VIVEKANAND EDUCATION SOCIETY'S

Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai, Approved by A.I.C.T.E & Recognized by Govt. of Maharashtra)

Department of Electronics and Computer Science

Department of Electronics and Computer Science

Syllabus (NEP Scheme)

Sem-III and Sem-IV

w.e.f. A.Y. 2026-27

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Department of Electronics and Computer Science

Course Type	Semester III Teaching Scheme (AY 2026-27)								
	Course Code	Course Name	Teaching Scheme (Contact hours)			Credits Assigned			
			TH	PR	TUT	TH	PR	TUT	Total
PCC	26ECPC31	Data Structures	3	2	---	3	1	---	4
PCC	26ECPC32	Digital System Design	3	2	---	3	1	---	4
PCC	26ECPC33	Database Management System	3	2	---	3	1	---	4
MM	26ECMM31	Microprocessor and Microcontroller	3	2	---	3	1	---	4
HSMM	26EM31	Finance Management	2	---	---	2	---	---	2
AE	26AE31	Professional Communication and Ethics II	1	2	---	1	1	---	2
	Total Credits								20

Course Type	Semester III Examination Scheme							
	Course Code	Course Name	TH	MT	CA	TW	PR/ OR	Total
	26ECPC31	Data Structures	60	20	20	25	25	150
PCC	26ECPC32	Digital System Design	60	20	20	25	25	150
PCC	26ECPC33	Database Management System	60	20	20	25	25	150
PCC	26ECMM31	Microprocessor and Microcontroller	60	20	20	25	25	150
HSMM	26EM31	Finance Management	30	20	---	---	---	50
EM	26AE31	Professional Communication and Ethics II	---	---	---	50	---	50
	Total Marks							700

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Department of Electronics and Computer Science

Semester III
Syllabus

COURSE NAME: - DATA STRCTURES

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC 31	Data Structures (Theory)	03	---	---	03	---	---	03
26ECPCL 31	Data Structures (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC31	Data Structures (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC31	Data Structures (Theory)	20	20	60	---	---	100

Course Prerequisite: Knowledge of one or more programming language e.g. C, C++. JAVA, Python and proficiency in any one of them.	
Course Objectives:	
1	To understand and demonstrate basic data structures (such as Arrays, linked list, stack, queue, binary tree, graph).
2	To implement various operations on data structures.
3	To study different sorting and searching techniques.
4	To choose efficient data structures and apply them to solve real world problems.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand various linear data structures.
2	Perform operations on linear data structures.
3	Comprehend various nonlinear data structures.
4	Implement various operations on nonlinear data structures.
5	Analyze appropriate sorting and searching techniques for a given problem.
6	Apply appropriate data structure and algorithms for solving real world problems.

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Department of Electronics and Computer Science

DATA STRUCTURE (THEORY)

Module	Contents	Hrs
1	**Introduction to Data Structures**	**05**
1.1	Introduction to Data Structures, Types of Data Structures – Linear and Nonlinear, Operations on Data Structures, Concept of array, Static arrays vs Dynamic Arrays.	
1.2	**Arrays, Pointers and Strings:** Introduction to Arrays, Definition, One Dimensional Array and Multidimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	
2	**Stack and Queues**	**06**
2.1	Introduction, Basic Stack Operations, Representation of a Stack using Array, Applications of Stack – Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation.	
2.2	Queue, Operations on Queue.	
3	**Linked List**	**07**
3.1	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List, Operations on Singly Linked List: Insertion, Deletion, reversal of SLL, Print SLL. Implementation of Stack and Queue using Singly Linked List.	
3.2	Representation of a Queue using array, Circular Queue, concept of priority Queue, Applications of Qubly Linked List and Circular Linked List.	
4	**Trees**	**07**
4.1	Introduction, Tree Terminologies, Binary Tree, Types of Binary Tree, Representation of Binary Trees.	
4.2	Binary Tree Traversals, Binary Search Tree Operations on Binary Search Tree, Applications of Binary Tree – Expression Tree, Huffman Encoding.	
5	**Graphs**	**06**
5.1	Introduction, Graph Terminologies, Representation of graph (Adjacency matrix and adjacency list).	
5.2	Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS), Application – Topological Sorting.	
6	**Introduction to Sorting and Searching**	**08**
6.1	Introduction to Searching: Linear search, Binary search, Sorting: Internal VS. External Sorting	

6.2	Sorting Techniques: Bubble, Insertion, selection, Quick Sort, Merge Sort, Complexity Analysis of Algorithm, Comparison of sorting Techniques based on their complexity.	
6.3	Hashing Techniques, Different Hash functions, Collision & Collision resolution techniques: Linear and Quadratic probing, Double hashing.	
Total		**39**

Textbooks:	
1	Data Structures Using C, Aaron M Tenenbaum, YedidyahLangsam, Moshe J Augenstein, Pearson Education First Edition, 2019.
2	Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G.Sorenson,Second Edition,2017.
3	Data Structures using C, Reema Thareja, Oxford,2nd edition,2014.
4	C and Data structures, Prof. P.S.Deshpande, Prof. O.G.Kakde, Dreamtech Press.
5	Data Structures: A Pseudocode Approach with C, Richard F. Gilberg& Behrouz A. Forouzan, Second Edition, CENGAGE Learning,2nd edition.
Reference books:	
1	Data Structure Using C, Balagurusamy, 4th Edition,2022.
2	Data Structures using C and C++, Rajesh K Shukla, Wiley – India.
3	Algorithms Design and Analysis, Bhasin, OXFORD.
4	Data Structures Using C, ISRD Group, Second Edition, Tata McGraw-Hill.
5	Computer Algorithms by Ellis Horowitz and Sartaj Sahni, Universities Press.
6	Data Structures, Adapted by: GAV PAI, Schaum's Outlines.
Access to software and virtual labs:	
1	NPTL: Data Structures and Algorithms https://archive.nptel.ac.in/courses/106/102/106102064/
2	NPTL: Programming, Data Structures and Algorithms https://archive.nptel.ac.in/courses/106/106/106106127/

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

DATA STRUCTURE (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL31	Data Structures Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL31	Data Structures Lab	---	---	---	25	25	50

Lab Prerequisite: Knowledge of one or more programming language e.g. C, C++. JAVA, Python and proficiency in any one of them.	
Lab Objectives:	
1	To implement basic data structures such as arrays, linked lists, stacks and queues.
2	To solve problem involving graphs, and trees.
3	To develop application using data structure algorithms.
4	To compute the complexity of various algorithms.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	To implement basic data structures such as arrays, linked lists, stacks and queues.
2	To solve problem involving graphs, and trees.
3	To develop application using data structure algorithms.
4	To compute the complexity of various algorithms.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Implement Stack ADT using array.
2	Convert an Infix expression to Postfix expression using stack ADT.
3	Evaluate Postfix Expression using Stack ADT.
4	Applications of Stack ADT.
5	Implement Linear Queue ADT using array.
6	Implement Circular Queue ADT using array.
7	Implement Priority Queue ADT using array.
8	Implement Singly Linked List ADT.
9	Implement Circular Linked List ADT.
10	Implement Doubly Linked List ADT.
11	Implement Stack / Linear Queue ADT using Linked List.
12	Implement Binary Search Tree ADT using Linked List.
13	Implement Graph Traversal techniques: a) Depth First Search b) Breadth First Search
14	Applications of Binary Search Technique.
15	Implementation of Topological sort.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - DIGITAL SYSTEM DESIGN

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC 32	Digital System Design (Theory)	03	---	---	03	---	---	03
26ECPCL 32	Digital System Design (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC32	Digital System Design (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC32	Digital System Design (Theory)	20	20	60	---	---	100

Course Prerequisite: Digital Electronics.	
Course Objectives:	
1	To teach design and analysis of combinational logic circuits.
2	To teach the elements of sequential logic design, analysis and design of sequential circuits.
3	To train students in writing programs with Verilog hardware description languages for combinational circuit design.
4	To train students in writing programs with Verilog hardware description languages for sequential circuit design.
5	To explain and describe various logic families and FPGA.
Course Outcomes: After successful completion of the course students will be able to:	
1	Design of Combinational logic circuits and implementation using Medium Scale Integration (MSI).
2	Design Sequential logic circuits using flip flops.
3	Design of Finite State Machines.
4	Apply Verilog Hardware Description Language to design Combinational logic circuits.
5	Apply Verilog Hardware Description Language to design sequential logic circuits.
6	Develop an understanding of TTL, CMOS logic families and FPGA technology.

DIGITAL SYSTEM DESIGN (THEORY)

Module	Contents	Hrs
1	**Design of Combinational Logic Circuit**	**08**
1.1	Arithmetic Circuits: Half adder, Full adder, Ripple carry adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, multiplexer, cascading of Multiplexer (up to 4:1), Demultiplexer (up to 4:1)	
1.2	Decoder, Comparator Designing using MSI devices: IC7483, IC74151	
2	**Elements of Sequential Logic Design**	**08**
2.1	Sequential Logic: Conversion of flip flops, SR to JK, JK to T, JK to D, D to T Flip Flop. Shift Register- Universal Shift Register.	
2.2	Counters: Asynchronous, Synchronous Counters, Up-Down Counters, Mod Counters, Ring Counter, Twisted ring counter.	
2.3	Sequential logic design practices: MSI 4-bit Binary counter (IC 7490, 7493), MSI Shift register (IC 74194).	
3	**Design of Sequential Logic Circuits**	**06**
3.1	Sequential Logic Design: Mealy and Moore Machines, clocked synchronous state machine analysis, state reduction.	
3.2	Sequence detector, Clocked synchronous state machine design.	
4	**Introduction to Verilog HDL**	**07**
4.1	Basics: Introduction to Hardware Description Language and its core features, synthesis in digital design, logic value system, data types, constants, parameters, wires and registers.	
4.2	Verilog Constructs: Continuous & procedural assignment statements, logical, arithmetic, relational, shift operator, always, if, case, loop statements, Gate level modelling, Module instantiation statements, Test bench, Modelling Examples: Combinational logic, Arithmetic circuits, Multiplexer, Demultiplexer, Decoder.	
5	**Verilog HDL programming for Sequential circuits**	**05**
5.1	Verilog HDL Programming for flip-flops, counters, Shift register	
5.2	Verilog HDL programming for Moore, Mealy type FSMs, Sequence detector	
6	**Logic Families and FPGA**	**05**
6.1	Logic Families: Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in)	

6.2	Zynq APSoC Architecture of ZYBO FPGA/Boolean Board, FPGA design flow: Functional simulation, Timing simulation, Logic synthesis, RTL, Functional Verification.	
Total		**39**
Textbooks:		
1	M. Morris R. Mano and Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 7th Edition, Prentice Hall of India, India,2020	
2	J. Bhaskar, A Verilog HDL Primer, Third Edition, Star Galaxy Publishing, 2018.	
3	Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2nd edition,2006.	
Reference books:		
1	M. Morris R. Mano and Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 7th Edition, Prentice Hall of India, India,2020.	
2	Stephen Brown and ZvonkoVranesic, Fundamentals of digital logic design with Verilog design, McGraw Hill, 3rd Edition,2013.	
3	William I.Fletcher, "An Engineering Approach to Digital Design", PrenticeHall of India,3rd edition,2007.	
4	Michael D. Ciletti, Advanced Digital Design with the Verilog HDL,2nd Edition, Pearson Pvt. Ltd, Noida, India,2011.	
5	Charles H. Roth, Jr., Fundamentals of Logic Design,7th Edition Reprint, Brooks/Cole, Pacific Grove, US,2014.	
Access to software and virtual labs:		
1	https://nptel.ac.in/courses/108105113	
2	https://nptel.ac.in/courses/108103179 (For Verilog)	
3	https://semiconductorclub.com/online-verilog-compiler/	
Industry articles and case studies:		
1	https://www.allaboutcircuits.com/technical-articles/getting-started-with-the-verilog-hardware-description-language/	
2	https://www.allaboutcircuits.com/technical-articles/fpga/	
3	https://embeddedcomputing.com/technology/processing/semiconductor-ip/fpga-insights-and-trends-2023	

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
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3	Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

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1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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DIGITAL SYSTEM DESIGN (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL32	Digital System Design Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL32	Digital System Design Lab	---	---	---	25	25	50

Lab Prerequisite: Digital Electronics.	
Lab Objectives:	
1	To design and implement combinational circuits.
2	To design and implement sequential circuits.
3	To implement combinational and sequential circuits using Verilog.
4	To implement combinational /sequential circuits on FPGA.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Design and implement combinational circuits using MSI.
2	Design and implement sequential circuits using MSI.
3	Develop Verilog code for combinational and sequential circuits
4	Implement combinational and sequential circuits using FPGA.

Suggested Experiments: Students are required to complete at least 10 experiments. (Hardware + Software based)	
Hardware Based Experiments:	
Sr.No.	**Name of the Experiments**
1	To implement BCD adder using binary adder IC 7483.
2	To implement logic equations using Multiplexer IC 74151.
3	To perform Flip flop conversion JK to D, JK to T and D to T flip flop.
4	To implement MOD N counter using IC 7490/ 7493.
5	To implement Sequence detector.
Software Based Experiments:	
Sr.No.	**Name of the Experiments**
1	To simulate basic logic gates using Verilog HDL.
2	To design and simulate Full adder/full subtractor using Verilog HDL.
3	To design and simulate Multiplexer/Demultiplexer using Verilog HDL.
4	To design and simulate decoder using Verilog HDL.
5	To design and simulate comparator using Verilog HDL.
6	To simulate basic flip flops using Verilog HDL.
7	To design and simulate 4-bit counter / up-down counter using Verilog HDL.
8	To design and simulate Shift register using Verilog HDL.
9	To simulate basic logic gates using Verilog HDL.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - DATABASE MANAGEMENT SYSTEM

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC 33	Database Management System (Theory)	03	---	---	03	---	---	03
26ECPCL 33	Database Management System (Lab)	---	02	---	---	01	---	01
Total Credits								04

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Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC33	Database Management System (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC33	Database Management System (Theory)	20	20	60	---	---	100

Course Prerequisite: Data Structures.	
Course Objectives:	
1	Develop entity relationship data model and its mapping to relational model.
2	Learn relational algebra and formulate SQL queries.
3	Apply normalization techniques to normalize the database.
4	Understand concepts of transaction, concurrency control and recovery techniques.
Course Outcomes: After successful completion of the course students will be able to:	
1	Identify the need of database, and define the problem statement for real life applications.
2	Create relational model for real life applications.
3	Construct relational model and write relational algebra queries.
4	Formulate query using SQL for efficient retrieval of data.
5	Apply the concept of normalization to relational database design.
6	Describe the concepts of transaction, concurrency and recovery.

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Department of Electronics and Computer Science

DATABASE MANAGEMENT SYSTEM (THEORY)

Module	Contents	Hrs
1	**Introduction to Database Concepts**	**03**
1.1	Introduction, Characteristics of databases.	
1.2	File systems v/s Database systems.	
1.3	Data abstraction and Data Independence.	
1.4	DBMS system architecture.	
1.5	Database Administrator.	
2	**Entity–Relationship Data Model**	**07**
2.1	The Entity-Relationship (ER) Model.	
2.2	Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys.	
2.3	Relationship Constraints: Cardinality and Participation.	
2.4	Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation.	
3	**Relational Model and Relational Algebra**	**06**
3.1	Introduction to the Relational Model.	
3.2	Relational schema and concept of keys.	
3.3	Mapping the ER and EER Model to the Relational Model.	
3.4	Relational Algebra – operators, Relational Algebra Queries.	
4	**Structured Query Language (SQL)**	**06**
4.1	Overview of SQL	
4.2	Data Definition Commands	
4.3	Integrity constraints: Key constraints, Domain Constraints, Referential integrity, Check constraints	
4.4	Data Manipulation commands, Data Control commands	
4.5	Set and string operations, aggregate function - group by, having	
4.6	Views in SQL, joins, Nested and complex queries, Triggers	
4.7	MYSQL Functions	
5	**Relational–Database Design**	**07**
5.1	Pitfalls in Relational-Database designs	
5.2	Concept of normalization	
5.3	Function Dependencies	
5.4	First Normal Form, 2NF, 3NF, BCNF.	
6	**Transactions Management and Concurrency and Recovery**	**10**

6.1	Transaction Concept, Transaction states	
6.2	ACID properties	
6.3	Transaction Control Commands	
6.4	Concurrent Executions	
6.5	Serializability: Conflict and View	
6.6	Concurrency Control: Lock-based, Timestamp-based protocols	
6.7	Recovery System: Log based recovery	
6.8	Deadlock handling	
Total		**39**

Textbooks:	
1	Korth, Slberchatz,Sudarshan, Database System Concepts, 6th Edition, McGraw Hill
2	Elmasri and Navathe, Fundamentals of Database Systems, 7th Edition, Pearson education,2015.
3	Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH 3rd edition,2003.
Reference books:	
1	Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management‖, Thomson Learning, 13th edition,2020.
2	Dr.P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press,1st edition,2006.
3	G. K. Gupta, Database Management Systems, McGraw Hill., 2012.
Access to software and virtual labs:	
1	https://nptel.ac.in/courses/106105175
2	http://vlabs.iitkgp.ac.in/se/4/simulation/
Industry articles and case studies:	
1	https://ieeexplore.ieee.org/document/8251067.
2	https://www.researchgate.net/publication/4349094/ Automatic_database_normalization_and_primary_key_generation.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
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Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
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8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
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2	Question paper will have a total of five questions.
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VIVEKANAND EDUCATION SOCIETY'S

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(An Autonomous Institute Affiliated to University of Mumbai, Approved by A.I.C.T.E & Recognized by Govt. of Maharashtra)

Department of Electronics and Computer Science

DATABASE MANAGEMENT SYSTEM (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL33	Database Management System Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL33	Database Management System Lab	---	---	---	25	25	50

Lab Prerequisite: Data Structures	
Lab Objectives:	
1	Develop entity relationship data model and its mapping to relational model.
2	Learn relational algebra and formulate SQL queries.
3	Apply normalization techniques to normalize the database.
4	Understand concepts of transaction, concurrency control and recovery techniques.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Design ER /EER diagram and convert to relational model for the real-world application.
2	Apply DDL, DML, DCL and TCL commands.
3	Create simple and complex queries.
4	Apply PL/SQL Constructs.
5	Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.
2	Mapping ER/EER to Relational schema model.
3	Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System
4	Apply DML Commands for the specified system
5	Perform Simple queries, string manipulation operations and aggregate functions.
6	Implement various Join operations.
7	Perform Nested and Complex queries.
8	Perform DCL and TCL commands.
9	Implement procedure and functions
10	Implementation of Views and Triggers.
11	Demonstrate Database connectivity.
12	Implementation and demonstration of Transaction and Concurrency control techniques using locks.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

COURSE NAME: - MICROPROCESSOR AND MICROCONTROLLER

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECMM 31	Microprocessor and Microcontroller (Theory)	03	---	---	03	---	---	03
26ECMML 31	Microprocessor and Microcontroller (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECMM31	Microprocessor and Microcontroller (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECMM31	Microprocessor and Microcontroller (Theory)	20	20	60	---	---	100

Course Prerequisite: Digital Electronics.	
Course Objectives:	
1	To teach the concepts and basic architecture of a Microprocessor and Microcontroller.
2	To explain Assembly language programs for Microprocessors and Microcontrollers for various applications.
3	To discuss the importance of different peripheral devices and their interfacing to 8086 and 8051.
4	To build Microprocessor and Microcontroller based systems.
Course Outcomes: After successful completion of the course students will be able to:	
1	Discuss about 16-bit Microprocessor Architectures.
2	Apply Assembly language programming skills for Microprocessors.
3	Design implement Microprocessor based systems.
4	Compare 16-bit Microprocessor and 8-bit microcontroller architectures.
5	Apply Assembly and C language programming skills for Microcontrollers.
6	Design I/O peripherals with Microcontroller systems.

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Department of Electronics and Computer Science

MICROPROCESSOR AND MICROCONTROLLER (THEORY)

Module	Contents	Hrs
1	**The 8086 Microprocessor**	**06**
1.1	Introduction of 8085 microprocessor.	
1.2	8086 Architecture	
1.3	Memory Segmentation and Memory Banking	
1.4	8086 pin description	
1.5	Interrupts and Interrupt service routines, Dedicated interrupts, Software interrupts	
2	**8086 Programming**	**05**
2.1	Addressing modes	
2.2	Instruction Set and Assembler Directives	
3	**8086 Interfacing –Part I**	**06**
3.1	Generating the 8086 System Clock and Reset Signals using 8284 clock generators	
3.2	8086 Minimum and Maximum Mode CPU Modules	
3.3	Memory interfacing	
4	**The 8051 Microcontroller**	**04**
4.1	Differences between a Microprocessor and Microcontroller	
4.2	Architecture of 8051	
4.3	Memory Organization of the 8051	
5	**8051 Programming**	**09**
5.1	Addressing modes	
5.2	Instruction set	
5.3	Assembly language programming-ADD/SUB/MUL/DIV/Smallest /largest/ascending order	
5.4	C Programming-program on LED blinking, seven segment interface, LCD interface and Stepper motor interface	
6	**8051 Interfacing**	**09**
6.1	I/O port programming	
6.2	Programming 8051 Timers	
6.3	Serial Port Programming	
6.4	IO Interfacing - Keypad interface, ADC & DAC interface,	
6.5	Introduction to 8051 variants Atmega 8, Nuvoton MS51	
Total		**39**

Textbooks:	
1	8086/8088 family: Design Programming and Interfacing: By John Uffenbeck (Pearson Education),3rd edition,2002.
2	Microprocessor and Interfacing: By Douglas Hall (TMH Publication),3rd edition,2017.
3	The 8051 Microcontroller and Embedded Systems Using Assembly and C: By M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay, Pearson Education, 2nd edition,2007.
Reference books:	
1	Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: By Liu & Gibson (PHI Publication),2nd edition,2004.
2	The 8051 Microcontroller: By Kenneth J. Ayala, Cengage Learning India Pvt. Ltd, 3rd edition.
3	The INTEL Microprocessors, Architecture, Programming and Interfacing: By Barry B. Brey (Pearson Publishers, 8th Edition).
4	Microcontrollers: Architecture, Programming, Interfacing and System Design: By RajKamal, Pearson Education, 2005.
Access to software and virtual labs:	
1	https://archive.nptel.ac.in/courses/108/105/108105102/
2	https://archive.nptel.ac.in/courses/108/103/108103157/
3	http://www.kitektechnologies.com/images/prod/mp5.pdf
Industry articles and case studies :	
1	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.htm
2	https://www.keil.com/dd/chips/all/8051.htm
3	https://www.keil.com/dd/chips/all/8051.htm

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

MICROPROCESSOR AND MICROCONTROLLER (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECMML31	Microprocessor and Microcontroller Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECMML31	Microprocessor and Microcontroller Lab	---	---	---	25	25	50

Lab Prerequisite: C-Programming, Digital Electronics.	
Lab Objectives:	
1	To write Assembly language programs for Microprocessors and Microcontrollers for various applications.
2	To know the importance of different peripheral devices and their interfacing to 8086 and 8051.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	To develop programming skills for Microprocessors and Microcontrollers.
2	To interface various devices in Microprocessor and Microcontroller systems.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Arithmetic Operations, Logical operations (using 8086)
2	Data Transfer, Arithmetic, Logical operations using 8051
3	Use of Subroutine in 8051 Programming
4	IO Port Programming using 8051
5	Interfacing of led, switch with 8051
6	Serial port programming of 8051
7	Applications of Timers of 8051
8	LCD Interfacing (using 8051)
9	Sensor interfacing using an ADC (using 8051)
10	Generation of different waveforms using DAC (using 8051)
11	Interfacing of Keypad with 8051
12	Interfacing of DC, Stepper, servo motors with 8051.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

COURSE NAME: - FINANCE MANAGEMENT

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26EM 31	Finance Management (Theory)	02	---	---	02	---	---	02
Total Credits								02

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26EM 31	Finance Management (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26EM 31	Finance Management (Theory)	20	---	30	---	---	50

Course Objectives:	
1	To know about the Indian financial system, instruments, and market.
2	To understand the relationship between risk, return, and time value of Money.
3	To understand the financial statements and ratio analysis.
4	To understand personal taxation.
Course Outcomes: After successful completion of the course students will be able to:	
1	Explain the Indian financial system, instruments, and market.
2	Determine the risk, return, and time value of Money with respect to financial decisions.
3	Decide investment decisions for projects with the help of financial ratios.
4	Determine the components involved in taxation.

FINANCE MANAGMENT (THEORY)

Module	Contents	Hrs
1	**Indian Financial System**	**08**
1.1	Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, Treasury Bills, Trade credit.	
1.2	Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market.	
1.3	Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions: Commercial Banks, Investment-Merchant Banks and Stock Exchanges.	
2	**Financial Risk and Returns**	**06**
2.1	Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio.	
2.2	Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.	
2.3	Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	
3	**Corporate Finance**	**06**
3.1	Overview of Financial Statements: Balance Sheet, Profit and Loss Account, and Cash Flow Statement.	
3.2	Financial Ratio Analysis: Purpose of Financial Ratio Analysis. Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	
4	**Introduction To Taxation**	**06**
4.1	Introduction and Objectives, Assessment Year, Previous Year, Person	
4.2	Assesses, Assessment, Income	
4.3	Gross Total Income, Total Income, Scheme of charging income tax	
Total		**26**

Reference books:	
1	Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2	Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3	Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4	Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

End Semester Theory Examination:	
1	Question paper will be of 30 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 10 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

COURSE NAME: - PROFESSIONAL COMMUNICATION AND ETHICS-II

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26AE31	Professional Communication and Ethics-II (Theory)	01	02	---	01	01	---	02
Total Credits								02

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Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26AE31	Professional Communication and Ethics-II (Theory)	01	---	---	01	---	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid Term Test	Continuous Assessment				
26AE31	Professional Communication and Ethics-II (Theory)	---	---	---	50	---	50

Course Prerequisite: Professional Communication and Ethics-I.	
Course Objectives:	
1	To discern and develop an effective style of writing important technical/business documents.
2	To investigate possible resources and plan a successful job campaign.
3	To understand the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement.
4	To develop creative and impactful presentation skills.
5	To analyze personal traits, interests, values, aptitudes and skills.
6	To understand the importance of integrity and develop a personal code of ethics.
Course Outcomes: After successful completion of the course students will be able to:	
1	Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
2	Strategize their personal and professional skills to build a professional image and meet the demands of the industry.
3	Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
4	Deliver persuasive and professional presentations.
5	Develop creative thinking and interpersonal skills required for effective professional communication.
6	Apply codes of ethical conduct, personal integrity and norms of organizational behavior.

PROFESSIONAL COMMUNICATION AND ETHICS-II (THEORY)

Module	Contents	Hrs
1	**Advanced Technical Writing: Project/Problem Based Learning (PBL)**	**06**
1.1	Definition, Purpose & Types of Proposals • Solicited & Unsolicited Proposals • Types (Short and Long proposals)	
1.2	Parts of a Proposal • Elements • Scope and Limitations • Conclusion	
1.3	Objectives of Report Writing • Information • Decision Making • Analysis • Recommendations	
1.4	Parts of a Long Formal Report: • Prefatory Parts (Front Matter) • Report Proper (Main Body) • Appended Parts (Back Matter)	
1.5	Language and Style of Reports • Tense, Person & Voice of Reports • Numbering Style of Chapters, Sections, Figures, Tables • Referencing Styles in APA & MLA Format • Proofreading through Plagiarism Checkers	
1.6	Technical Paper Writing: • Parts of a Technical Paper • Language and Formatting • Writing an abstract • Referencing in IEEE Format	
1.7	Presenting data-figures, diagrams and labelling • Graphic Organizers for Summaries • Radial Diagrams like Mind Maps • Flow Charts • Cyclic Diagrams • Linear Diagrams like Timelines • Pyramids • Venn Diagrams	

2	**Employment Skills**	**06**
2.1	Cover Letter & Resume • Parts and Content of a Cover Letter • Difference between Bio-data, Resume & CV • Essential Parts of a Resume • Types of Resumes (Chronological, Functional & • Combination)	
2.2	Statement of Purpose • Importance of SOP • Tips for Writing an Effective SOP	
2.3	Group Discussions • Purpose of a GD • Parameters of Evaluating a GD • Types of GDs (Normal, Case-based & Role Plays) • GD Etiquettes	
2.4	Personal Interviews • Planning and Preparation • Types of Questions • Types of Interviews (Structured, Stress, Behavioral, Problem • Solving & Case-based) • Modes of Interviews: Face-to-face (One-to one and Panel) • Telephonic, Virtual	
3	**Business Meetings**	**02**
3.1	Documentation • Notice • Agenda • Minutes	
3.2	Conducting Business Meetings: • Types of Meetings • Roles and Responsibilities of Chairperson, Secretary and • Members • Meeting Etiquette	
4	**Technical/ Business Presentations**	**02**
4.1	• Effective Presentation Strategies • Defining Purpose • Analyzing Audience, Location and Event • Gathering, Selecting and Arranging Material	

	• Structuring a Presentation • Making Effective Slides • Types of Presentations Aids • Closing a Presentation • Platform skills	
4.2	Group Presentations • Sharing Responsibility in a Team • Building contents and visuals together • Transition Phases	
5	**Interpersonal Skills**	**05**
5.1	Interpersonal Skills • Emotional Intelligence • Leadership & Motivation • Conflict Management & Negotiation • Time Management • Assertiveness • Decision Making	
6	**Corporate Ethics**	**02**
6.1	Intellectual Property Rights • Copyrights • Trademarks • Patents • Industrial Designs	
6.2	Case Studies • Cases related to Business/ Corporate Ethics	
7	**Professional Writing Skills**	**03**
7.1	Developing Professional Writing Skills • Effective introduction with emphasis on general statement, opposing statement and thesis statement • Critical response to a text with special reference to purpose, evaluation of the content, theme and style of a text • Organization of ideas, sentence construction and word choice, grammar and usage • Explanation and support of ideas (special reference to writing paragraphs opening statement, body, closing statement, linkers)	
7.2	Creative Writing • Narrative essays	

	• Content writing • Blog	
Total		**26**

Reference books:	
1	Lesiker and Petit (1997), "Report Writing for Business", McGraw-Hill Education10th edition.
2	Butterfield, J. (2017). Verbal communication: Soft skills for a digital workplace. Boston, MA: Cengage Learning.
3	Bovée, C. L., & Thill, J. V. (2017). Business communication today, 14th Edition, NJ: Pearson.
4	Robbins, S. P., Judge, T. A., & Campbell, T. T. (2017). Organizational Behaviour. Harlow,England: Pearson.
5	Fred Luthans. (2010). Organizational Behavior, McGraw Hill Education, 12th edition.
6	B N Ghosh (2017), Managing Soft Skills for Personality Development, Tata McGraw Hill Education.
7	R. C. Sharma, Krishna Mohan, Virendra Singh Nirban (2020). Business Correspondence and Report Writing, 6th Edition, McGraw Hill
8	Julie-Ann Amos (2004). Handling Tough Job Interviews Jaico Publishing House

References: Web Links	
1	http://networketiquette.net/
2	https://public.wsu.edu/~brians/errors/
3	http://users3.ev1.net/~pamthompson/body_language.htm
4	http://www.albion.com/netiquette/corerules.html
5	http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/1535_questionanswer/page15.shtml
6	http://www.colostate.edu/Depts/Speech/rccs/theory44.html
7	http://www.dailywritingtips.com

Term Work:
Term work will be for 50-Marks as given below

Sr No	Headings	Marks
A	Assignments	10 Marks
B	Mini Project with Presentation	10 Marks
C	Media Studies	10 Marks
D	Book Report and Presentation	10 Marks
E	Group Discussion	10 Marks
Total		**50 Marks**

A) Assignments: List of assignments are as given below. The assignments have to be discussed in the group and approved by faculty. Each student in the group will have to write the assignments individually (10 Marks): -

Sr No	List of Assignments
1	Resume, Cover Letter and SOP
2	Summarizing data figures into paragraphs (Module 1.7)
3	Notice, Agenda and Minutes of Meeting
4	Two case studies on Business Ethics
5	Assignment on (Teamwork, Leadership, Decision Making and Problem Solving)

B) Report on presentation: A detail typed report has to be prepared of minimum 25 pages and maximum 30 pages. The format of the report has to be discussed and approved by faculty

C) A final Group Discussion Round will be conducted and every student must participate in the group discussion

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Department of Electronics and Computer Science

Semester IV
Syllabus

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Department of Electronics and Computer Science

Course Type	Semester IV Teaching Scheme (AY 2026-27)								
	Course Code	Course Name	Teaching Scheme (Contact hours)			Credits Assigned			
			TH	PR	TUT	TH	PR	TUT	Total
PCC	26ECPC41	Electronic Devices and Circuits	3	2	---	3	1	---	4
PCC	26ECPC42	Operating Systems	2	2	---	2	1	---	3
PCC	26ECPC43	Signal & Systems	2	2	---	2	1	---	3
MM	26ECMM42	Embedded System and RTOS	3	2	---	3	1	---	4
OE	26OE401	Open Elective*	4	---	---	4	---	---	4
HSSM	26ECEM42	Introduction to Innovation and Entrepreneurship for Engineers	---	---	2	---	---	2	2
VEL	26ECVEL41	Full Stack Development	---	2	---	---	2	---	2
FP	26ECFP41	Field Projects	---	2	---	---	2	---	2
	Total Credits								24

Course Type	Semester IV Examination Scheme							
	Course Code	Course Name	TH	MT	CA	TW	PR/ OR	Total
PCC	26ECPC41	Electronic Devices and Circuits	60	20	20	25	25	150
PCC	26ECPC42	Operating Systems	60	20	20	25	25	150
PCC	26ECPC43	Signal & Systems	60	20	20	25	25	150
EM	26ECMM42	Embedded System and RTOS	60	20	20	25	25	150
OE	26OE401	Open Elective*	60	20	20	---	---	100
HSSM	26ECEM42	Introduction to Innovation and Entrepreneurship for Engineers	---	---	---	25	---	25
VEL	26ECVEL41	Full Stack Development	---	---	---	25	25	50
FP	26ECFP41	Field Projects	---	---	---	25	---	25
	Total Marks							800

COURSE NAME: - ELECTRONIC DEVICES AND CIRCUITS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC41	Electronics Devices and Circuits (Theory)	03	---	---	03	---	---	03
26ECPCL41	Electronics Devices and Circuits (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC41	Electronics Devices and Circuits (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC41	Electronics Devices and Circuits (Theory)	20	20	60	---	---	100

Course Prerequisite: Basic Electrical and Electronics Engineering.	
Course Objectives:	
1	To deliver the knowledge and enhance comprehension capabilities of students through understanding of electronic devices (Diode, BJT).
2	To analyze amplifiers using BJT and MOSFET.
3	To perform AC analysis, low and high frequency response of an amplifier.
4	To teach fundamental principles of differential amplifiers and Operational amplifiers.
5	To teach applications by using opamp IC and special purpose IC.
Course Outcomes: After successful completion of the course students will be able to:	
1	Analyze diode applications and DC analysis of BJT.
2	Evaluate DC analysis of MOSFET.
3	Evaluate AC analysis and frequency response of an amplifier.
4	Analyze Differential amplifier and operational amplifier.
5	Design linear and nonlinear applications of operational amplifier.
6	Design circuits that perform desired applications using special purpose ICs.

ELECTRONIC DEVICES AND CIRCUITS (THEORY)

Module	Contents	Hrs
1	**PN junction diode applications and Introduction to BJT**	**06**
1.1	Application of P-N junction diode as clippers & clampers (different types of configurations with input-output waveforms & transfer characteristics).	
1.2	BJT construction & structure, symbol, operation, V-I characteristics of common emitter configuration. DC Circuit Analysis: DC load line, Q-point & region of operation, concept of biasing, bias stability, analysis of CE amplifier using voltage divider biasing circuit. (numerical examples to be included).	
2	**Metal Oxide Semiconductor Field Effect Transistor (MOSFET)**	**06**
2.1	MOSFET: Types, Construction, operation, symbol, V-I & transfer characteristics of the E-MOSFET.	
2.2	DC Circuit Analysis: DC load line, Q-point & region of operation, common MOSFET configurations of common source (CS), analysis of biasing circuits (only CS configuration using voltage divider biasing) (numerical examples only for E-MOSFET).	
3	**AC Analysis and Frequency Response of Amplifier**	**08**
3.1	AC analysis of MOSFET: Small signal (AC) model of MOSFET & its equivalent circuit, small signal analysis of Common source (CS) configuration MOSFET amplifier only (Numerical examples included).	
3.2	Low frequency response & analysis, effect of the coupling, bypass & load capacitances on single stage MOSFET amplifier for common source (CS) configuration (mathematical analysis & numerical examples included).	
3.3	High frequency response & analysis, effect of parasitic capacitances in MOSFET amplifier, high frequency equivalent circuit of MOSFET, Miller's theorem, effect of Miller's capacitance, unity gain bandwidth (mathematical analysis & numerical examples included).	
4	**Introduction to Differential amplifier and Operational Amplifier**	**06**
4.1	MOSFET differential amplifier, types, DC characteristics, Transfer characteristics	
4.2	The ideal operational amplifier (op-amp), internal block diagram of op-amp, characteristics of op-amp, ideal & practical op-amp parameters / specifications (no detailed description or any analysis), mathematical model of op-amp, Virtual ground and virtual short circuit concept, IC 741 pin diagram & description.	
5	**Applications of Operational Amplifier**	**07**

5.1	Inverting amplifier, Non-inverting amplifier, Summing amplifier, Difference amplifier, Ideal and practical integrator, ideal and practical differentiator.	
5.2	Comparators: Inverting comparator, non-inverting comparator, zero crossing detector (ZCD) & Schmitt Trigger	
6	**Special Purpose Integrated Circuits**	**06**
6.1	IC 555 timer internal block diagram & pin configuration, operation in astable & monostable multivibrator with mathematical analysis & numerical examples.	
6.2	Voltage regulator IC 78XX, IC 723 (Low voltage low current and High voltage low current application)	
Total		**39**

Textbooks:	
1	Donald A. Neamen, "Electronic Circuit Analysis and Design", TATA McGraw Hill, 3rd Edition,2006.
2	David A. Bell, "Electronic Devices and Circuits", Oxford, 7th Edition,2009.
3	Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, revised 4th Edition,2021.
Reference books:	
1	Boylestead," Electronic Devices and Circuit Theory", Pearson Education,12th Edition,2021.
2	Adel S. Sedra, Kenneth C. Smith and Arun N Chandorkar, "Microelectronic Circuits Theory and Applications", International Version, OXFORD International Students Edition, 7th Edition,2017.
3	Muhammad H. Rashid, "Microelectronics Circuits Analysis and Design", Cengage,3rd edition,2016.
4	S. Salivahanan, N. Suresh Kumar,"Electronic Devices and Circuits", Tata McGraw Hill,5th edition,2022.
5	Sergio Franco, "Design with operational amplifiers & analog integrated circuits", Tata McGraw Hill, 4th edition,2016.
6	D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 5th Edition,2018.
Access to software and virtual labs:	
1	LTspice software - https://www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html
2	https://www.pspice.com/
3	Virtual lab-http://vlabs.iitkgp.ac.in/be/

4	https://onlinecourses.nptel.ac.in/noc24_ee99/preview
Industry articles and case studies:	
1	https://www.researchgate.net/topic/Electronic-Circuit-Design/publications
2	https://circuitdigest.com/tech-articles
3	https://www.azom.com/article.aspx?ArticleID=22700
4	https://www.researchgate.net/topic/Operational-Amplifiers/publications
5	https://www.electronicsforu.com/
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
1	https://www.collegelib.com/artificial-intelligence-in-electronics/
2	https://www.snapmagic.com/

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

VIVEKANAND EDUCATION SOCIETY'S

Institute of Technology

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Department of Electronics and Computer Science

ELECTRONIC DEVICES AND CIRCUITS (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL41	Electronic Devices and Circuits Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL41	Electronic Devices and Circuits Lab	---	---	---	25	25	50

Lab Prerequisite: Basic Electrical and Electronics Engineering.	
Lab Objectives:	
1	To deliver a hands-on approach for studying electronic devices.
2	To comprehend characteristics of electronic devices; thereby understanding their behavior.
3	To analyze and calculate inherent parameters of electronic devices through an experimental approach.
4	To introduce modern software simulation tools for modelling & simulation of electronic devices.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Demonstrate an understanding of the semiconductor devices.
2	Perform DC analysis of CE and CS amplifier.
3	Analyze the frequency response of single stage amplifiers.
4	Design linear and Nonlinear applications using Op-amp IC 741.
5	Design circuits using special purpose IC 555 / IC 723.

Suggested Experiments: Students are required to complete at least 10 experiments. At least 50% experiments should be Simulation based.	
Sr.No.	**Name of the Experiments**
1	To perform Clippers and Clampers.
2	To perform DC analysis of CE amplifier in voltage divider configuration.
3	To perform DC analysis of CS MOSFET amplifier in voltage divider configuration.
4	To perform AC analysis of CE amplifiers (Calculate Av, Ai, Ri, Ro).
5	To analyze the frequency response of CS amplifier.
6	To design Inverting and Noninverting amplifier using IC 741.
7	To design of linear application using op amp IC 741 (eg. adder/ subtractor, Integrator, Differentiator etc)
8	To design nonlinear applications of opamp IC 741 (eg. Comparator, zero crossing detector, Schmitt trigger etc..)
9	To design Monostable/Astable multivibrator using IC 555
10	To design voltage regulator using IC 723
List of Simulation Experiments	
1	SPICE simulation of and implementation of Clipper and Clamper circuits.
2	SPICE simulation of and implementation for BJT characteristics.
3	SPICE simulation of MOSFET characteristics.
4	SPICE simulation of AC analysis of CS amplifier.
5	SPICE simulation of frequency response of amplifier.
6	SPICE simulation of Linear and Nonlinear applications using IC 741.
7	SPICE simulation of Voltage regulator using IC 723.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - COMPUTER COMMUNICATION NETWORK

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC42	Operating System (Theory)	02	---	---	02	---	---	02
26ECPCL42	Operating System (Lab)	---	02	---	---	01	---	01
Total Credits								03

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC42	Operating System (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC42	Operating System (Theory)	20	20	60	---	---	100

Course Objectives:	
1	To understand the major components of the Operating System and its functions.
2	To introduce the concept of a process and its management like transition, scheduling, etc.
3	To understand basic concepts related to Inter-process Communication (IPC) like mutual exclusion, deadlock, etc. and role of an Operating System in IPC.
4	To understand the concepts and implementation of memory management policies and virtual memory.
5	To understand functions of Operating Systems for storage management and device management.
6	To study the need and fundamentals of special-purpose operating system with the advent of new emerging technologies.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand the basic concepts related to Operating Systems.
2	Comprehend Process management policies and scheduling of processes by CPU.
3	Understand various concepts involved in Process Coordination.
4	Understand the memory allocation and management functions of Operating Systems.
5	Understand the services provided by the Operating System for storage management.
6	Compare the functions of various special-purpose Operating Systems.

OPERATING SYSTEM (THEORY)

Module	Contents	Hrs
1	**Fundamentals of Operating System**	**03**
1.1	Introduction to Operating Systems; Operating System Structure-Layered, Monolithic, Microkernel operating system; Functions of Operating Systems; Operating System Services and Interface; System Calls and its Types; System Programs; Operating System Structure.	
1.2	Self-learning Topics: Study of any three different OS. System calls with examples for different OS.	
2	**Process Management**	**05**
2.1	Basic Concepts of Process; Operation on Process; Process State Model and Transition; Process Control Block; Context Switching; Introduction to Threads; Types of Threads, Thread Models; Basic Concepts of Scheduling; Types of Schedulers; Scheduling Criteria; Scheduling Algorithms and performance evaluation of the scheduling.	
2.2	Self-learning Topics: Performance comparison of Scheduling Algorithms, Selection of Scheduling Algorithms for different situations, Real-time Scheduling.	
3	**Process Coordination**	**05**
3.1	Basic Concepts of Inter-process Communication and Synchronization; Race Condition; Critical Region and Problem; Peterson's Solution; Synchronization Hardware and Semaphores; Monitors, Classic Problems of Synchronization; Message Passing; Introduction to Deadlocks; System Model, Deadlock Characterization; Deadlock Detection and Recovery; Deadlock Prevention; Deadlock Avoidance.	
3.2	Self-learning Topics: Study a real time case study for Deadlock detection and recovery.	
4	**Memory Management**	**05**
4.1	Basic Concepts of Memory Management; Logical and Physical address map, swapping; Memory Allocation: Contiguous memory allocation, Fixed and variable partition. Internal and External fragmentation and compaction; Paging; Structure of Page Table; Segmentation; Basic Concepts of Virtual Memory; Demand Paging, Page Replacement Algorithms; Thrashing.	
4.2	Self-learning Topics: Memory Management for any one Operating System, Implementation of Page Replacement Algorithms.	
5	**Storage Management**	**04**

5.1	Basic Concepts of File System; File Access Methods; Directory Structure; File-System Implementation; Allocation Methods; Free Space Management; Overview of Mass-Storage Structure; Disk Structure; Disk Scheduling; RAID Structure; Introduction to I/O Systems.	
5.2	Self-learning Topics: File System for Linux and Windows, Features of I/O facility for different OS.	
6	**Special-purpose Operating Systems**	**04**
6.1	Open-source and Proprietary Operating System; Fundamentals of Distributed Operating System; Network Operating System; Cloud and IoT Operating Systems; Real-Time Operating System; Mobile Operating System; Multimedia operating System; Comparison between functions of various Special-purpose Operating Systems.	
6.2	Self-learning Topics: Case Study on any one Special-purpose Operating Systems.	
Total		**26**

Textbooks:	
1	A. Silberschatz, P. Galvin, G. Gagne, Operating System Concepts, 10th ed., Wiley, 2018.
2	W. Stallings, Operating Systems: Internal and Design Principles, 9th ed., Pearson, 2018.
3	A. Tanenbaum, Modern Operating Systems, Pearson, 4th ed., 2015.
Reference books:	
1	N. Chauhan, Principles of Operating Systems, 1st ed., Oxford University Press, 2014.
2	A. Tanenbaum and A. Woodhull, Operating System Design and Implementation, 3rd ed., Pearson,2006.
3	R. Arpaci-Dusseau and A. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Independent Publishing Platform, 1st ed., 2018.
Access to software and virtual labs:	
1	https://nptel.ac.in/courses/106105214
2	https://naim30.github.io/OS-virtual-lab/
Industry articles and case studies:	
1	https://www.ijcaonline.org/archives/volume176/number39/adekotujo-2020-ijca-920494.pdf
2	https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID3820615_code1673756.pdf?abstractid=3820615&mirid=1

3	https://www.acs.eonerc.rwth-aachen.de/cms/E-ON-ERC-ACS/Studium/Lehrveranstaltungen/~lrhs/Spezial-Betriebssysteme/lidx/1/

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

OPERATING SYSTEM (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL42	Operating System Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL 42	Operating System Lab	---	---	---	25	25	50

Lab Prerequisite: C-Programming.	
Lab Objectives:	
1	To learn Unix general purpose commands and programming in the Unix editor environment.
2	To understand file system management and user management commands in Unix.
3	To understand process management and memory management commands in Unix.
4	To learn basic shell scripting.
5	To understand different process scheduling algorithms.
6	To understand different memory management algorithms.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Identify the Unix general purpose commands.
2	Apply Unix commands for system administrative tasks such as file system management and user management.
3	Execute Unix commands for system administrative tasks such as process management and memory management.
4	Demonstrate basic shell scripts for different applications.
5	Analyze different process scheduling algorithms.
6	Analyze different memory management algorithms.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	To study network components.
2	To build a simple client-server model in NS-2, demonstrating TCP or UDP-based communication.
3	To study the working of wireshark, a packet sniffing tool, and analyze network traffic using sniffing technique.
4	To understand and implement socket programming using NetSim for communication between client and server.
5	To view, add, delete, and modify routing tables and configure IP forwarding using IP tables in Windows operating systems.
6	Use a tool (Eg. NS2) to implement a specific Network topology with respect to the given number of nodes and physical configuration and do: ● Graphical simulation of network with Routing Protocols and traffic consideration (TCP, UDP) ● Analysis of network performance for quality parameters such as packet-delivery-ratio, delay, and throughput
7	Set up and configuration of firewalls in Linux/windows (Use IP Tables)
8	To install and configure the WiMAX module in NS-2 and study how varying the symbol rate (low vs. high) affects throughput, latency, and packet loss.
9	Use basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP,ip, ifconfig, dig, route, etc) and set up a network environment with multiple IP addresses and configuration of ARP tables. Set up a network environment in Windows platform also.
10	Working with routing in Linux: ● View the current routing table ● Add and delete routes ● Change default gateway Perform IP Tables for IP forwarding.
11	Configure and simulate either a Bluetooth or ZigBee network in NS-2. To compare key performance metrics (throughput, range, power consumption) with other wireless technologies (Wi-Fi, MANET). To examine how different topologies (star, mesh) and superframe structures (in ZigBee) influence network behavior.
12	To implement and analyze a Wireless Sensor Network using the LEACH protocol in NS-2. To study energy consumption, network lifetime, and packet delivery under various node densities and clustering scenarios. To explore the "new" wireless trace file format in NS-2 for gathering detailed WSN simulation metrics.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual

course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

COURSE NAME: - SIGNAL AND SYSTEMS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC43	Signal And Systems (Theory)	02	---	---	02	---	---	02
26ECPCL43	Signal And Systems (Lab)	---	02	---	---	01	---	01
Total Credits								03

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECPC43	Signal And Systems (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPC43	Signal And Systems (Theory)	20	20	60	---	---	100

Course Prerequisite: Basic knowledge of - Integration, Differentiation, Complex Numbers, Partial Fractions Basics of Laplace transform, Fourier transform and Z transform (Engineering Mathematics - I, II)	
Course Objectives:	
1	To introduce the mathematical concepts of continuous and discrete time signals and systems.
2	To acquaint the students with various time domain and frequency domain methods for analysis of signals and systems.
Course Outcomes: After successful completion of the course students will be able to:	
1	Identify and differentiate between continuous and discrete time signals and systems.
2	Develop input output relationship for LTI systems.
3	Apply the concept of Laplace transform and understand conversion from time domain to frequency domain for continuous time systems.
4	Apply the concept of Z transform and comprehend conversion from time domain to frequency domain for discrete time systems.
5	Analyse continuous time signals using Fourier series.
6	Analyse discrete time signals using Fourier Transform.

SIGNAL AND SYSTEMS

Module	Contents	Hrs
1	**Continuous and Discrete Time Signals and Systems**	**07**
1.1	Mathematical Representation and Classification of Continuous Time CT) and Discrete Time (DT) Signals Arithmetic Operations on Signals, Time Shifting, Time Scaling, Time Reversal of Signals, Sampling Theorem and Aliasing.	
1.2	Mathematical Representation and Classification of CT systems	
1.3	Mathematical Representation and Classification of DT systems	
2	**Time Domain Analysis of Continuous And Discrete Signals and Systems**	**07**
2.1	Properties of Linear Time Invariant (LTI) systems, Impulse and Step Response	
2.2	Use of Convolution Integral and Convolution Sum and Correlation for Analysis of LTI Systems	
2.3	Properties of Convolution Integral/Sum	
3	**Frequency Domain Analysis of Continuous Time System using Laplace Transform**	**03**
3.1	Review of Laplace Transform and Inverse Laplace Transform, Concept of ROC,Poles and Zeros	
3.2	Analysis and characterization of LTI system using Laplace transform: impulse and step response, causality, stability, stability of causal system	
4	**Frequency Domain Analysis of Discrete Time System using Z Transform**	**03**
4.1	Review of Z Transform, Properties of Unilateral and Bilateral Z Transform, Mapping with s Plane.	
4.2	Analysis and Characterization of LTI System Using Z Transform: Impulse and Step Response, Causality, Stability in z-Domain.	
5	**Frequency Domain Analysis of Continuous Time Signals**	**03**
5.1	Fourier Series of Continuous Time Signals	
5.2	Fourier Transform of Standard Signals, Relationship Between Fourier and Laplace Transform	
6	**Frequency Domain Analysis of Discrete Time Signals**	**03**
6.1	Concept of Discrete Time Fourier Series, Properties of DTFS , Discrete Time Fourier Transform and Determination of Magnitude and Phase Functions using DTFT	
Total		**26**

Textbooks:	
1	Tarun Kumar Rawat, "Signals and Systems", Oxford University Press, 2016.
2	A. Nagoor Kani, "Signals and Systems", Tata McGraw-Hill Education, 2014.
Reference books:	
1	John Proakis and Dimitris Monolakis, "Digital Signal Processing", Pearson Publications, 4th Edition, 2006.
2	Alan V. Oppenheim, AlanS. Willsky, and S.Hamid Nawab, "Signals and Systems", 2nd Edition,PHI learning, 2010
3	B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2nd Edition, 2006.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

SIGNAL AND SYSTEMS (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECPCL43	Signal and Systems Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECPCL 43	Signal and Systems Lab	---	---	---	25	25	50

Lab Objectives:	
1	To study and classify continuous-time and discrete-time signals and systems using mathematical representations and graphical analysis.
2	To perform arithmetic operations, time shifting, time scaling, and time reversal on CT and DT signals and verify their effects practically.
3	To analyze Linear Time Invariant (LTI) systems using convolution integral, convolution sum, impulse response, and step response techniques.
4	To apply Laplace Transform and Z-Transform methods for solving and analyzing continuous-time and discrete-time systems.
5	To investigate frequency-domain characteristics of signals using Fourier Series, Fourier Transform, DTFS, and DTFT techniques.
6	To study sampling theorem, aliasing effects, system stability, causality, and frequency response characteristics through simulations and experiments.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Identify and classify different continuous-time and discrete-time signals and systems based on their properties.

2	Perform signal operations such as scaling, shifting, reversal, sampling, and reconstruction for CT and DT signals.
3	Analyze and implement LTI systems using convolution, correlation, impulse response, and step response methods.
4	Apply Laplace Transform and Z-Transform techniques to determine system response, poles, zeros, causality, and stability.
5	Compute and interpret Fourier Series, Fourier Transform, DTFS, and DTFT for frequency-domain analysis of signals.
6	Use simulation tools/software to model signal-processing systems and evaluate practical issues such as aliasing, stability, and spectral analysis.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
2	Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3	Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
4	Convolution for Signals and sequences.
5	Auto Correlation and Cross Correlation for Signals and Sequences.
6	Verification of Linearity and Time Invariance Properties of a given Continuous /Discrete System.
7	Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
8	Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
9	Waveform Synthesis using Laplace Transform.
10	Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
11	Verification of Sampling Theorem.
12	Removal of noise by Autocorrelation / Cross correlation.
13	Extraction of Periodic Signal masked by noise using Correlation.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - EMBEDDED SYSTEM AND RTOS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECMM42	Embedded System and RTOS (Theory)	03	---	---	03	---	---	03
26ECMML42	Embedded System and RTOS (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECMM42	Embedded System and RTOS (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECMM42	Embedded System and RTOS (Theory)	20	20	60	---	---	100

Course Prerequisite: Microprocessors & Microcontrollers, C programming.	
Course Objectives:	
1	To study concepts involved in Embedded Hardware and Software for System realization.
2	To learn the concepts of modern microcontroller cores like the ARM-Cortex.
3	To learn Real-time programming to design time-constrained embedded systems.
Course Outcomes: After successful completion of the course students will be able to:	
1	Identify various characteristic features and applications of embedded systems.
2	Identify hardware for embedded system implementation.
3	Evaluate various communication protocols for embedded system implementation.
4	Compare GPOS and RTOS.
5	Apply various tools for testing and debugging embedded systems.
6	Design a system for different requirements based on life-cycle for the embedded system, keeping oneself aware of ethics and environmental issues.

EMBEDDED SYSTEM AND RTOS (THEORY)

Module	Contents	Hrs
1	**Introduction to Embedded Systems**	**04**
1.1	Definition, Characteristics, Classification, Applications.	
1.2	Design metrics of Embedded system.	
2	**Embedded Hardware Elements**	**11**
2.1	Features of Embedded cores- µC, ASIC, ASSP, SoC, FPGA, RISC and CISC cores. Types of memories. Communication Interfaces: Comparative study of Serial communication Interfaces -RS-232, I2C, CAN, Bluetooth (Frame formats of above protocols are not expected)	
2.2	ARM Cortex-M3 Features, Architecture, Programmer's model, Special Registers, Operating Modes and States, MPU, Memory map, Low Power modes and NVIC.	
3	**Embedded Software**	**10**
3.1	Embedded Programming in C: ALP and High-level language programming, Real-time Operating system: GPOS vs RTOS, Need of RTOS in Embedded system software. Task, Task states, Multi-tasking, Task scheduling	
3.2	Inter-process communication: Message queues, Mailbox, Event timers. Task synchronization: Need, Issues- Deadlock, Race condition, live Lock, Solutions using Mutex, Semaphores. Shared Data problem, Priority inversion	
4	**Introduction to Free RTOS**	**05**
4.1	Free RTOS Task Management features, Resource Management features, Task Synchronization features, Event Management features, Interrupt Management features, Time Management features.	
5	**Testing and Debugging Methodology**	**03**
5.1	Testing & Debugging: Hardware testing tools, Emulator.	
5.2	Software Testing tools, Simulator, Debugger. White-Box and Black-Box testing.	
6	**System Integration (Case Studies)**	**06**
6.1	Embedded Product Design Life-Cycle (EDLC)- Waterfall Model Hardware-Software Co-design	
6.2	Case studies for Automatic Chocolate Vending Machine, Washing Machine, Smart Card, highlighting i) Specification requirements (choice of components), ii) Hardware architecture , iii) Software architecture	
Total		**39**

Textbooks:	
1	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2009.
2	SriramIyer, Pankaj Gupta," Embedded Real Time Systems Programming", Tata McGraw Hill Publishing Company ltd., 2003.
Reference Books:	
1	Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill Education (India) Private Limited, New Delhi, 2015, Edition 3rd.
2	Joseph Yiu,"The Definitive guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.
3	www.freertos.org
4	Dr. K.V. K. K. Prasad, "Embedded Real Time System: Concepts, Design and Programming", Dreamtech, New Delhi, Edition 2014.
5	Frank Vahid, Tony Givargis, "Embedded System Design – A Unified Hardware/Software Introduction", John Wiley & Sons Inc., 2002.
6	Jonathan W. Valvano, "Embedded Microcomputer Systems – Real Time Interfacing", Publisher - Cengage Learning,3rd, edition,2012.
7	Andrew Sloss, Domnic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimising System Software", Elsevier, 2004
Access to software and virtual labs:	
1	vlabs.iitkgp.ernet.in
2	swayam - IIT kharagpur NPTEL 2024- Introduction to Embedded System design , nptel.ac.in.
Industry articles and case studies:	
1	nxp.com - Embedded papers
2	www.engpaper.com
3	https://ieeexplore.ieee.org
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
1	www.digi.com real life 10 examples.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Peer Review and Participation	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

VIVEKANAND EDUCATION SOCIETY'S

Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai, Approved by A.I.C.T.E & Recognized by Govt. of Maharashtra)

Department of Electronics and Computer Science

EMBEDDED SYSTEM AND RTOS (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
26ECMML42	Embedded System and RTOS Lab	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECMML42	Embedded System and RTOS Lab	---	---	---	25	25	50

Lab Prerequisite: Microprocessors & Microcontrollers, C programming.	
Lab Objectives:	
1	To design and write efficient code for single-tasking and multi-tasking embedded systems.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Interface various sensors and actuators to embedded cores.
2	Write code using RTOS for multi-tasking Embedded systems.
3	Design applications using different embedded cores.

Suggested Experiments: Students are required to complete at least 08 experiments.	
Sr.No.	**Name of the Experiments**
1	Interfacing of LEDs /switches with any embedded core. (8051/ARM/STM32, etc
2	Interfacing of LCD/ Seven segment display with any embedded core. (8051/ARM/STM32, etc)
3	Interfacing of BUZZER with any embedded core.
4	Interfacing of a DC motor (speed and Direction control) with any embedded core. (8051/ARM/STM32,etc)
5	Write a Program to Create Multiple Tasks and understand the Multitasking capabilities of RTOS using (FreeRTOS).
6	Write a Program to illustrate the use of Binary and Counting Semaphore for Task Synchronization.
7	Build a Multitasking Real-Time Applications using the above IPC Mechanisms.
8	Write a Program to illustrate the Queue Management Features.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - INTRODUCTION TO INNOVATION AND ENTREPRENEURSHIP FOR ENGINEERS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECEM42	Introduction to Innovation and Entrepreneurship for Engineers (Theory)	---	---	02	---	---	02	02
Total Credits								02

VIVEKANAND EDUCATION SOCIETY'S

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Department of Electronics and Computer Science

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECEM 42	Introduction to Innovation and Entrepreneurship for Engineers (Theory)	---	---	02	---	---	02	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECEM 42	Introduction to Innovation and Entrepreneurship for Engineers (Theory)	---	---	---	25	---	25

Course Objectives:	
1	Understand the concepts and theories of innovation and entrepreneurship within engineering disciplines.
2	Develop critical thinking and problem-solving skills necessary for identifying and evaluating entrepreneurial opportunities.
3	Gain practical experience in ideation, prototyping, and validation of innovative solutions to engineering challenges.
4	Explore the role of engineering in addressing societal and environmental challenges through innovation and entrepreneurship.
5	Cultivate teamwork, communication, and leadership skills essential for entrepreneurial success in interdisciplinary contexts.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand principles of innovation and entrepreneurship.
2	Identify and evaluate entrepreneurial opportunities.
3	Understand and Apply design thinking and innovation methodologies.
4	Develop and validate viable business models and innovative solutions.
5	Understand and demonstrate ethical practices in innovation and entrepreneurship
6	Demonstrate entrepreneurial mind set and skills.

INTRODUCTION TO INNOVATION AND ENTREPRENEURSHIP FOR ENGINEERS (THEORY)

Module	Contents	Hrs
1	**Introduction to Innovation and Design Thinking**	**06**
1.1	Overview of innovation concepts and importance in engineering.	
1.2	Types of innovation and innovation processes.	
1.3	Introduction to design thinking methodology.	
1.4	Applying design thinking principles to engineering challenges.	
1.5	Empathy mapping and user journey analysis.	
1.6	Iterative design process and user testing.	
2	**Opportunity Identification, Ideation**	**04**
2.1	Techniques for identifying customer needs and pain points.	
2.2	Idea generation exercises and brainstorming sessions.	
2.3	Problem-solving through human-cantered design.	
3	**Prototyping and MVP Development**	**04**
3.1	Introduction to prototyping techniques and tools.	
3.2	Minimum viable product (MVP) development and validation.	
3.3	Rapid iteration and feedback gathering.	
4	**Introduction to Entrepreneurship**	**04**
4.1	Overview of entrepreneurship concepts and mindset.	
4.2	Role of entrepreneurs in driving economic and social change.	
4.3	Characteristics of successful entrepreneurs. - Case Studies	
5	**Business Model Innovation and Validation**	**04**
5.1	Introduction to business model canvas and value proposition design.	
5.2	Revenue models, pricing strategies, and cost structure analysis.	
5.3	Techniques for market research and customer validation.	
5.4	Identifying target markets and understanding customer needs.	
6	**Legal and Ethical Considerations**	**04**
6.1	Intellectual property rights and patents in engineering innovation.	
6.2	Ethical considerations in entrepreneurship and engineering practice.	
6.3	Social responsibility and sustainability in innovation and entrepreneurship.	
Total		**26**

Textbooks:	
1	"Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath.
2	"Innovation and Entrepreneurship: Practice and Principles" by Peter F. Drucker.
3	"Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur.
4	"Innovative India: Science and Technology Entrepreneurship" by K. Vijayaraghavan and Rajan Srikanth.
5	"Startup Nation: Making India a Startup Ecosystem" by Dr. H.K. Mittal.
6	"Entrepreneurship: Theory, Process, and Practice" by Kuratko, Hornsby, and Covin:
7	"Zero to One: Notes on Startups, or How to Build the Future" by Peter Thiel and Blake Masters.
Websites:	
1	Startup India (startupindia.gov.in): Provides resources, guidelines, and support for start-ups and entrepreneurs in India, including information on funding, policies, and events.
2	National Entrepreneurship Network (NEN) (wadhwanifoundation.org/national-entrepreneurship-network): Offers resources, workshops, and programs for entrepreneurship education and ecosystem development in India.
3	MIT Open Course Ware (ocw.mit.edu): Offers free online courses on entrepreneurship and innovation, including lecture notes, assignments, and case studies from MIT's entrepreneurship curriculum.
4	Stanford eCorner (ecorner.stanford.edu): Features a rich collection of videos, podcasts, and articles on entrepreneurship and innovation from Stanford University, including talks by successful entrepreneurs and industry experts.
5	Coursera (coursera.org): Provides online courses on entrepreneurship and innovation from top universities and institutions, allowing students to learn at their own pace and earn certificates.
6	TiE (The Indus Entrepreneurs) (tie.org): A global non-profit organization dedicated to fostering entrepreneurship through mentoring, networking, and education, with many chapters in India offering local support and events.
Additional Resources:	
1	Entrepreneurship Development Institute of India (EDII) (ediindia.org) Provides entrepreneurship education, training, and research programs, as well as workshops and seminars on various aspects of entrepreneurship.
2	Harvard Business Review (hbr.org) Offers articles, case studies, and insights on innovation, entrepreneurship, and business strategy from industry experts and thought leaders.
3	Khan Academy (khanacademy.org)

	Offers free educational resources, including lessons on entrepreneurship, economics, and business fundamentals.
Term-Work: The Assessment will be based on a set of 5 activities of 5 marks each. The suggested list of activities:	
1	Individual and group assignments (e.g., business model canvas, market research report).
2	Presentations and pitches for venture ideas.
3	Participation in discussions and workshops.
4	Reflection papers or journals documenting personal learning and growth.
5	Presentation of innovation projects by students.
6	Feedback and peer evaluation of prototypes.
7	Reflection on the innovation process and lessons learned.

COURSE NAME: - FULL STACK DEVELOPMENT

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECVEL 41	Full Stack Development	---	02	---	---	02	---	02
Total Credits								02

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECVEL41	Full Stack Development	---	02	---	---	02	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECVEL41	Full Stack Development	---	---	---	25	25	50

Course Objectives:	
1	To design and create web pages using HTML5 and CSS3.
2	To implement client side scripting to static web pages.
3	To create dynamic web pages using server side scripting.
4	To use MVC framework for web application development.
Course Outcomes: After successful completion of the course students will be able to:	
1	Design static web pages using HTML5
2	Design the layout of web pages using CSS3
3	Apply the concepts of client side validation and scripts to static web pages using JavaScript
4	Build responsive web pages using front-end framework Bootstrap.
5	Build dynamic web pages using server side scripting.
6	Develop a web application using appropriate web development framework.

Suggested Experiments:	
Sr.No.	**Name of the Experiments**
1	To install, configure and test XAMPP (Apache and MySQL)
2	Design a web page using HTML5, containing images with relative link and absolute link.
3	Design web pages using HTML5 and CSS3 on selected problem statements. Design at least two pages linked with each other and containing links to other websites on the Internet.
4	Design a form, with different form fields e.g. text fields, password fields, checkboxes, radio buttons, sliders. Write Java Script for client side validation.
5	Design a web page using Bootstrap
6	Design web pages using php to demonstrate, control statements, loops, arrays, functions, and sessions.
7	Design Web pages using php with database connectivity to MySQL
8	To develop a real-time auto-updating graph using ChartJS, JSON, JavaScript, MySQL and PHP.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - FIELD PROJECTS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECFP 41	Field Projects	---	02	---	---	02	---	02
Total Credits								02

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
26ECFP 41	Field Projects	---	02	---	---	02	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
26ECFP 41	Field Projects	---	---	---	25	---	25

Scheme: Students are expected to complete any one of the following activities as part of their field project:	
A	To identify and address pressing challenges faced by industry or society. This course provides students with the opportunity to apply theoretical knowledge gained in their academic studies to real-world situations. The course also provides networking opportunities with industry experts. Through engaging projects, students synthesize concepts from their academic coursework, empowering them to explore, design, implement, and present solutions to engineering problems.
B	Students will engage in experiential learning to connect academic knowledge with real-world contexts through the development of case studies focused on various sectors such as industry, government, or non- governmental organizations. These case studies involve observing and analysing processes, operations, or systems during visits or surveys. Through critical thinking, students can propose potential enhancements or innovations to improve existing processes, operations, or systems.

Course Objectives:	
1	To engage students in field visits, with an objective of identifying and formulating problem statements based on observations during visits in industry, Government/ Non-governmental organizations as well as the broader societal context. **(with reference to Scheme A).** Students engage in experiential learning through developing industry or organizational case studies, analysing real-world processes, and proposing innovative enhancements based on critical observations and analysis **(with reference to Scheme B).** These approach bridges academic theory with practical application, fostering deeper understanding and actionable insights for students.
2	To apply theoretical knowledge and foster creativity & innovation in addressing practical real-world problems.
3	To enhance student's analytical, design & problem-solving skills, increase student's critical thinking ability to engage them in lifelong learning.
4	To enhance students' communication and presentation skills.
Course Outcomes: After successful completion of the course students will be able to:	
1	Identify and resolve the issues with industry & society at large, to provide practical solutions for real-world challenges.
2	Implement novel and efficient solutions fostering interdisciplinary collaboration in addressing challenges.
3	Apply appropriate techniques, resources and modern engineering tools, to improve the analytical, design, and problem-solving skills to abreast with the booming technologies.
4	Develop effective teamwork abilities, facilitating collaboration and synergy among individuals to achieve common goals.

FIELD PROJECTS

Module	Contents	Hrs
1	**Project Planning and Proposal Development**	**06**
1.1	Defining project objectives and scope, conducting literature review and background research, developing project proposal and timeline, Identifying required resources and constraints.	
2	**Design and Implementation**	**06**
2.1	Selecting appropriate methodologies and Simulation tools, designing system architecture and components, Prototyping and testing system functionalities, iterative development and troubleshooting.	
3	**Documentation and Reporting**	**06**
3.1	Maintaining detailed project documentation, recording progress, challenges and solutions, writing technical reports and documentation, Creating presentations for project updates and final presentation.	
4	**Project Presentation and Evaluation**	**06**
4.1	Delivering oral presentations of project progress, demonstrating project outcomes and achievements, responding to questions and feedback from peers and instructors, reflecting on lessons learned and areas for improvement.	
Total		**24**

Term Work:	
1	**Guideline to maintain quality of field project are as follows:** Students can achieve this by making proper selection of projects based on field visit/ study of archives from the library. Encourage the use of open-source software's for simulation, design and documentation of the projects. **Project Topic selection and approval: -** 1. The group may be of maximum **FOUR (04)** students. 2. The students are required to visit industry/community/library to identify the problem statement and be able to provide the proof of interaction. 3. Topic selection and approval by **2 Expert** faculty from department at the start of semester. 4. **Log Book** to be prepared for each group to record the work per week by students. Weekly comment, remarks to be put by guiding faculty. Both students and faculty will put signatures in it per week. The log book can be managed **online** with proper authentication method using google sheets/forms or open-source project management software. 5. **Suggested steps for project selection and implementation as per scheme A.** a. Identify Project Goals and Objectives b. Conduct Needs Assessment: (Identify potential stakeholders, such as industries, communities, or organizations, and assess their needs or challenges that could be addressed through the project.) c. Research and Explore Options d. Formulate Problem Statements e. Evaluate Feasibility f. Select Project Scope g. Develop Project Plan h. Prototype Development (for Hardware Projects) Software Development (for Software Projects) i. Testing and Validation j. Monitoring and Evaluation k. Documentation and Reporting
2	**Project Report Format:** 1. Project **report** should include Introduction, Literature review, Methodology, Project design and implementation, Testing, Result and discussion, Conclusion, References, Appendices Report should not exceed **20 pages** and spiral binding not required.

3	The final certification and acceptance of term work ensures satisfactory performance of project work and minimum passing marks in term work.
4	**Term Work evaluation and marking as per Scheme A:** 1. At the end of semester, the above 2 expert faculty who have approved the topic will internally **evaluate the performance**. 2. Students have to give a presentation and demonstration on the Field Project. 3. In the evaluation each individual student should be assessed for his/her contribution, understanding and knowledge gained about the project completed. Based upon it the marks will be awarded to students. **4. <u>Distribution of 25 Marks for Term Work</u>:** • **Initial Stage:** Field study report and Project Proposal = **05 Marks** • **Prototype development and Testing = 05 Marks** • **Project report** = **05 Marks** **Prototype Demonstration and final presentation** = **10 Marks**
5	**Project selection, implementation and report writing with reference to Course Description B.** The student will mention the objectives of the field visit, description including field visit data collection, processes/ operations, analysis and suggestions for the improvement and innovations if any. **<u>Distribution of 25 Marks for Term Work in scheme B is as follows:</u>** **1.** Assessment of case study report with analysis prepared by student groups: **10 marks** 2. Presentation by student groups and Q&A: **10 marks** Suggestions given for improvement in the present Processes/ Systems / Operations, innovation identification: **05 marks.**