CURRICULUM STRUCTURE

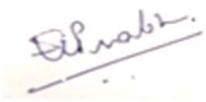
SECOND YEAR UG: B.E.

ELECTRONICS AND COMPUTER SCIENCE

REVISION: FRCRCE-2-25

Effective from Academic Year **2025-26**
Board of Studies Approval: **28/02/2025**
Academic Council Approval: 14/02/2025 to 8/3/2025

Dr. DEEPAK BHOIR
Dean Academics



Dr. SAPNA PRABHU
HoD (ECS)

DR. SURENDRA RATHOD
Principal

Preamble:

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

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

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

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

Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 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	Cocurricular Courses
HMM	Honors and Multidisciplinary Minor
DM	Double Minor
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.

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Credit requirements for different options of the Degrees:

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

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

Salient Features of Curriculum:

✓ Framed as per Government Resolution dated 4th July 2023 in line with National Education Policy (NEP) 2020.

✓ Minimum 172 choice-based credit structure with options of Degrees earning additional credits

✓ Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning environment having bridge connecting verticals providing unique path for each learner for 3-dimensional growth, Life Long Learning, bridge courses, inclusive model indicating equal distribution of central resources

✓ More emphasis on laboratory based and experiential learning

✓ More weightage to continuous assessment to reduce examination stress

✓ Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework

✓ Well balanced curriculum to attain Program Outcomes and skills of 21st century learner

✓ Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.

✓ Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21st Century

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SEMESTERWISE CURRICULUM STRUCTURE

UG Electronics and Computer Science Program:

SEM-III

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25PCC12EC05	PCPEC	PCC	Electronic Devices	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC12EC06	PCPEC	PCC	Computer Organization and Architecture	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC12EC07	PCPEC	PCC	Database Management System	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC12EC08	PCPEC	PCC	Object Oriented Programming with JAVA	PR	2	20	-	30	-	50	1	1
25OE1X	MDC	OE	1. Law for Engineers 2. Financial Planning, Taxation and Investment	TH	2	50	-	50	-	100	2	2
25MDMXX1	MDC	MDM	MDM Course-1	TH	2	20	30	20	30	100	2	2
25MDMXX2	MDC	MDM	MDM Course-2	TH	2	20	30	20	30	100	2	2
25EEM12EC1X	HSSM	EEMC	Modern Indian Language	TH	2	50	--	50	--	100	2	2
25VEC12EC01	HSSM	VEC	Human Values and Professional Ethics	TH	1	50	-	50	-	100	1	2
				PR	2						1	
25CEP12EC01	EL	CEFP	Community Engagement Project	PRJ	4	50	-	50	-	100	2	2
25DMX1	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4#
				TU	2	20	-	30	-	50	2	
25HR02	HR	HR	Honors with Research	PR	-	-	-	-	-	-	4	4*
25DM01/25RM01	DM/RM	DM/RM	Introduction to Emerging Technologies	TH	2	20	30	20	30	100	2	2$
				Total	**TH:TU:PR 15:0:14=29**			-	-	**1100**	-	**22**

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

SEM-IV

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25BSC12EC05	BSESC	BSC	Mathematics and Numerical Methods	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25PCC12EC09	PCPEC	PCC	Analog Electronic Circuits	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
25PCC12EC10	PCPEC	PCC	Discrete Structures and Automata Theory	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25PCC12EC11	PCPEC	PCC	Web Technologies Lab	PR	2	20	-	30	-	50	1	1
25OE2X	MDC	OE	1. Emerging Technology and Law 2. Principles of Management	TH	2	50	-	50	-	100	2	2
25MDMXX3	MDC	MDM	MDM Course-3	TH	2	20	30	20	30	100	2	2
25VSE12EC03	SC	VSEC	Data Structures	TH	3	20	50	30	50	150	3	4
				PR	2	20	-	30	-	50	1	
25EEM12EC02	HSSM	EEMC	Technology Entrepreneurship	TH	2	50	-	50	-	100	2	2
25VEC12EC02	HSSM	VEC	Technology Innovation for Sustainable Development	TH	1	40	-	60	-	100	1	2
				PR	2						1	
25DMX2	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4#
				TU	2	20	-	30	-	50	2	
25HR03	HR	HR	Honors with Research	-	-	-	-	-	-	-	4	4*
25BC	BC	BC	MOOC	-	-	-	-	-	-	-	-	2$
				Total	**TH:TU:PR 16:2:8=26**			-	-	**1100**	-	**22**

$ Discipline specific additional course to Lateral Entry (Diploma) students from Swayam Plus/Swayam platform

Kindly refer **'Manual for Degree Options'** for List of Courses offered under MDM and DM Degree options

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

1. Sanskrit for Beginners
2. Telugu for Beginners
3. Kannada for Beginners
4. Tamil for Beginners

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12EC05	Electronic Devices	L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	–	30	–	50	

Pre-requisite Courses	Basic Electrical and Electronics Engineering Fundamentals of Electromagnetics and Semiconductor Devices	
Course Outcomes	After the successful completion students should be able to	
	CO1	Explain the working of semiconductor devices.
	CO2	Interpret the characteristics of semiconductor devices.
	CO3	Explain characteristics of power electronics and optoelectronic devices.
	CO4	Apply the optoelectronic and power electronic devices for various applications

Module No.	Unit No.	Topics	Ref.	Hrs
1		**Bipolar Junction Transistors**		
	1.1	Minority carrier distributions and terminal currents, Generalized Biasing: The Coupled-Diode Model, Charge control analysis; switching, drift in base region, base narrowing, avalanche breakdown, thermal effects, Kirk effect.	1,3	5
	1.2	Uni-junction Transistor (UJT)		
2		**Field Effect Transistors**		
	2.1	JFET (characteristics), MOS capacitor (threshold voltage, C-V characteristics)	4	5
	2.2	MOSFET: I-V characteristics, Equivalent circuits for the MOSFET.		
3		**MOS Transistor**		
	3.1	MOS Transistor under Static Conditions, Dynamic Behaviour, Secondary Effects	2,4	5
	3.2	SPICE Models for MOS Transistor, Technology Scaling		
4		**Optoelectronic Devices**		
	4.1	Photodiodes: I-V characteristics in an illuminated junction, Solar Cells, Photodetectors	1,2,4	5
	4.2	LEDs, Semiconductor LASER		
5		**Power Semiconductor Devices**		
	5.1	SCR (Silicon Controlled Rectifier): two transistor model, protection circuits, series and parallel operation of SCR, triggering and commutation circuits	2	6

	5.2	GTO, TRIAC, DIAC, Power Diode, Power BJT, Power MOSFET, IGBT.		
			Total	**26**

List of Experiments:

Sr. No.	Title of Experiment	Ref.
1	Input & Output Characteristics of BJT in Common Emitter (CE) Configuration	1, 2
2	Simulation of Input & Output Characteristics of BJT (CE Configuration)	1, 2
3	Uni-junction Transistor (UJT) V-I Characteristics	1, 2
4	UJT as Relaxation Oscillator	1, 2
5	Junction Field Effect Transistor (JFET) V-I & Transfer Characteristics	1, 2
6	Simulation of MOSFET Transfer & Output Characteristics	1, 2
7	Simulation of Channel Length Modulation for MOSFET (Secondary Effects)	1, 2, 3
8	Silicon Controlled Rectifier (SCR) V-I Characteristics	1, 2, 3

Recommended Books:

1. B.G. Streetman, S. K. Banerjee, "Solid State Electronic Devices ", 7th edition, Pearson India Education Service Pvt. Ltd., 2017.
2. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", 4th Edition, Pearson India Education Service Pvt. Ltd, 2017.
3. S. M. Sze, "Physics of Semiconductor Devices", 3rd Edition, John Wiley & Sons, Inc. 2007.
4. Donald. A. Neamen, "Semiconductor Physics and Devices: Basic Principles", 4th Edition, McGraw Hill Higher Education, 2011.

Useful Links:

1. https://nptel.ac.in/courses/108/107/108107142/
2. https://www.youtube.com/playlist?list=PLF178600D851B098F
3. https://www.youtube.com/playlist?list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP

Course Assessment:

Theory:

ISE-1: 20 marks

1. Quiz/ crossword:10 Marks
2. Poster making:10 marks

ISE-2: 20 Marks

1. 3D model making : 10 Marks
2. Open Book Test : 10 marks

MSE: 90 Minutes, 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes, 30 Marks written examination based on remaining 50% syllabus

Laboratory:

ISE-1:
Conducted for four experiments with continuous pre-defined rubrics-based evaluation for 20 Marks.

ISE-2:
(i) Conducted for four experiments with continuous pre-defined rubrics-based evaluation for 20 Marks
(ii) Viva-voce (oral) examination based on entire syllabus for 10 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
25PCC12EC06	Computer Organization and Architecture	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	--	30	--	50	

Pre-requisite Courses		Digital Electronics
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**		4
	1.1	Basic Building blocks of a Computer, Evolution of x86 Computers, Von Neumann model, Harvard Model, Performance measures	1,2,5	
	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-Datapath 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 Organization**		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	
	3.4	Case Study: Virtual Memory management in Pentium processor	1,2,7	
4		**I/O Organization**		3
	4.1	I/O interfacing: Handshaking, Interrupt handling, Direct memory Access (DMA)	1	
	4.2	I/O Buses: Protocols, Arbitration	1	
5		**Parallel processing**		3
	5.1	Introduction to Parallel processing, Flynn's Classification, Amdahl's Law	4,5	
	5.2	Pipelining, Pipeline Performance metrics, Pipeline Hazards	2,4,5	
6		**Advanced Processor Architectures**		4
	6.1	Superscalar processors, GPU, Clusters, Multi-core processors	1,5,8	
	6.2	NVIDIA GPU Case study and Programming Model	9	
			Total	**26**

Recommended Books:

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

Course Assessment:

Theory:

ISE-1: Activity: Quiz 10 Marks Assignment 10 Marks

ISE-2: Activity: Technical Report on latest Motherboard design 10 Marks Seminar on Research paper (IEEE /ACM) 10 Marks

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

ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MSE

Laboratory Experiments:

Sr. No.	Suggested list of experiments	Ref.
1.	Design of a Booth Multiplier	1
2.	Implement Restoring and Non-Restoring Division Algorithm.	1
3.	Implementation of Arithmetic/Logical operations using 8086 (Assembly language)	3,8
4.	Block transfer using 8086 (String instructions)	3,8
5.	Implementation of subroutines and macros using 8086	3,8
6.	Implementation of various cache mapping techniques to measure cache hit rate.	1,2,5
7.	Implement various page replacement policies (LRU, FIFO, LFU)	1,2,5
8.	Simulate various data hazards in a pipeline (for a given program segment).	2,5

Course Assessment:

Lab:

ISE-1: Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2:

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

b. Activity: **Design of Experiment** using any simulator (Cache/ Performance monitoring)10 marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	2	2	--	1	3
25PCC12EC07	Database Management System	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	--	30	--	50	

Pre-requisite Course	--	
Course Outcomes	CO1	Explain basic concepts and the applications of database management systems.
	CO2	Design ER/EER diagrams for real-world scenario.
	CO3	Convert ER/EER diagram to relational model and write relational algebra queries.
	CO4	Formulate SQL queries to retrieve, manipulate, and analyze data stored in a relational database.
	CO5	Apply the concept of normalization to relational database to improve the database design.
	CO6	Describe the concepts of transaction and concurrency control.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Module 1: Introduction To Database Systems**	1,2,6	2
	1.1	Characteristics of Database systems		
	1.2	File System Vs. Database systems		
	1.3	Three Schema Architecture and Data Independence		
	1.4	DBMS Architecture, Applications of DBMS		
2		**Module 2: Conceptual Data Modelling using Entity-Relation Diagram**	1,2,6	4
	2.1	The Entity-Relationship (ER) Model: Entity types, Types of Attributes, Types of Keys		
	2.2	Relationships**:** Types of Relationships (Unary, Binary, Ternary, N-ary), Constraints on Relationship (Cardinality and Participation)		
	2.3	Extended ER Diagram**:** Generalization, Specialization, and Aggregation.		
3		**Module 3: Relational Model and Relational Algebra**	1,2,6	4
	3.1	Introduction to Relational Model: Relational Schema and Concepts of keys.		
	3.2	Mapping the ER and EER Model to the Relational Model		
	3.3	Relational Algebra**:** Operators and Relational Algebra Queries		
4		**Module 4: Structured Query Language**	1,2	6
	4.1	DDL commands**:** CREATE, ALTER, DROP, TRUNCATE, Integrity constraints**:** Key constraints, Domain constraints, Referential integrity constraints, and Check constraints		
	4.2	DML Commands: Insert, Update, Delete, WHERE clause, OrderBy		

		clause, DCL commands (Data control commands)		
	4.3	Aggregate Functions, GroupBy – Having clause		
	4.4	SQL Joins, Set operations, String operations, Nested queries		
	4.5	Views and Indexing		
	4.5	PL/SQL and Triggers		
5		**Normalization**	1,2,4,6	5
	5.1	Pitfalls in Relational Database designs, Concept of Normalization, Function Dependencies.		
	5.2	1NF, 2NF, 3NF, BCNF		
	5.3	Converting Relational Schema to higher normal form		
6		**Transaction and Concurrency Control , Introduction to NoSQL**	1,2	5
	6.1	Introduction to Transaction, Transaction States, ACID properties, Serial and Concurrent Schedules, Serializability**:** Conflict and View serializability. Transaction Control Commands (TCL)		
	6.2	Introduction to Concurrency Control**:** Lock-based protocols, Timestamp-based protocols.		
	6.3	Recovery System: Log based recovery, Time-stamp based recovery , deadlock handling		
	6.4	Introduction to Nosql: NoSQL database concepts, Benefits of NoSQL, comparison between SQL and NoSQL database system, NoSql data modelling, Documents and collections, CRUD operation.		
			Total	**26**

Module No.	**Sr.no**	**Suggested List of experiments**	**Ref.**
2	**1**	Write a problem statement for a selected case study. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model	1,2
3	**2**	Convert ER/EER model to relational model	1,2
4	**3**	To create Primary table with basic constraints and use simple DML commands to retrieve data form these tables..	2,3
	4	To create all FOREIGN KEY tables (Apply necessary Referential Integrity constraints). Perform operations involving ALTER, DELETE, and UPDATE commands on the tables created.	2,3
4	**5**	To implement Joins and Nested queries to solve complex queries	2,3
	6	To implement aggregate functions with Group by and Having clause.	2,3
4	**7**	To apply Plsql procedures and functions in Postgresql	5,6
	8	Implement Triggers and cursors in SQL	5,6
4	**9**	To implement views , index and transaction in Postgre sql	2,3,4
All Modules	**10**	Mini Project based on suggested list of topics	

Course Assessment:

Theory:

ISE-1 (20M)

a. Quiz (10M)
b. Activity: 90 Minutes activity on Database Design Contest, Group Activity (10M)

ISE-2 (20M)

a. Activity: Quiz/crossword (10M)
b. Activity: Solve Hacker rank challenges (10M)

MSE: 90 Minutes 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MSE

Lab:

ISE-1 (20M)

Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2 (30M)

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
b. Mini Project OR Internal Hackathon Competition for 10 marks

Recommended Books:

1. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw Hill, 6thEdition.
2. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education, 5thEdition.
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, 5thEdition.
5. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2007th edition.
6. G. K. Gupta, Database Management Systems, McGraw Hill, 2018.

Online Resources:

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. https://www.postgresql.org/docs/current/plpgsql.html
5. NPTEL Certification link: https://onlinecourses.nptel.ac.in/noc22_cs91/preview
6. http://www.mysqltutorial.org/ or https://www.tutorialspoint.com/postgresql/
7. https://www.tutorialspoint.com/postgresql/

Further Reading:

1. Pramod Sadalge, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglon Persistence, Addison Wesely/ Pearson
2. Adam Fowler, NoSQL for dummies, John Wiley & Sons, Inc

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned		
		L	T	P	L	T	P	Total
25PCC12EC11	Object Oriented Programming with Java	0	0	2	0	0	1	1
		Examination Scheme						
		ISE	MSE		ISE	ESE		Total
		20	--		30	--		50

Pre-requisite Courses	Programming Fundamentals	
	On successful completion of the course learner will be able to	
Course Outcomes	CO1	Demonstrate Proficiency in Core Java Concepts
	CO2	Apply Object-Oriented Programming Principles
	CO3	Explore Java Programming concepts including multithreading, File I/O, and exception handling
	CO4	Develop and Debug Java Applications

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

3	Inheritance: Types of Inheritance, Interface, Abstract class and methods, super and final keywords **Suggested Experiment List: (Any One) Shape Drawing Application** Design a shape drawing application that allows users to draw different shapes (circle, rectangle, triangle) on a canvas and perform operations like resizing and rotating. **Employee Payroll Processing** Create a program for managing employee payroll information, including salary calculation, deductions, and tax withholding. Allow HR personnel to add new employees, update salary information, and generate pay stubs.	1,2
4	Arrays and Vector: Arrays in Java, Vector. **Suggested Experiment List: (Any One) Library Management App:** Develop a program for a library that manages book inventory, allowing users to search for books by title or author **Contact Management App:** Build a contact management application that stores contact information (name, phone number, email) and provides features like searching, sorting, and exporting contacts.	1,2
5	Strings: Introduction to strings and string manipulation **Suggested Experiment List: (Any One) String Encoding:** Design a Java application that efficiently compresses a given string using any encoding technique, balancing between compression ratio and computational complexity. **Word Frequency:** Create a Java application for generating word clouds from textual data. Implement algorithms for frequency analysis, word weighting, and layout optimization to produce visually appealing representations of word distributions. **NLP:** Create a Java application for natural language processing that extracts named entities from a text corpus. Implement algorithms for recognizing and categorizing entities such as persons, organizations, locations, and dates.	1,2
6	Exception Handling: Handling exceptions in Java (try-catch- throw- throws-finally), User defined Exceptions **Suggested Experiment List: (Any One) Flight Booking System** Develop a program for a flight booking system that handles exceptions such as invalid input, seat availability, and payment errors. **Transportation Management** Create a Java program for a transportation management system that handles exceptions related to route planning, vehicle breakdowns, traffic congestion, and delivery delays. Implement resilience patterns like circuit breakers and retry mechanisms."	1,2

7	Multithreading: Introduction to Multithreading- lifecycle, creation of threads. Synchronization and Thread Communication, Handling Thread Interruption and Thread Pools. **Suggested Experiment List: (Any One)** **Chat Application** Develop a real-time chat application that allows multiple users to communicate with each other concurrently using separate threads for sending and receiving messages. **Social Media Platform** Build a simple social media platform where users can create profiles, connect with friends, and share posts. Implement features such as news feed, notifications, and privacy settings.	1,2, 3
8	Introduction to JavaFx: Setting Up a JavaFX Application, Creating UI Elements, Event Handling in JavaFX **Suggested Experiment List: (Any One) Inventory management app** Design a simple inventory management system for a retail store that allows employees to add, update, and remove products from inventory using a graphical user interface. **Educational Game:** Create an educational game using JavaFX for teaching complex concepts in mathematics, physics, or computer science. Design engaging gameplay mechanics, interactive tutorials, and challenging puzzles to facilitate learning through exploration and experimentation.	4
9	Database Connection with Java: Setting Up Database Environment (MySQL/PostgreSQL), Establishing Database Connection, Executing SQL Queries, basics of Exception Handling Demonstration Program on Database Connection and Queries handling	1,2
10	File Handling: File Input/ Output with Streams, Serialization and Deserialization, Random Access Files **Suggested Experiment List: (Any One) File Master App** Create a file management tool that allows users to organize and manage files and folders on their computer, including operations like creating, deleting, and renaming files. **Weather Forecasting Application** Develop a weather forecasting application that retrieves data from a file and displays current weather conditions and weather stats.	1,2
11	**Mini Project:** Defining the problem statement and objectives. Create UML diagram (Class diagram/ Use case diagram) Implement the idea of Mini Project based on the content of the syllabus (Group of 2-3 students)	

Course Assessment:

Term work should consist of 8-10 experiments.
Mini Project based on the content of the syllabus (Group of 2-3 students)

ISE:

ISE-1 will be conducted for 50% experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
ISE-2 will be conducted for remaining experiments. Continuous pre-defined rubrics-based evaluation for 30 marks (20 marks for lab performance + 10 marks for project).

Text Books:

1. "Java: The Complete Reference" by Herbert Schildt
2. "Programming with JAVA" by E. Balaguruswamy

Reference Books:

3. "Head First Java" by Kathy Sierra and Bert Bates
4. "Effective Java" by Joshua Bloch
5. "Java Concurrency in Practice" by Brian Goetz et al.
6. "JavaFX 8: Introduction by Example" by Carl Dea, Gerrit Grunwald, and José Pereda

Online References:

7. Java Course Online for Beginners by Scalar Topics-

   https://www.scaler.com/topics/course/java-beginners/

8. Object Oriented Programming in Java by Coursera

   https://www.coursera.org/learn/object- oriented-java
9. Java Tutorial for Complete Beginners by Udemy
   https://www.udemy.com/course/java- tutorial/
10. Java Programming by Great Learning
    https://www.mygreatlearning.com/academy/learn-for- free/courses/java-programming
11. Core Java Basics by UpGrad
    https://www.upgrad.com/software-engineering-course/core- java/
12. Practice Java by Building Projects on Udemy
    https://www.udemy.com/course/practice-java- by-building-projects/
13. Java for Absolute Beginners by Udemy
14. https://www.udemy.com/course/java-for-absolute- beginners-learn-java-from-zero/

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25OE11	Law for Engineers	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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.,		
	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 Contracts, Contract of Agency, Performance of Contracts, Government Contracts, Standard Form Contracts		
3		**Industrial and Labour Laws**	2,3	8
	3.1	Labour Laws in India: An Overview, Industrial Disputes Act, 1947, Industrial Employment (Standing Orders) Act, 1946		
	3.2	Factories Act, 1948, Industries (Development and Regulation) Act, 1951		
	3.3	Contract Labour (Regulation and Abolition) Act, 1970, Bonded Labour System (Abolition) Act, 1976, Child and		

		Adolescent Labour (Prohibition and Regulation) Act, 1986		
	3.4	Workmen's Compensation Act, 1923, Equal Remuneration Act, 1976, Payment of Bonus Act, 1965, Payment of Gratuity Act, 1972, Employees' State Insurance Act, 1948, Employees' Provident Funds and [Miscellaneous Provisions] Act, 1952, Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees' Pension Scheme 1995		
	3.5	Apprentices Act, 1961, Maternity Benefit Act, 1961, Fatal Accidents Act, 1855, Trade Unions Act, 1926, Sexual Harassment of Women at Workplace Act, 2013, Collective Bargaining		
4		**Right to Information**	2,3	2
	4.1	Official Secret Act, 1923, Indian Evidence Act, 1872		
	4.2	Right to Information Act, 2005, Impact of Right to Information Act		
5		**Intellectual Property Rights**	2,3	2
	5.1	Types of Intellectual Property, Indian Copyright Act 1957, Indian Trademark Act 1999, Indian Patent Act 1970		
6		**Other Important Laws**	2,3	2
	6.1	Electricity Act 2003, Atomic Energy Act 1962, Motors Vehicle Act 1988, Food Safety and Standards Act 2006, National Food Security Act 2013, Environment Protection Act 1986		
			Total	**26**

Recommended Books:

1. N. S. Nappinai, "*Technology Laws Decoded*," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "*Law for*DRAFT *Engineers*" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "*Laws for Engineers*", ProCare, 2015

Course Assessment:

ISE-1:
Quiz: 20Marks
Activity: Debating Session: 20 Marks
Activity: Poster Making: 10 Marks

ISE-2:
Quiz: 20 Marks
Activity: Client Counselling: 10 Marks Activity:
Animation Making: 20 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE12	Financial Planning, Taxation and Investment	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	50	--	50	--	100	

Pre-requisite Courses		--
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.

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-1:
Quiz: **20 Marks**
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.

ISE-2:
Quiz: **20 Marks**
Activity: Tax Return Case Studies (*Perquisite: 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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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25EEM12EC11	Sanskrit for Beginners	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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**

Recommended Books/ References:

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

7. https://onlinecourses.nptel.ac.in/
8. https://www.learnsanskrit.org/

Course Assessment:

ISE-1: Activities and Assignments: 50 Marks
ISE-2: Activities and Assignments: 50 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EEM12EC12	Tamil for Beginners	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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
	1.2	Learning Tamil Alphabets		1
	1.3	Basic Pronunciation and Oral drills with visual learning		2
	1.4	Greetings and common expressions		2
2	2.1	**Basic Grammar and Sentence Structure** Sentence Construction: Subject, Verb, Object (SVO)		2
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	**Building Vocabulary for Everyday Conversation** Learning Numerals (Cardinal numbers) 1-20, 100. 200…1000		2
	3.2	Forming Simple sentences with interactive lessons		3
	3.3	Learning Days of week, Months of the year, Fruit, Food grains, Parts of the Body, Names of Common places like Hospitals, Market place, shops, Saloons etc.		3
4	4.1	**Daily life and Survival Phrases** Day to day usage of language for daily routines in conversation with Student to Teacher, Vegetable shop vendor, Railway Station, conversation with Auto Drivers, Hospitals etc.		3
	4.2	Role Play exercises in common situations		3
			Total	**26**

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.

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
ISE-2: Activities and Assignments: 20 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
EEM12EC13	Kannada for Beginners	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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	1-4	1
	1.2	Learning Kannada Alphabets		1
	1.3	Pronunciation and visual learning		2
	1.4	Greetings and Common expressions		2
2	2.1	**Basic Grammar and Sentence Structure with Subject, Verb, Objective (SVO)** Basics of Sentence Formation	1-4	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	1-4	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.	1-4	3
	4.2	Role play exercises in common situations		3
			Total	**26**

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.Prabhu sankara & B.V.Sridhar," Oxford English-English-Kannada dictionary", Oxford Publications.

Course Assessment:

ISE-1:

a) Activities and Assignments : 20 Marks
b) Oral Examination : 30 Marks

ISE-2:

a) Activities and Assignments : 20 Marks
b) Oral Examination :30 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EEM12EC14	Telugu for Beginners	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	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	1-4	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)	1-4	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	1-4	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..	1-4	3
	4.2	Role Play Exercises in Common situations, presentation on Telugu culture, Telugu scripts, Telugu classical music, Telugu festivals.		3
			Total	**26**

Recommended Books:

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

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
ISE-2: Activities and Assignments: 20 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned				
		L	T	P	L		T	P	Total
		1	--	2	1		--	1	2
25VEC12EC01	Human Values and Professional Ethics	Examination Scheme							
			ISE-I	MSE	ISE-II		ESE		Total
		Theory	50	---	50		---		100
		Lab	---	---	---		---		---

Pre-requisite Courses		--
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**	7,8	**3**
	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		2
	1.2	Promotion of Inter-Religious harmony and inter-faith values, Composite Culture		1
2		**Professional Ethics and Human Values**	1-5	
	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
	2.2	Human Values. Morals, values, and Ethics – Integrity- Academic integrity- Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- cooperation Commitment Empathy-Self Confidence -Social Expectations.		2
	2.3	Managing conflict- Respect for authority- Collective bargaining- Confidentiality, Role of confidentiality in moral integrity-Conflicts of interest		2
3		**Global Ethical Concerns**	2	
	3.1	Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics		2
	3.2	Engineers as Expert witnesses and advisors-Moral leadership- case studies		1
			Total	**13**

Recommended Books/ References:

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

Course Assessment:

ISE-1:
AICTE & UNESCO's certificate course on Self-directed Emotional Learning for Empathy and Kindness (SEEK) **30 marks**
Link : https://www.framerspace.com/cour se/seek (Select SEEK self-directed cohort under the category of youth courses)
Activity: Quiz and assignments **20 Marks**

ISE-2:
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**

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
25CEP12EC01	Community Engagement Project	Examination Scheme						
			ISE 1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	50	--	50	--	100	

Pre-requisite Courses		--
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 f[DRAFT]ield-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[DRAFT] why it is important. Outline what is broken and focus on what is working. Is the issue a people problem or a situation problem? Can the problem be solved with technical expertise or will it require something else? Determine the interest and merit in hosting future discussions.

Phase-II: Gather Facts, Brainstorm and Select

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

Phase-III: Plan and Review

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

Phase-IV: Implement and Evaluate

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

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

Course Assessment:

ISE-1:

Activity: Report Submission: 20 Marks
Activity: Report Presentation: 30 Marks

ISE-2:

Activity: Report Submission: 20 Marks
Activity: Report Presentation: 30 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25DM01/ 25RM01	Introduction to Emerging Technologies	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
After the successful completion students should be able to:		
Course Outcomes	CO1	Recognize the dynamic nature of emerging technologies and their evolving landscape.
	CO2	Demonstrate knowledge of the key characteristics and potential applications of emerging technologies.
	CO3	Identify the value, innovative solutions or applications for real-world challenges using emerging technologies
	CO4	Analyze the implications of emerging technologies on society, business, and various industries
	CO5	Identify various emerging technologies relevant to his/her discipline for personal and professional growth
	CO6	Recognize the need for continuous learning to keep pace with technological advancements.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Industrial Revolution, Important Inventions during various Industrial Revolutions (IR).	1,2	2
	1.2	Role of data, Enabling devices, Network and Human to Machine Interaction during IR	1,2	1
2	2.1	Data Science: Overview of data science, Data Science Life Cycle, Cloud Computing with examples of available Clouds, Big Data, Big data Life Cycle with Hadoop	1,2	3
	2.2	Artificial Intelligence and Machine Learning: Philosophy of AI, Components of AI, Important terminologies, AI Problem Solving, Real-World AI, Types of Machine Learning, Neural Networks, Applications: Computer Vision, Robotics, NLP. Societal Implications of AI.	1,2	3
	2.3	Fundamentals of Blockchain, Blockchain applications and architecture. Introduction to Cyber Security, Cyber attacks and defenses, Case studies.	1,2	3
	2.4	Robotic Process Automation, RPA Tools and Applications		1
3	3.1	Internet of Things (IoT): Introduction, IoT Sensors, IoT Data	1,2	3

		acquisition & platforms, IoT Data Communication, IoT data storage and Retrieval, IoT data analytics & visualization and IoT Security, IoT Product Development Life Cycle, Industrial IoT, Concept of Edge Computing. Case studies		
	3.2	Introduction to Immersive Technologies (AR, VR and MR), AR /VR systems with IOT, AI and Haptics, Tools needed to build AR Apps, usecases, Human Centric UX design	3	2
4	**4.1**	Semiconductor and Nanotechnology: Evolution of Semiconductor Industry, Trends and Innovations in Semiconductor Technologies with respect to material, devices, circuits, architecture and applications. Indian Semiconductor Industry: present status, market trends, challenges, policy initiatives by GoI	4	3
	4.2	Digital Manufacturing, Principles of 3D Printing, Classification and material used in 3D printing, software tools and applications to various fields. Introduction to Robotics, Drones and Autonomous Systems. Fundamentals of tools, software and hardware required to build robot and autonomous systems. Applications and Case studies.	1,6	3
	4.3	Other Trends in emerging technologies: 5G telecom networks and Electric Vehicles	6	2
			Total	**26**

Course Assessment:

Theory:

ISE-1: Quiz: 10Marks
Activity: Group Discussion on applications, benefits, effects of emerging technologies: 10 Marks
Learning Outcome:
PO6: Engineer and Society
CO4: Analyze the implications of emerging technologies on society, business, and various industries
Industry Skill: Critical Thinking

ISE-2: Quiz: 10 Marks
Activity: Article discussion on emerging technologies: 10 Marks
Learning Outcome: PO12: Life Long Learning
CO6: Recognize the need for continuous learning to keep pace with technological advancements.
CO5: Identify various emerging technologies relevant to his/her discipline for personal and professional growth

MSE : 90 Minutes 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MS

Recommended Books:

1. Vasudha Tiwari. Sunil Kumar Chaudhary and Iqbal Ahmed Khan, "*Emerging Technology For Engineers*", Vayu Education of India, 1st Edition.
2. Chanagala Shankar, "*Emerging Technologies*", Bluerose Publishers Pvt. Ltd, 1st Edition
3. Chandradev Yadav, "*The Evolution of Immersive Technologies: A Journey into the Extraordinary*", 1st Edition
4. Website of India Semiconductor Mission (https://ism.gov.in/)
5. SWAYAM course on 'An Introduction to Artificial Intelligence'
6. Other relevant online resources to be used.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25BSC12EC05	Mathematics and Numerical Methods	L	T	P	L	T	P	Total
		2	1	0	2	1	0	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Tutorial	20	--	30	--	50	

Pre-requisite Courses	Matrices and Differential Calculus, Integral Calculus and Probability Theory	
Course Outcomes	At the end of the course learner will be able to	
	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

Theory:

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.		
	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**

Recommended Books:

1. Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4nd Edition.
2. H. K. Dass, "*Advanced Engineering Mathematics*", S. Chand, 28th Edition.
3. Erwin Kreysizg, "*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.

Course Assessment:

Theory:

ISE-1: Quiz/Assignment: 20 Marks

ISE-2: Quiz/Assignment/Activity: 20 Marks

MSE: 90 Minutes 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MSE

Tutorial:

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:

1. ISE-1 will be conducted for three tutorials. Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2 will be conducted for five tutorials. Continuous pre-defined rubrics-based evaluation for 30 marks.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
PCC12EC08	Analog Electronic Circuits	2	--	2	2	--	1	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	20	–	30	–	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, 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		**Non-linear Applications of Operational Amplifier**		6
	4.1	Various zero crossing detectors (ZCD) & comparator circuits	1,2, 3,4	
	4.2	Non-sinusoidal waveform generators – astable multivibrator (square wave generator) & triangular waveform generators, Schmitt Trigger		
5		**Special Purpose Integrated Circuits**		5
	5.1	IC 555 Timer – internal block diagram & pin configuration, astable & monostable multivibrator applications with numerical analysis for duty cycle (D), time period (T) & frequency (f)	3,4	
	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 and Design", TATA McGraw Hill, 2nd Edition
2. Robert Boylestead and Louis Nashelsky " Electronic Devices and Circuit Theory", Pearson Education 10th Edition
3. D. Roy Choudhury and 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 and Design", Cengage

Course Assessment:

Theory:

ISE-1: 20 marks

1. Quiz/ crossword for 10 Marks
2. Mini-project on Power supply Design for 10 marks

ISE-2: 20 Marks

1. Open book test :10 Marks
2. Mini-project on Signal Generator: 10 marks

MSE: 90 Minutes 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MS

Laboratory Experiments:

S.N.	Title of experiment	References
1.	Design the rectifier and compare the performance.	1,2
2.	Use diode to achieve clipping and clamping of the circuits. Try different circuits and compare the performance.	1,2
3.	Compare the performance of various filters to get better performance.	1,2
4.	Design the voltage regulator circuit to get proper regulation and determine % load and Line regulation	1,2
5.	Analyze CE and CS amplifier both DC analysis (At-least two different devices) (Perform simulation)	1,2
6.	AC analysis for CE amplifier (Determine Av, Zi and Zo)	1,2
7.	Simulate the transfer characteristics for the DIFF-AMP	3,4
8.	Oscillator design: Wien bridge as well as Phase shift oscillator using OP-AMP	3.4

Course Assessment:

Lab:

ISE-1 will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2:

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
b. Activity based: Mini project debugging for 10 marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12EC09	Discrete Structures and Automata Theory	L	T	P	L	T	P	Total
		2	1	--	2	1	--	3
		Examination Scheme						
			ISE 1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Tutorial	20	--	30	--	50	

Pre-requisite Courses		Number theory, Set theory
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		**Relations, Functions and Lattices**	1,2	5
	1.1	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, Partially Ordered Sets, External Elements of Partially Ordered Sets, Hasse Diagram		
	1.2	Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice		
2		**Algebraic Structures**	2,4	3
	2.1	Algebraic Structures - Semi group, Monoids, Groups, Cyclic groups		
	2.2	Abelian groups, Normal Subgroups		
3		**Graph Theory**	2,3, 4	4
	3.1	Concepts and terminologies, Graphs as Model, Isomorphism, Bipartite Graphs, Directed Graphs		
	3.2	Definitions, Paths and circuits: Eulerian and Hamiltonian, Planner Graph. Isomorphism of graphs, Dijkstra Shortest Path Algorithm		
	3.3	Trees, Types of Trees, Minimal Spanning Trees-Prim's Algorithm and Kruskal's Algorithm		
3		**Finite Automata**	5,6, 7	5
	3.1	Regular languages and regular expressions		
	3.2	Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with ϵ-transitions, NFA to DFA Conversion		
	3.3	Finite Automata with output (Moore and Mealy Machine)		

4		**Regular Languages**	5,6, 7	4
	4.1	Regular Language, The pumping lemma for regular languages, Applications of the pumping lemma		
	4.2	Closure properties for regular languages		
	4.3	Decision Properties for Regular Languages		
5		**Context Free Grammar (CFG) and Push Down Automata (PDA)**	5,6, 7	5
	5.1	Grammars: Chomsky hierarchy, CFG- Definition, Sentential forms, Leftmost and Rightmost derivations.		
	5.2	Context Free languages (CFL): Parsing and Ambiguity. CFLs: Simplification and Applications.		
	5.3	Normal Forms: Chomsky Normal Form		
	5.4	PDA- Definition, Transitions (Diagrams, Functions and Tables), Design of PDA with Graphical Notation and Instantaneous Descriptions.		
			Total	**26**

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.

Course Assessment:

Theory:

ISE-1:

Activity: -

1. Quiz/Assignment: 10 Marks
2. Case study presentation discussing applications of Discrete Structures: 10 Marks

ISE-2:

Activity: -Quiz/Assignment/Activity: 10 Marks

1. Case study presentation discussing applications of Automata: 10 Marks

MSE: 90 Minutes 30 Marks written examination based on 50% syllabus
ESE: 90 Minutes 30 Marks written examination based on remaining syllabus after MSE

Tutorial:

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

Course Assessment:

Tutorial:

ISE-1: - Four tutorials based on Set theory, Relations, Functions and Lattice, Graph Theory, Algebraic Structures. Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2: - Four tutorials based on Finite automata, Regular Languages and grammar will be conducted for five tutorials. Continuous pre-defined rubrics-based evaluation for 30 marks.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned		
		L	T	P	L	T	P	Total
25PCC12EC10	Web Technologies Lab	0	0	2	0	0	1	1
		Examination Scheme					
		ISE	MSE		ISE	ESE	Total
		20	--		30	--	50

Pre-requisite Courses	Essential Computing Skill for Engineers	
	On successful completion of the course learner will be able to	
Course 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:

ISE-1

For first two experiments, Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2

Remaining three experiments, Continuous pre-defined rubrics-based evaluation for 30 marks

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 Resources:

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25OE21	Emerging Technology and Law	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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 res hape legal system		
	1.3	Career Development in Legal Tech Domain		
2		**Emerging Technologies and Legal Implications-1**	1	8
	2.1	Cyber Crimes, Cyber Threats and Issues: Information Technology Act 2000		
	2.2	Blockchain and Legal Issues		
	2.3	Legal Implications of Artificial Intelligence		
	2.4	Electronic and Digital Signatures		
	2.5	Implications of social media Laws		
3		**Emerging Technologies and Legal Implications-2**	1	6
	3.1	Legal Ecosystem for Autonomous Vehicles and Unmanned Aerial Vehicles (UAV)		
	3.2	Privacy and Data Protection with a Trillion Connected & Cognitive Devices		
	3.3	Legal Ecosystem for 5G		
4		**Company Laws**	2,3	4
	4.1	Companies Act, 1956- Nature and Meaning, Classification of Companies, Incorporation of Companies		
	4.2	Sources of Capital, Board of Directors, Company Meetings		
5		**Regulation and Management of Foreign Exchange**	2,3	2
	5.1	Foreign Exchange Management Act FEMA 1999		
6		**Other Important Laws**	2,3	2
	6.1	Consumer Protection Act, Competition Act 2002, Semiconductor Integrated Circuits Layout-Design Act 2000, Designs Act 2000, Bureau of Indian Standards Act 2016,		
			Total	**26**

Recommended Books:

1. N. S. Nappinai, "*Technology Laws Decoded*," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "*Law for Engineers*" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "*Laws for Engineers*", ProCare, 2015

Course Assessment:

ISE-1: Quiz: 20 Marks
Activity: Negotiation: 30 Marks

ISE-2: Quiz: 20 Marks
Activity: Moot Court: 30 Marks

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25OE22	Principles of Management	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses	--	
Course Outcomes	After completing the given assignments and experiments, students will be able to:	
	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.	Topic	Ref	Hours
1	**Introduction to Management** Definition and Nature of Management: Understanding management as a process and its significance in organizations. Historical Evolution: Exploration of classical management theories, including contributions from Henri Fayol and Frederick Taylor. Managerial Roles and Skills: Analysis of the roles managers play and the skills required at different managerial levels.	1-5	04
2	**Planning** Strategic and Tactical Planning: Differentiating between long-term strategic planning and short-term tactical planning. Decision-Making Processes: Tools and techniques for effective managerial decision-making. Goal Setting and Management by Objectives (MBO): Establishing clear objectives and aligning them with organizational goals	4-7	05
3	**Organizing** Organizational Structure and Design: Examining various organizational structures and their impact on efficiency. Delegation and Authority: Understanding the distribution of authority and		

	responsibility within an organization. Coordination and Communication: Strategies for effective internal communication and 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**

Assessment:

ISE-1: Quiz based on Module 1,2 and 3 (20 Marks)

Case study / Application with PPT Presentation (Group of 4 students) of Decision Making Process Approach, MBO (30 Marks)

ISE-2: Quiz based on Module 4,5 and 6 (20 Marks)

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)

Note: ISE will be based on Continuous predefined rubrics based evaluation

References :

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		3	--	2	3	--	1	4
25VSE12EC03	Data Structures	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	50	20	50	150	
		Lab	20	--	30	--	50	

Pre-requisite Course Codes		
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 queues - 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.	1,2,3	4
			Total	**39**

Module No.	Sr.no	Suggested List of experiments	Ref.	Hrs.
2	**1**	Implement a given problem using Stack. (Basic and Applications)	1,2,3	2
2	**2**	Implement a given problem using Queue. (Basic and Applications)	1,2,3	2
3	**3**	Implement a given problem using Singly Linked List. (Basic and Applications)	1,2,3	4
3	**4**	Implement a given problem using Doubly Linked List.	1,2,3	4
4	**5**	Implement a given problem using Binary Search Tree. (Basic and Applications)	1,2,3	4
4	**6**	Implement Min Heap and Max Heap operations / create a priority queue using Heap.	1,2,3	2
5	**7**	Apply graph traversal techniques (BFS and DFS) to solve a given problem.	1,2,3	4
5	**8**	Implement hash functions with different collision resolution techniques (chaining, open addressing).	1,2,3	2
	9	Mini Project: Develop a working prototype demonstrating real-life applications of data structures.	1,2,3	2
			Total	**26**

Course Assessment:

Theory:

ISE-1 & ISE-2: Activities (50 Marks)

- Quiz/ Problem solving score of hacker rank / code chef/ leetcode.
- Assignments/Internal coding competition / certification course of 10-12 hrs duration on platform like courser/ Udemy/ NPTEL

MSE: 120 minutes 50 Marks written examination based on 50% syllabus

ESE: 120 minutes 50 Marks written examination based on remaining syllabus after MSE

Lab:

ISE1:

- Continuous predefined rubrics-based evaluation of experiments based on Module 1 to 3 for 20 Marks

ISE2:

- Continuous predefined rubrics-based evaluation of experiments based on Module 4 to 6 for 20 Marks.
- Mini Project of 10 Marks

Recommended Books:

[1] "Data Structures using C and C++" by Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd edition, Prentice Hall.

[2] "Data Structures using C", Reema Thareja, Third Edition, Oxford University Press.

[3] "Data Structures and Program Design in C++", Robert L. Kruse, Alexander J. Ryba, Prentice-Hall India.

[4] "Data Structures and Algorithm in Java", Goodrich and Tamassia, John Wiley and Sons, Sixth Edition 2014. John Wiley & Sons.

[5] "Data Structures and Pseudocode approach with C", 2nd Edition by Richard F. Gilberg; Behrouz A. Forouzan, Thomson Publishing.

Online Resources:

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

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		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
25EEM12EC02	Technology Entrepreneurship		ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Lab	--	--	--	--	--	

Pre-requisite Courses		--
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		
	1.5	Present the problem		
2		**Value Proposition Canvas and Business Model**	2,3	7
	2.1	Craft your value proposition		
	2.2	Presentation of Value Proposition Canvas		
	2.3	Business Model and Lean Approach (Finance, Marketing, Operations)		
	2.4	Presentation of Lean Canvas		
3		**Business Plan**	4	6
	3.1	Creation of Business Plan		
4		**Company Formation**	5	7
	4.1	Promoters, Capital, Shareholders		
	4.2	Directors, DIN		
	4.3	Company Name, Registrations		
	4.4	Branding		
			Total	**26**

Recommended Books:

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

Course Assessment:

ISE-1:
Quiz: 10 Marks
Assignment: Effectuation case study: 10Marks
MSE:
Activity: Presentation of Value Proposition Canvas: 30 Marks Rubric Based assessment

ISE-2:
Quiz: 10 Marks
Assignment: Presentation of Lean Canvas: 10Marks
ESE:
Activity: Virtual Company registration: 30 Marks Rubric Based assessment

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		1	--	2	1	--	1	2
25VEC12EC02	Technology Innovation for Sustainable Development	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	40	--	60	--	100	

Pre-requisite Courses		--
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**		6
	3.1	Sustainable development goals 6, 12-15	4,5	
	3.2	Technological Solutions to advance planet theme		
4		**Prosperity Theme**		7
	4.1	Sustainable development goals 7-11		
	4.2	Technological Solutions to advance prosperity theme		
5		**Peace Theme**	4,5	3
	5.1	Sustainable development goal 16		
	5.2	Technological Solutions to advance peace theme		
6		**Partnership Theme**	4,5	3
	4.1	Sustainable development goals 17		
	4.2	Technological Solutions to advance partnership theme		
			Total	**26**

Recommended Books/ References:

1. https://sdgs.un.org/goals
2. https://sdgs.un.org/tfm
3. Himanshu Sharma, Tina Sobti "*An Introduction to Sustainable Development Goals*" 2018
4. Henrik Skaug Sætra "*Technology and Sustainable Development*" Routledge, 2023
5. Sinan Kufeoglu "*Emerging Technologies: Value Creation for Sustainable Development*", Springer International Publishing, 2022

Course Assessment:

ISE-1: Quiz: 20 Marks
Activity: Case Study Presentation: 20 Marks

ISE-2: Quiz: 20 Marks
Activity: Short Film Creation and Presentation: 30 Marks