automata with output (Moore and Mealy Machine)
5	5.1	Regular Languages	5,6,7	4	
		Regular Language, The pumping lemma for regular languages, Applications of the pumping lemma			



	5.2	Closure properties for regular languages, Decision Properties for Regular Languages		
6		Context Free Grammar (CFG) and Push Down Automata (PDA)	5,6,7	4
	6.1	Grammars: Chomsky hierarchy, CFG- Definition, Sentential forms, Leftmost and Rightmost derivations.		
	6.2	Context Free languages (CFL): Parsing and Ambiguity. CFLs: Simplification and Applications.		
	6.3	Normal Forms: Chomsky Normal Form		
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-Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial			
		Ref.	Hrs.
1	Tutorial 1: Set theory, Functions	1,2	2
2	Tutorial 2: Relations, Lattices	1,2	2
3	Tutorial 3: Graph Theory	1,2	2
4	Tutorial 4: Algebraic Structures	1,2	2
5	Case Study Presentation: Graph Algorithms, Web Graph, Google maps etc.	1,2	6
6	Tutorial 5: Finite Automata	5,6,7	2
7	Tutorial 6: Regular Language	5,6,7	2
8	Tutorial 7: Context Free Grammar	5,6,7	2
9	Tutorial 8: PDA and Turing Machine	5,6,7	2
10	Case Study Presentation: Applications of Automata	5,6,7	6
Total			30



Course Assessment-Lab:

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

Recommended Books:

- [1] Kenneth H. Rosen, “Discrete Mathematics and it’s applications”, Tata McGraw-Hill, 7th Edition
- [2] Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeemur-Rehman, “Discrete Mathematical Structures”, Pearson Education, 6th Edition.
- [3] C L Liu, Mohapatra: “Elements of discrete mathematics: a Computer Oriented approach”, McGraw Hill-New Delhi.
- [4] Doughlas west, “Introduction to Graph theory,” Prentice Hall India
- [5] John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory, Languages, and Computation”, Pearson Education, 3rd Edition.
- [6] Michael Sipser, “Introduction to the Theory of computation”, Cengage, 3rd Edition
- [7] John C. Martin, “Introduction to Languages and the Theory of Computation”, McGraw-Hill, 4th Edition.

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember	Understand	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12EC11	Web Technologies Lab	--	--	2	--	--	--	1	1
		Examination Scheme							
				ISE	MSE	ESE		Total	
				Min	Max				
		Theory		--	--	--	--	--	
		Lab		50	--	--	--	50	

Pre-requisite Course Codes		Essential Computing Skill for Engineers (PCC11EC02)
Learning Outcomes	CO1	Design static web pages using HTML5 and CSS3
	CO2	Apply the concepts of client-side validation and scripts to static web pages using JavaScript
	CO3	Design a website using Node.JS framework

Week No	Topic / Experiment	Title of Topic / Experiment	Ref
1	Topic 1	Revision: HTML / CSS /	1
2	Experiment 1	Design a website using HTML / CSS /	1
3	Topic 2	Introduction to JavaScript	1, 2
4	Experiment 2	Addition of JavaScript in the website designed in Experiment 1	1, 2
5	Topic 3.1	a. Installing and exploring Node JS b. Node JS Module system	3, 4
6	Topic 3.2	a. File system and command line arguments b. Asynchronous Node JS	3, 4
7	Topic 3.3	a. Node JS – Web Server management b. Accessing API from browser	3, 4
8	Topic 3.4	a. Connectivity with MongoDB b. API authentication and security	3, 4
9-10	Experiment 3	Design a website on the given problem statement using Node JS	3, 4
11	Experiment 4	Add customized chatbot application to the website designed in experiment 3	OL-4
12	Experiment 5	Create a personalized portfolio using Node JS and host it on GitHub	3, 4



Course Assessment-Lab:

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

Recommended Books:

- [1] Kogent Learning Solutions Inc., “HTML 5 Black book”, Wiley (Dreamtech) Publications, 2016
- [2] Nick Morgan, “JavaScript crash course”, No Starch Press
- [3] Nathen Sabhastian, “Node.JS Web development for beginners”
- [4] <https://www.anuragkapur.com/assets/blog/programming/node/PDF-Guide-Node-Andrew-Mead-v3.pdf>

Online Repository:

- 1. <https://www.w3schools.com/>
- 2. <https://www.youtube.com/watch?v=f2EqECiTBL8>
- 3. https://www.youtube.com/watch?v=nu_pCVPKzTk
- 4. <https://www.youtube.com/watch?v=1YU83Lw58eo>

Certification Courses:

- 1. Coursera: <https://www.coursera.org/courses?query=node%20js>
- 2. Udemy: <https://www.udemy.com/courses/search/?src=ukw&q=Node.js+Certification+Training>

Suggested CO - PO Articulation Matrix

Laborator y Outcomes	Program Outcomes (POs)											Program Specific Outcomes* (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
LO1	3	1	3	-	3	1	1	-	2	-	2	3	2
LO2	3	2	3	1	3	-	-	-	-	-	3	3	2
LO3	3	3	3	2	3	1	1	2	1	1	3	3	2

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

Blooms level

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE21	Emerging Technology and Law	2	--	--	2	2	--	--	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		100	--	--	--	100	
Lab		--	--	--	--	--			

Pre-requisite Course Codes		--
Course Outcomes	CO1	To recognize the importance of legal technology domain
	CO2	To demonstrate awareness of the laws related to emerging technologies and legal implications of their work
	CO3	To demonstrate understanding of the impact of emerging/contemporary technologies on the legal ecosystem
	CO4	To 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		
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:

- a. Quiz: 40 Marks
- b. Activity: Negotiation: 30 Marks
- c. Activity: Moot Court: 30 Marks

Recommended Books:

Text Books

- [1] N.S.Nappinai, "*TechnologyLawsDecoded*," Lexis Nexis, 2017
- [2] Vibha Arora and Kunwar Arora, "*Law for Engineers*", Central Law Publications, 2017
- [3] Vandana Bhatt and Pinky Vyas, "*LawsforEngineers*", 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 Dato, Drago Indjic, Sophia Adams Bhatti, Susanne Chisht by Wiley Publisher.

Online Repository:

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>.



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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 Articulation Matrix

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

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

Blooms level

Remember	Understand✓	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
250E22	Principles of Management	2	--	--	2	2	--	--	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory	100	--	--	--	--	100	
		Lab	--	--	--	--	--	--	

Pre-requisite Course Codes	
CO1	Understand the evolution of management theories and their relevance today
CO2	Apply planning tools and techniques to real-world business scenarios
CO3	Understand effective organizational structures based on business requirements
CO4	Study different leadership styles and apply appropriate leadership techniques in various situations.
CO5	Recognize ethical dilemmas in management and apply responsible decision-making frameworks.
CO6	Study critical thinking and problem-solving techniques to organizational issues.

Module No.	Topics	Ref.	Hrs.
1	<p>Introduction to Management</p> <p>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.</p> <p>Managerial Roles and Skills: Analysis of the roles managers play and the skills required at different managerial levels.</p>	1-5	04
2	<p>Planning</p> <p>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-</p>	4-7	05



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	making.Goal Setting and Management by Objectives (MBO): Establishing clear objectives and aligning them with organizational goals		
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 coordination among departments.	4-7	04
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.

Course Assessment:

ISE:



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- a. Quiz based on Module 1,2 and 3 (20 Marks)
- b. Case study / Application with PPT Presentation (Group of 4 students) of Decision Making Process Approach, MBO (30 Marks)
- c. Quiz based on Module 4,5 and 6 (20 Marks)
- d. Case Study / Application / Research Literature Studies with PPT Presentation (Group of 4 students) on Leadership in Organization, Innovation and Change Management, continuous improvement processes (30 Marks)

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

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

Blooms level

Remember	Understand✓	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25VSE12EC03	Data Structures	2	1	2	3	3	--	1	4
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		Theory		20	30	20	50	100	
		Tut		50	-	-	-	50	
Lab		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:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE :

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

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



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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 using Heap.	CO2, 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

Course Assessment: - Lab

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

Recommended Books:

- [1] “Data Structures using C and C++”, Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd Edition, Prentice Hall
- [2] “Data Structures using C”, ReemaThareja, 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 Repository:

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



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6. www.codechef.com

Suggested CO- PO Articulation Matrix

Course Outcomes	Program Outcomes (POs)											Program Specific Outcomes (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	2	2	2	1	1	-	-	1	1	-	2	2	1
CO2	2	2	2	1	1	-	-	1	1	-	2	2	1
CO3	2	2	2	1	1	-	-	1	1	-	2	2	1
CO4	2	2	2	1	1	-	-	3	2	1	2	2	1

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

Blooms level

Remember	Understand	Apply✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12EC02	Technology Entrepreneurship	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE	ESE		Total		
					Min	Max			
		Theory	100	--	--	--	100		
Lab	--	--	--	--	--				

Pre-requisite Course Codes		--
Course Outcomes	CO1	Identify problems worth solving
	CO2	Craft value proposition
	CO3	Prepare B-Plan
	CO4	Register virtual company

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		
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)		
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 e-Commerce Management – Dave Chaffey
10. Principles of Effectuation – Dr Saras Saraswathy

Course Assessment-Theory:

ISE:

- a. Quiz: 20 Marks
- b. Assignment: Effectuation case study: 10Marks
- c. Activity: Presentation of Value Proposition Canvas: 30 Marks Rubric Based assessment
- d. Assignment: Presentation of Lean Canvas: 10Marks
- e. Activity: Virtual Company registration: 30 Marks Rubric Based assessment

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 Papadacos, “*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*” ,Lexi Nexis, 2018



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Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25VEC12EC02	Technology Innovation for Sustainable Development	1	--	2	1	1	--	1	2
		Examination Scheme							
				ISE	MSE	ESE		Total	
						Min	Max		
		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	4,5	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
	6.1	Sustainable development goals 17		
	6.2	Technological Solutions to advance partnership theme		
Total				26



Course Assessment-Lab:

ISE:

- a. Quiz: 40 Marks
- b. Activity: Case Study Presentation: 20 Marks
- c. 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

Online Repository:

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

Suggested CO - PO Articulation Matrix

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

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

Blooms level

Remember	Understand	Apply	Analyze ✓	Evaluate	Create
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