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. 2024-25

| Semester III Teaching Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **Teaching Scheme (Contact hours)** | | | **Credits Assigned** | | | |
| | | **TH** | **PR** | **TUT** | **TH** | **PR** | **TUT** | **TOTAL** |
| **NECPC31** | Data Structures | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC32** | Digital System Design | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC33** | Operating System | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECMM31** | Microprocessor and Microcontroller | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECEM31** | Finance Management | 2 | --- | --- | 2 | --- | --- | 2 |
| **NECAE31** | Professional Communication and Ethics II | 1 | 2 | --- | 1 | 1 | --- | 2 |
| **Total Credits** | | | | | | | | **20** |

| Semester III Marks Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **TH** | **MT** | **CA** | **TW** | **PR/OR** | **Total** |
| **NECPC31** | Data Structures | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC32** | Digital System Design | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC33** | Operating System | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECMM31** | Microprocessor and Microcontroller | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECEM31** | Finance Management | 30 | 20 | --- | --- | --- | 50 |
| **NECAE31** | Professional Communication and Ethics II | --- | --- | --- | 50 | --- | 50 |
| **Total Marks** | | | | | | | **700** |

| Semester IV Teaching Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Type** | **Course Name** | **Teaching Scheme (Contact hours)** | | | **Credits Assigned** | | | |
| | | **TH** | **PR** | **TUT** | **TH** | **PR** | **TUT** | **TOTAL** |
| **NECPC41** | Electronic Devices and Circuits | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC42** | Database Management System | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC43** | Discrete Structure and Automata Theory | 2 | --- | --- | 2 | --- | --- | 2 |
| **NECMM42** | Embedded System and RTOS | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NOE401** | Open Elective* | 3 | --- | 1 | 3 | --- | 1 | 4 |
| **NECEM42** | Introduction to Innovation and Entrepreneurship for Engineers | --- | --- | 2 | --- | --- | 2 | 2 |
| **NECVEL41** | Simulation Lab for Signal Processing | --- | 2 | 1 | --- | 1 | 1 | 2 |
| **NECFP41** | Field Projects | --- | 2 | --- | --- | 2 | --- | 2 |
| **Total Credits** | | | | | | | | **24** |

| Semester IV Marks Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Type** | **Course Name** | **TH** | **MT** | **CA** | **TW** | **PR/OR** | **TOTAL** |
| **NECPC41** | Electronic Devices and Circuits | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC42** | Database Management System | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC43** | Discrete Structure and Automata Theory | 60 | 20 | 20 | --- | --- | 100 |
| **NECMM42** | Embedded System and RTOS | 60 | 20 | 20 | 25 | 25 | 150 |
| **NOE401** | Open Elective | 60 | 20 | 20 | --- | --- | 100 |
| **NECEM42** | Introduction to Innovation and Entrepreneurship for Engineers | --- | --- | --- | 25 | --- | 25 |
| **NECVEL41** | Simulation Lab for Signal Processing | --- | --- | --- | 25 | 25 | 50 |
| **NECFP41** | Field Projects | --- | --- | --- | 25 | --- | 25 |
| **Total Marks** | | | | | | | **750** |

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**Department of Electronics and Computer Science**

# Semester III
# Syllabus

# VIVEKANAND EDUCATION SOCIETY'S

# Institute of Technology

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## Department of Electronics and Computer Science

## COURSE NAME: - DATA STRCTURES

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECPC 31 | Data Structures (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECPCL 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 |
| NECPC 31 | 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 | | | | |
| NECPC 31 | 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. |

# VIVEKANAND EDUCATION SOCIETY'S

# Institute of Technology

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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.<br>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 | Rubrics | 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. |

# DATA STRUCTURE (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECPCL 31 | 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 | | | | |
| NECPCL 31 | 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:<br>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<br>(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 |
| NECPC 32 | Digital System Design (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECPCL 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 |
| NECPC 32 | 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 | | | | |
| NECPC 32 | 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 Combinational logic circuits using Medium Scale Integration (MSI). |
| 2 | Design counter circuits using MSI. |
| 3 | Design Sequential logic circuits using flip flops. |
| 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, Demultiplexer, decoder, Comparator (Multiplexer and Demultiplexer gate level up to 4:1). | |
| 1.2 | Designing using MSI devices: IC7483, IC74151, CD74HC147, CD4585. | |
| | | |
| **2** | **Elements of Sequential Logic Design** | **06** |
| 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. | |
| | | |
| **3** | **Design of Sequential Logic Circuits** | **08** |
| 3.1 | Sequential Logic Design: Mealy and Moore Machines, clocked synchronous state machine analysis, state reduction techniques (inspection, partition and implication chart method) and sequence detector, Clocked synchronous state machine design. | |
| 3.2 | Sequential logic design practices: MSI 4-bit Binary counter (IC 7490, 7493), MSI Shift register (IC 74194). | |
| | | |
| **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. Verilog Constructs: Continuous & procedural assignment statements, logical, arithmetic, relational, shift operator, always, if, case, loop statements, Gate level modelling, Module instantiation statements, Test bench. | |
| 4.2 | Modelling Examples: Combinational logic eg. 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, Serial adders. | |
| | | |
| **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, 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. |
| | |
| **Reference books:** | |
| 1 | Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2nd edition,2006. |
| 2 | 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 |
| 3 | Stephen Brown and ZvonkoVranesic, Fundamentals of digital logic design with Verilog design, McGraw Hill, 3rd Edition,2013. |
| 4 | William I.Fletcher, "An Engineering Approach to Digital Design", PrenticeHall of India,3rd edition,2007. |
| 5 | Michael D. Ciletti, Advanced Digital Design with the Verilog HDL,2nd Edition, Pearson Pvt. Ltd, Noida, India,2011. |
| 6 | 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. |
| 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 | Rubrics | 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

## DIGITAL SYSTEM DESIGN (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECPCL 32 | 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 | | | | |
| NECPCL 32 | 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 verify the comparator IC 7485. |
| 4 | To perform Flip flop conversion JK to D, JK to T and D to T flip flop. |
| 5 | To implement MOD N counter using IC 7490/ 7493. |
| 6 | To implement universal shift register using IC 74194. |
| | |
| **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. |

**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<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |

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## Department of Electronics and Computer Science

## COURSE NAME: - OPERATING SYSTEM

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECPC 33 | Operating System (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECPCL 33 | Operating System (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 |
| NECPC 33 | 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 | | | | |
| NECPC 33 | Operating System (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Prerequisite:** C Programming. | |
| **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** | **04** |
| 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** | **07** |
| 2.1 | Basic Concepts of Process; Operation on Process; Process State Model and Transition; Process Control Block; Context Switching;<br>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** | **09** |
| 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** | **07** |
| 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** | **07** |

| | | |
|---|---|---|
| 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** | **05** |
| 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** | | **39** |

| | |
|---|---|
| **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 | Rubrics | 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

## OPERATING SYSTEM (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECPCL 33 | 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 | | | | |
| NECPCL 33 | 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 | a) Execution of Unix General Purpose Utility Commands like echo, clear, exit, date, time, uptime, cal, cat, tty, man, which, history, id, pwd, whoami, ping, ifconfig, pr, lp, lpr, lpstat, lpq, lprm, cancel, mail, etc.<br>b) Working with Editor Vi/other editor. |
| 2 | Execution of File System Management Commands like ls, cd, pwd, cat, mkdir, rmdir, rm, cp, mv, chmod, wc, piping and redirection, grep, tr, echo, sort, head, tail, diff, comm, less, more, file, type, wc, split, cmp, tar, find, vim, gzip, bzip2, unzip, locate, etc. |
| 3 | Execution of User Management Commands like who, whoami, su, sudo, login, logout, exit, passwd, useradd/adduser, usermod, userdel, groupadd, groupmod, groupdel, gpasswd, chown, chage, chgrp, chfn, etc. |
| 4 | Execution of Process Management Commands like ps, pstree, nice, kill, pkill, killall, xkill, fg, bg, pgrep, renice, etc. |
| 5 | Execution of Memory Management Commands like free, /proc/meminfo, top, htop, df, du, vmstat, demidecode, sar, pagesize, etc. |
| 6 | • Write a shell script to perform arithmetic operations.<br>• Write a shell script to calculate simple interest and Compound Interest calculation.<br>• Write a shell script to determine largest among three integer numbers.<br>• Write a shell script to determine if a given year is a leap year or not.<br>• Write a shell script to determine Fahrenheit to Centigrade Conversion<br>• Write a shell script to determine Area & Circumference of Circle<br>• Write a shell script to search whether an element is present in the list or not.<br>• Write a shell script to compare two strings.<br>• Write a shell script for Employee Pay calculation<br>• Write a Shell script to calculate Grade.<br>• Write a shell script to implement a menu-driven calculator using a case statement.<br>Write a shell script to perform operations on directory like: display name of current directory; display list of directory contents; create another directory, write contents on that and copy it to a suitable location in your home directory; etc |
| 7 | • Write a Shell script for a Menu Driven program to check if entered number is<br>• Even or Odd 2.Prime 3.Palindrome 4.Armstrong<br>• Write a shell script to search whether an element is present in the list or not.<br>• Write a shell script to compare two strings.<br>• Write a shell script to read and check if the directory / file exists or not, if not make the directory / file.<br>• Write a shell script to perform operations on directory like: display name of current directory; display list of directory contents; create another directory, |

| | |
|---|---|
| | write contents on that and copy it to a suitable location in your home directory; etc. |
| 8 | Execute the following scripts using grep / sed commands:<br>• Write a script using grep command to find the number of words character, words and lines in a file.<br>• Write a script using egrep command to display a list of specific types of files in the directory.<br>• Write a script using sed command to replace all occurrences of a particular word in a given file.<br>• Write a script using sed command to print duplicate lines in input. |
| 9 | Write a program to demonstrate any two CPU scheduling algorithms like FCFS, SJF, SRT, Round Robin, priority (preemptive or non preemptive) etc. |
| 10 | Write a program to implement dynamic partitioning placement algorithms i.e Best Fit, First-Fit, Worst-Fit etc. |
| 11 | Write a program to implement process synchronization using semaphore. |
| 12 | Implementing Various page replacement policies: FIFO, Optimal, LRU |

**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<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |

# COURSE NAME: - MICROPROCESSOR AND MICROCONTROLLER

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECMM 31 | Microprocessor and Microcontroller (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECMML 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 |
| NECMM 31 | 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 | | | | |
| NECMM 31 | 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. |

# VIVEKANAND EDUCATION SOCIETY'S

# Institute of Technology

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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. | |
| 5.4 | C Programming | |
| | | |
| **6** | **8051 Interfacing** | **09** |
| 6.1 | I/O port programming | |
| 6.2 | Programming 8051 Timers | |
| 6.3 | Serial Port Programming | |
| 6.4 | Interrupts Programming | |
| 6.5 | IO Interfacing -LCD & Keypad, ADC, DAC, Stepper and DC Motors | |
| 6.6 | 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 | Rubrics | 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

## MICROPROCESSOR AND MICROCONTROLLER (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECMML 31 | 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 | | | | |
| NECMML 31 | 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:**<br>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<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |

# COURSE NAME: - FINANCE MANAGEMENT

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECEM 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 |
| NECEM 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 | | | | |
| NECEM 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 |
| NECAE31 | Professional Communication and Ethics-II (Theory) | 01 | 02 | --- | 01 | 01 | --- | 02 |
| Total Credits | | | | | | | | 02 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECAE31 | 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 | | | | |
| NECAE31 | 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<br>• Solicited & Unsolicited Proposals<br>• Types (Short and Long proposals) | |
| 1.2 | Parts of a Proposal<br>• Elements<br>• Scope and Limitations<br>• Conclusion | |
| 1.3 | Objectives of Report Writing<br>• Information<br>• Decision Making<br>• Analysis<br>• Recommendations | |
| 1.4 | Parts of a Long Formal Report:<br>• Prefatory Parts (Front Matter)<br>• Report Proper (Main Body)<br>• Appended Parts (Back Matter) | |
| 1.5 | Language and Style of Reports<br>• Tense, Person & Voice of Reports<br>• Numbering Style of Chapters, Sections, Figures, Tables<br>• Referencing Styles in APA & MLA Format<br>• Proofreading through Plagiarism Checkers | |
| 1.6 | Technical Paper Writing:<br>• Parts of a Technical Paper<br>• Language and Formatting<br>• Writing an abstract<br>• Referencing in IEEE Format | |
| 1.7 | Presenting data-figures, diagrams and labelling<br>• Graphic Organizers for Summaries<br>• Radial Diagrams like Mind Maps<br>• Flow Charts | |

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

| | | |
|---|---|---|
| 4.1 | • Effective Presentation Strategies<br>• Defining Purpose<br>• Analyzing Audience, Location and Event<br>• Gathering, Selecting and Arranging Material<br>• Structuring a Presentation<br>• Making Effective Slides<br>• Types of Presentations Aids<br>• Closing a Presentation<br>• Platform skills | |
| 4.2 | Group Presentations<br>• Sharing Responsibility in a Team<br>• Building contents and visuals together<br>• Transition Phases | |
| | | |
| **5** | **Interpersonal Skills** | **05** |
| 5.1 | Interpersonal Skills<br>• Emotional Intelligence<br>• Leadership & Motivation<br>• Conflict Management & Negotiation<br>• Time Management<br>• Assertiveness<br>• Decision Making | |
| | | |
| **6** | **Corporate Ethics** | **02** |
| 6.1 | Intellectual Property Rights<br>• Copyrights<br>• Trademarks<br>• Patents<br>• Industrial Designs | |
| 6.2 | Case Studies<br>• Cases related to Business/ Corporate Ethics | |
| | | |
| **7** | **Professional Writing Skills** | **03** |
| 7.1 | Developing Professional Writing Skills<br>• Effective introduction with emphasis on general statement, opposing statement and thesis statement<br>• Critical response to a text with special reference to purpose, evaluation of the content, theme and style of a text<br>• Organization of ideas, sentence construction and word choice, grammar and usage<br>• Explanation and support of ideas (special reference to writing paragraphs opening statement, body, closing | |

| | | |
|---|---|---|
| | statement, linkers) | |
| 7.2 | Creative Writing<br>• Narrative essays<br>• Content writing<br>• 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

| Semester IV Teaching Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Type** | **Course Name** | **Teaching Scheme (Contact hours)** | | | **Credits Assigned** | | | |
| | | **TH** | **PR** | **TUT** | **TH** | **PR** | **TUT** | **TOTAL** |
| **NECPC41** | Electronic Devices and Circuits | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC42** | Database Management System | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NECPC43** | Discrete Structure and Automata Theory | 2 | --- | --- | 2 | --- | --- | 2 |
| **NECMM42** | Embedded System and RTOS | 3 | 2 | --- | 3 | 1 | --- | 4 |
| **NOE401** | Open Elective* | 4 | --- | --- | 4 | --- | --- | 4 |
| **NECEM45** | Introduction to Innovation and Entrepreneurship for Engineers | --- | --- | 2 | --- | --- | 2 | 2 |
| **NECVEL46** | Simulation Lab for Signal Processing | --- | 2 | 1 | --- | 1 | 1 | 2 |
| **NECFP47** | Field Projects | --- | 2 | --- | --- | 2 | --- | 2 |
| **Total Credits** | | | | | | | | **24** |

| Semester IV Marks Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Type** | **Course Name** | **TH** | **MT** | **CA** | **TW** | **PR/OR** | **TOTAL** |
| **NECPC41** | Electronic Devices and Circuits | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC42** | Database Management System | 60 | 20 | 20 | 25 | 25 | 150 |
| **NECPC43** | Discrete Structure and Automata Theory | 60 | 20 | 20 | --- | --- | 100 |
| **NECMM44** | Embedded System and RTOS | 60 | 20 | 20 | 25 | 25 | 150 |
| **NOE401** | Open Elective | 60 | 20 | 20 | --- | --- | 100 |
| **NECEM41** | Introduction to Innovation and Entrepreneurship for Engineers | --- | --- | --- | 25 | --- | 25 |
| **NECVEL41** | Simulation Lab for Signal Processing | --- | --- | --- | 25 | 25 | 50 |
| **NECFP41** | Field Projects | --- | --- | --- | 25 | --- | 25 |
| **Total Marks** | | | | | | | **750** |

## *Open Electives

| | |
|---|---|
| NOE401 | Design Thinking |
| NOE402 | Green IT |
| NOE403 | Database Management System |
| NOE404 | Quantitative Analysis |
| NOE405 | Web Development |

# COURSE NAME: - ELECTRONIC DEVICES AND CIRCUITS

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECPC41 | Electronics Devices and Circuits (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECPCL41 | 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 |
| NECPC41 | 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 | | | | |
| NECPC41 | 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. |

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## Department of Electronics and Computer Science

## 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.<br>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 | Rubrics | 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. |

# ELECTRONIC DEVICES AND CIRCUITS (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECPCL41 | 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 | | | | |
| NECPCL 41 | 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<br>(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 |
| NECPC42 | Database Management System (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECPCL42 | Database Management System (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 |
| NECPC42 | 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 | | | | |
| NECPC42 | 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. |

# 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. |
| 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 | Rubrics | 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

## DATABASE MANAGEMENT SYSTEM (LAB)

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECPCL42 | 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 | | | | |
| NECPCL 42 | 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. (Hardware + Simulation Based) | |
|---|---|
| **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<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |

# VIVEKANAND EDUCATION SOCIETY'S

# Institute of Technology

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## Department of Electronics and Computer Science

## COURSE NAME: - DISCRETE STRUCTURE AND AUTOMATA THEORY

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECPC43 | Discrete Structure and Automata Theory (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 |
| NECPC43 | Discrete Structure and Automata Theory (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 | | | | |
| NECPC43 | Discrete Structure and Automata Theory (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Prerequisite:** Engineering Mathematics – I & II. | |
| **Course Objectives:** | |
| 1 | To cultivate clear thinking for Creative Problem Solving. |
| 2 | To train students to understand and construct Mathematical Proofs. |
| 3 | To introduce the notions of Sets, Relations, Functions, Graphs and their applications. |
| 4 | To build concepts of theoretical design of Basic machines, Deterministic and Non-Deterministic Finite state machines and Pushdown Machines. |
| 5 | To gain the conceptual understanding of fundamentals of Grammars. |
| 6 | To prepare students with the mathematical aspects in other courses such as Formal Specification, Verification, Artificial Intelligence etc |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Apply the notion of mathematical thinking, mathematical proofs in problem solving. |
| 2 | Analyze logically. |
| 3 | Perform operations with Sets, Relations, Functions, Graphs and their applications. |
| 4 | Design Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata |

| | |
|---|---|
| | (NFA) and Pushdown Automata with understanding of power and limitations. |
| 5 | Design Context Free Grammar and perform the operations like simplification and normal forms. |
| 6 | Apply Discrete Structures and Automata Theory concepts into solving real world computing problems in the domain of Formal Specification, Verification, Artificial Intelligence etc. |

# DISCRETE STRUCTURE AND AUTOMATA THEORY

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Relations** | **04** |
| 1.1 | Relations- Definition, Properties of Relations. | |
| 1.2 | Types of binary relations (Equivalence and partial ordered relations). | |
| 1.3 | Closures, Poset, Hasse diagram and Lattice. | |
| 1.4 | Pigeonhole Principle, Extended Pigeonhole Principle. | |
| | | |
| **2** | **Functions** | **04** |
| 2.1 | Functions-Definition. | |
| 2.2 | Types of Functions (Injective, Surjective and Bijective). | |
| 2.3 | Identity and Inverse Functions. | |
| | | |
| **3** | **Graph Theory** | **03** |
| 3.1 | Graphs. | |
| 3.2 | Euler paths and circuits. | |
| 3.3 | Hamiltonian Paths and circuits . | |
| | | |
| **4** | **Finite Automata** | **05** |
| 4.1 | Introduction of Automata and its applications | |
| 4.2 | Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language recognizers, NFA to DFA Conversion. | |
| 4.3 | Eliminating epsilon-transitions from NFA. | |
| 4.4 | FSM with output: Moore and Mealy machines. | |
| | | |
| **5** | **Regular Expression (RE) and Regular Grammar (RG)** | **05** |
| 5.1 | Regular Grammar and Regular Expression (RE): Definition, Equivalence and Conversion from RE to RG and RG to RE. | |
| 5.2 | Equivalence of RE and FA, Converting RE to FA and FA to RE. | |
| | | |
| **6** | **Context Free Grammar (CFG) and Push Down Automata (PDA)** | **05** |
| 6.1 | Grammars: Chomsky hierarchy, CFG- Definition, Sentential forms, Leftmost and Rightmost derivations. | |
| 6.2 | Context Free languages (CFL): Parsing and Ambiguity's: Simplification and Applications. | |
| 6.3 | Normal Forms: Chomsky Normal Form | |
| | | |
| **Total** | | **26** |

| | |
|---|---|
| **Textbooks:** | |
| 1 | BernadKolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "DiscreteMathematical Structures", Pearson Education. |
| 2 | C.L.Liu, "Elements of Discrete Mathematics", Second edition 1985, McGraw-HillBook Company, Reprinted 2000. |
| 3 | John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages andComputation", Pearson Education,3rd edition,2006. |
| 4 | Vivek Kulkarni, "Theory of Computation", Oxford University Press, India. |
| | |
| **Reference books:** | |
| 1 | K.H.Rosen, "Discrete Mathematics and applications",Tata McGraw Hill publishing Company,7th edition,2011. |
| 2 | Y N Singh, "Discrete Mathematical Structures", Wiley-India. |
| 3 | J .L.Mott, A.Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India |
| 4 | J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill. |
| 5 | Seymour Lipschutz, Marc Lars Lipson," Discrete Mathematics" Schaum's Outline, McGraw Hill Education,3rd edition,2009. |
| 6 | Daniel I. A. Cohen," Introduction to Computer Theory", Wiley Publication,2nd edition,2006. |
| 7 | Michael Sipser, "Theory of Computation", Cengage learning,3rd edition,2012. |
| 8 | J. C. Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill,4th edition,2010. |
| | |
| **Access to software and virtual labs:** | |
| 1 | Discrete structures : https://www.mathily.org/dm-rw.html |
| 2 | Discrete structures: https://micsjournal.springeropen.com/ |
| 3 | Automata theory :https://www.sciencedirect.com/science/article/pii/S0950705117300655 |
| | |

| 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 | Rubrics | 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. |

# COURSE NAME: - EMBEDDED SYSTEM AND RTOS

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECMM42 | Embedded System and RTOS (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NECMML42 | Embedded System and RTOS (Lab) | --- | 02 | --- | --- | 01 | --- | 01 |
| Total Credits | | | | | | | | 04 |

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
|---|---|---|---|---|---|---|---|---|
| NECMM42 | 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 | | | | |
| NECMM42 | 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. |

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## Department of Electronics and Computer Science

## 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.<br>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<br>Hardware-Software Co-design | |
| 6.2 | Case studies for Automatic Chocolate Vending Machine, Washing Machine, Smart Card, highlighting<br>i) Specification requirements (choice of components),<br>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 | Rubrics | 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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# Institute of Technology

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## 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 |
| NECMML 42 | 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 | | | | |
| NECMML 42 | 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:**<br>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<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |

# COURSE NAME: - DESIGN THINKING

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE401 | Design Thinking (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |
| Total Credits | | | | | | | | 04 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE401 | Design Thinking (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NOE401 | Design Thinking (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| Course Objectives: | |
|---|---|
| 1 | To cultivate a thorough grasp of Design Thinking's definition, principles, and practical applications. |
| 2 | To achieve proficiency in Design Thinking methodologies and processes, encompassing the 5-stage approach and various implementation strategies. |
| 3 | To learn diverse methods and tools during the Empathize and Design phases of product development within the framework of Design Thinking. |
| 4 | To learn to apply design thinking tools and methods in ideation stage. |
| 5 | To comprehend different prototype methods and learn the importance of testing. |
| 6 | To apply Design Thinking principles through case studies and real-world scenarios, fostering practical understanding and proficiency in problem-solving and innovation. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Develop a comprehensive understanding of Design Thinking's definition, principles, and applications. |
| 2 | Acquire proficiency in Design Thinking methodologies and processes, encompassing the 5-stage approach and diverse implementation strategies. |
| 3 | Learn various methods/tools for Empathize and Design phases in product development through Design Thinking. |
| 4 | Tackle idea generation challenges by employing techniques such as brainstorming, mind mapping, and ideation tools, prioritizing visualization and empathy prior to generating |

| | |
|---|---|
| | ideas. |
| 5 | Understanding various prototype types and methods, implementing focused experiments, exploration maps, and minimum viable products. |
| 6 | Applying interdisciplinary collaboration, ethics, culture, global perspectives, and technology integration in real-world scenarios. |

## DESIGN THINKING (THEORY)

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Introduction to Design Thinking** | **05** |
| 1.1 | **Design Thinking Background:** Definition, Importance, Origin, Design Vs Design Thinking, Problem Solving and Need, Principles of Design Thinking, Business Uses, Variety within the Design Thinking Discipline<br>**Design Thinking Approach:** Empathy, Ethnography, Divergent Thinking, Visual Thinking, Assumption Testing and Prototyping | |
| 1.2 | *Activities for Tutorials: Identify an Opportunity and Scope of the Project Explore the possibilities and prepare a design brief* | |
| | | |
| **2** | **Design thinking process and methodology** | **08** |
| 2.1 | **Design Thinking Resources:** Organization, People, Place, Material<br>**Principles of Design Thinking**<br>**Design Thinking Processes**<br>**Design Thinking Methodology:** The 5 Stages of the Design Thinking Process- Empathize, define (the problem), Ideate, Prototype, and Test. | |
| 2.2 | *Activities for Tutorials: Identify design thinking process and methodology which will be useful for your case study and also identify the important applicable principles.* | |
| | | |
| **3** | **Empathize and Design** | **07** |
| 3.1 | **Methods and Tools for Empathize and Design phases:** Ask 5 Why (5W+H Questions), Stakeholder and Empathy Map Peer Observation, Trend Analysis, Data Gathering methods, Observation, Focus Graph, Interview, Q&A, Design Thinking Application, Design Thinking Applied to product development. | |
| 3.2 | *Activities for Tutorials: Apply the methods of empathizing and Define Phases Finalize the problem statement.* | |
| | | |
| **4** | **Design Thinking in Practice** | **07** |

| | | |
|---|---|---|
| 4.1 | **Visualisation and Ideation:** Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating. Ideation Tools: How Might We? (HMW), Storyboard, Mind mapping, Brainstorming, Affinity diagram. | |
| 4.2 | *Activities for Tutorials: Apply the methods of Ideate Phase: Generate Lots of Ideas.* | |
| **5** | **Prototyping and Testing** | **08** |
| 5.1 | **Prototyping:** Types of Prototypes, Methods of prototyping, focused experiments, exploration map, minimum viable product, Testing prototypes with users | |
| 5.2 | *Activities for Tutorials: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas. Collect feedback, iterate and improve the ideas.* | |
| | | |
| **6** | **Case Studies/Real World Application** | **04** |
| 6.1 | **Case Studies and Real-World Applications:** Important considerations: Cross Disciplinary Collaborations, Ethical consideration, cultural sensitivity and global perspective, technology integration. | |
| 6.2 | *Activities for Tutorials Find out any one-use case considering the above discussed factors that have impacted the real-world business/society.* | |
| | | |
| **Total** | | **39** |

| | |
|---|---|
| **Textbooks:** | |
| 1 | Idris Mootee, ―Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School‖, Wiley, 2017. (e-book) https://www.aitskadapa.ac.in/e-books/CSE/DESIGN%20THINKING/Design%20Thinking%20for%20Strategic%20Innovation_%20What%20They%20Can_t%20Teach%20You%20at%20Business%20or%20Design%20School%20(%20PDFDrive%20).pdf |
| 2 | Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation".(e-book) http://hozekf.oerp.ir/sites/hozekf.oerp.ir/files/kar_fanavari/manabe%20book/Thinking/Change%20by%20Design_%20How%20Design%20Thinking%20Transforms%20Organizations%20and%20Inspires%20Innovation%20.pdf |
| 3 | Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing ISBN:978-1790435371, November 2018. (https://www.researchgate.net/publication/329310644_Handbook_of_Design_Thinking). |
| | |
| **Reference books:** | |
| 1 | Gavin Ambrose, Paul Harris, "Basics Design - 8: Design Thinking", illustrated, reprint, AVAPublishing, 2010. |
| 2 | Christine Charyton, Creative Engineering Design Assessment, Springer. |

| | |
|---|---|
| 3 | Warren K Wake Wake, Design Paradigms: A Sourcebook for Creative Visualization, JohnWiley & Sons. |
| | |
| **Online Resources:** | |
| 1 | https://www.gasq.org/files/content/gasq/downloads/certification/Design%20Thinking/DesignThinking_Syllabus_0-6-3_EN.pdf |
| 2 | https://www.cuelogic.com/blog/core-principles-of-design-thinking |
| 3 | https://www.uxuiopen.com/trial/ux_fundamentals/design_process/ |
| 4 | https://digitalleadership.com/blog/design-thinking/ |
| 5 | https://www.interaction-design.org/literature/topics/design-thinking |
| 6 | https://www.pvpsiddhartha.ac.in/dep_it/lecture%20notes/FDLD_21/UNIT-1.pdf |
| 7 | https://aim.gov.in/pdf/Mentor-DesignThinking.pdf |
| | |
| **Industry articles and case studies:** | |
| 1 | MJV Tecnologia ltda,"Design Thinking_business innovation"e-book |
| 2 | https://theaccidentaldesignthinker.com/2017/09/16/40-design-thinking-success-stories/ |
| 3 | https://voltagecontrol.com/blog/8-great-design-thinking-examples/ |
| 4 | https://online.hbs.edu/blog/post/design-thinking-examples |
| 5 | https://www.theknowledgeacademy.com/blog/design-thinking-case-study/ |
| | |
| **Any other (Access to AI tools / Data driven insights (if applicable) or any other):** | |
| 1 | User Research and Sentiment Analysis Tools:CrystalKnows, MonkeyLearn, Clarabridge |
| 2 | User Interviews and Surveys:Affectiva, Surveysparrow |
| 3 | Data Analysis Tools:Tableau, IBM Watson Analytics |
| 4 | Insight Extraction: Sift |
| 5 | Brainstorming and Idea Generation:Miro, Ideaflip, Writeseer |
| 6 | Prototyping Tools: Figma, Sketch2Code, Uizard |
| 7 | User Testing and Feedback:UserTesting, Lookback,Optimal Workshop |
| 8 | Automated Documentation and Note-Taking:Otter.ai,Notion |
| 9 | Collaboration Tools:Slack, Microsoft Teams |

| **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 | Rubrics | 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. |

# COURSE NAME: - GREEN IT

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE402 | Green IT (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |
| Total Credits | | | | | | | | 04 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE402 | Green IT (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NOE402 | Green IT (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Prerequisite:** Environmental Studies | |
| **Course Objectives:** | |
| 1 | To understand what Green IT is and How it can help improve environmental Sustainability. |
| 2 | To understand the principles and practices of Green IT. |
| 3 | To understand how Green IT is adopted or deployed in enterprises. |
| 4 | To understand how data centres, cloud computing, storage systems, software and networks can be made greener. |
| 5 | To measure the Maturity of a Sustainable ICT world. |
| 6 | To implement the concept of Green IT in Information Assurance in Communication and Social media and all other commercial fields. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement. |
| 2 | Identify IT Infrastructure Management and Green Data Centre Metrics for software development. |
| 3 | Recognize Objectives of Green Network Protocols for Data communication. |
| 4 | Use Green IT Strategies and metrics for ICT development. |
| 5 | Illustrate various green IT services and its roles. |
| 6 | Use new career opportunities available in the IT profession, audits and others with special skills such as energy efficiency, ethical IT assets disposal, carbon footprint estimation, reporting and development of green products, applications and services. |

# 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

## GREEN IT (THEORY)

| Module | Contents | Hrs |
|---|---|---|
| 1 | **Introduction:** Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and Eco-Labeling, Enterprise Green IT Strategy<br>**Hardware:** Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose<br>**Software:** Introduction, Energy-Saving Software Techniques. | **07** |
| | **Self-learning Topics:** Evaluating and Measuring Software Impact to Platform Power. | |
| | | |
| 2 | **Sustainable Software development and data centres:** Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics Data Centers and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, Green Data Centre Metrics. | **07** |
| | **Self-learning Topics:** Sustainable Software: A Case Study, Data Centre Management Strategies: A Case Study. | |
| | | |
| 3 | **Data storage and communication:** Storage Media Power Characteristics, Eenergy Management Techniques for Hard Disks Objectives of Green Network Protocols, Green Network Protocols and Standards. | **06** |
| | **Self-learning Topics:** System-Level Energy Management. | |
| | | |
| 4 | **Information systems, green it strategy and metrics :** Approaching Green IT Strategies, Business Drivers of Green IT Strategy Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Measuring the Maturity of Sustainable ICT: A Capability Maturity Framework for SICT, Defining the Scope and Goal, Capability Maturity Levels. | **07** |
| | **Self-learning Topics:** Business Dimensions for Green IT Transformation. | |
| | | |
| 5 | **Green IT services and roles:** Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware. | **06** |
| | **Self-learning Topics:** Inter-organizational Enterprise Activities and Green Issues, Enablers and Making the Case for IT and the Green Enterprise. | |
| | | |
| 6 | **Managing and regulating green IT:** Strategizing Green Initiatives, Implementation of Green IT, Communication and Social Media The Regulatory Environment and IT Manufacturers, Non regulatory Government | **06** |

| | | |
|---|---|---|
| | Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Social Movements and Greenpeace | |
| | **Self-learning Topics:** Information Assurance, Green Data Centers, Case study : Managing Green IT | |
| | | |
| **Total** | | **39** |

| | |
|---|---|
| **Textbooks:** | |
| 1 | San Murugesan, G. R. Gangadharan, Harnessing Green IT, WILEY 1st Edition-2013. |
| 2 | Mohammad Dastbaz Colin Pattinson Babak Akhgar, Green Information Technology A Sustainable Approach, Elsevier 2015. |
| 3 | Reinhold, Carol Baroudi, and Jeffrey HillGreen IT for Dummies, Wiley 2009. |
| | |
| **Reference books:** | |
| 1 | Mark O'Neil, Green IT for Sustainable Business Practice: An ISEB Foundation Guide,BCS. |
| 2 | Jae H. Kim, Myung J. Lee Green IT: Technologies and Applications, Springer, ISBN: 978-3-642-22178-1 |
| 3 | Elizabeth Rogers, Thomas M. Kostigen The Green Book: The Everyday Guide to Saving the Planet One Simple Step at a Time, Springer |
| | |
| **Access to software and virtual labs:** | |
| 1 | https://greentheweb.com/tools/ |
| 2 | https://apiumhub.com/tech-blog-barcelona/green-software-tools-metrics/ |
| 3 | https://climatecalculator.net/ |
| 4 | https://greenit.ee/en/calculator/ |
| 5 | https://natnavi.com/carbon-footprint-credit-calculator |
| | |
| **Industry articles and case studies:** | |
| 1 | https://cekh.ccreee.org/cekh_resources/virtual-labs-green-energy-energy-identify-and- erent-energy-sources-for-a-home-for-csec-cape-and-cvq/ |
| 2 | https://github.com/carstenwindler/green-it |
| 3 | https://www.infoworld.com/article/2640285/6-valuable-green-it-resources.html |
| | |
| **Any other (Access to AI tools / Data driven insights (if applicable) or any other):** | |
| 1 | OpenAI GPT Models, OpenAI Codex, OpenAI Gym, OpenAI CLIP, OpenAI DALL-E etc... |
| 2 | TensorFlow and PyTorch, Microsoft Azure AI, Google Cloud AI, Amazon AI Services, HPE GreenLake etc.. |

| **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: | |

**Suggested List of Tutorials:**

| Sr.No. | Detailed Contents |
|---|---|
| 1 | Research an organization's IT power usage and identify ways to reduce it. Find creative ways to measure power output of your computer(s) and peripherals e.g. pull battery on laptop and measure charging requirements. |
| 2 | Measuring and reducing the carbon footprint of IT professionals' operations and suggesting means of reducing Carbon Footprint. |
| 3 | Research the sustainability of an organization's IT cooling. |
| 4 | Research the sustainability of paper use in an organization. |
| 5 | Research an organizations and your local municipality's recycling efforts. Particularly focus on the way they handle e-waste. |
| 6 | Develop a more sustainable design of an organization's data centres. Submit your proposal with justifications. |
| 7 | Using the readings as a guideline, research an organization's IT sustainability plan and summarize it along with your recommendations on how to improve it. |
| 8 | Real-world case studies of organizations successfully implementing Green IT Initiatives. |
| 9 | Measuring and reporting on the environmental performance of IT operations. |
| 10 | Studying which of the latest Green IT techniques (eg:- Remote Maintenance using Tools, E-Learning & E-Training, Web Conferencing & E-Webinar Meetings, E-Signatures, Virtual Filing & Cloud Computing) can be applied to your Institute and submitting report for the same. |

**Note:** Suggested List of Tutorials is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging tutorials, (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.

| Sr. No | Rubrics | 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

## COURSE NAME: - DATABASE MANAGEMENT SYSTEMS

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE403 | Database Management Systems (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |
| Total Credits | | | | | | | | 04 |

# VIVEKANAND EDUCATION SOCIETY'S

# Institute of Technology

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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 |
| NOE403 | Database Management Systems (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NOE403 | Database Management Systems (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Prerequisites:** Data Structures | |
| **Course Objectives:** | |
| 1 | Collaborate effectively in teams to design and implement data-driven solutions to complex problems. |
| 2 | Gain proficiency in designing, implementing, and managing relational and non-relational database management systems. |
| 3 | Explore advanced topics such as data warehousing and big data analytics. |
| 4 | Explore concepts of distributed database systems. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Recognize the need for a database management system. |
| 2 | Understand and apply the concept of ER model and Relational Model and normalization to relational database design. |
| 3 | Construct relational models and execute SQL queries. |
| 4 | Explore advanced Database management concepts and No SQL. |
| 5 | Explore data warehousing and big data technologies. |
| 6 | Understand distributed Database systems. |

# DATABASE MANAGEMENT SYSTEMS (THEORY)

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Introduction Database Concepts** | **02** |
| 1.1 | Introduction, Importance of data management in organizations, DBMS system architecture, Evolution of database technologies. | |
| | | |
| **2** | **Relational Database Management Systems (RDBMS)** | **10** |
| 2.1 | **The Entity-Relationship (ER) Model:** Entity types, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model.<br>**Relational Model:** Relational schema and concept of keys. Mapping the ER and EER Model to the Relational Model<br>**Database normalization:** 1NF, 2NF, 3NF, BCNF | |
| | | |
| **3** | **SQL fundamentals** | **08** |
| 3.1 | Overview of SQL: Data Definition Command with constraints, Data Manipulation commands, Data Control commands, views in SQL, joins, Nested Queries Transaction concept, Transaction states, ACID properties, Transaction Control Commands. | |
| | | |
| **4** | **Non-Relational Database Management Systems (NoSQL)** | **06** |
| 4.1 | Types of NoSQL databases: document-based, key-value, column-family, and graph databases, Characteristics and use cases of NoSQL databases, Comparison between SQL and NoSQL databases (e.g., MongoDB, Cassandra) | |
| | | |
| **5** | **Advanced Data Management Concepts** | **06** |
| 5.1 | Data warehousing and OLAP (Online Analytical Processing), Introduction to big data technologies (e.g., Hadoop, Spark), Data lakes and data integration strategies, Data governance and security in modern data systems. | |
| | | |
| **6** | **Introduction to Distributed Databases** | **07** |
| 6.1 | Introduction to distributed database systems, characteristics of distributed databases, Comparison with centralized and decentralized database systems, Distributed Database Architectures, Distributed data storage: Data fragmentation, replication, and allocation strategies, Distributed transaction management: Two-phase commit protocol, Three-phase commit protocol, Data consistency and concurrency control in distributed environments. | |
| | | |
| **Total** | | **39** |

| | |
|---|---|
| **Textbooks:** | |
| 1 | Korth, Slberchatz, Sudarshan, Database System Concepts, 6 thEdition, McGraw Hill. |
| 2 | Elmasri and Navathe, Fundamentals of Database Systems, 5 thEdition, Pearson Education. |
| 3 | Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH. |
| | |
| **Reference books:** | |
| 1 | Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management‖, Thomson Learning, 5 thEdition. |
| 2 | Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press. |
| 3 | G. K. Gupta, Database Management Systems, McGraw Hill, 2012 |
| 4 | Bradshaw, S., Brazil, E., Chodorow, K. (2019). MongoDB: The Definitive Guide: Powerful and Scalable Data Storage. United States: O'Reilly Media. |
| 5 | Data Warehousing Fundamentals. India, Wiley India Pvt. Limited, 2006. |
| 6 | Burns, Brendan. Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services. Japan, O'Reilly Media, 2018. |
| | |
| **Online Resources:** | |
| 1 | https://nptel.ac.in/courses/106/105/106105175/ |
| 2 | https://swayam.gov.in/nd1_noc19_cs46/preview |
| 3 | https://www.classcentral.com/course/swayam-database-management-system-9914 |
| 4 | https://www.mooc-list.com/tags/dbms |
| | |
| **Virtual Labs:** | |
| 1 | http://vlabs.iitkgp.ac.in/se/4/simulation/ |
| 2 | https://vsit.edu.in/vlab/DBMS/Views_Simulator.html |
| | |
| **AI Tools:** | |
| 1 | Draw.io: A free, web-based tool for creating ER and EER diagrams. |
| 2 | https://dbschema.com/ :An interactive database design and management tool |
| 3 | SQLFiddle: An online tool to write and test SQL queries against different databases. |
| 4 | SQLBot: An AI tool that helps generate SQL queries from natural language inputs. |
| | |
| **Industry articles:** | |
| 1 | https://shorturl.at/NFsay:The Google File System |
| 2 | Bigtable: A Distributed Storage System for Structured Data: Google |
| | |
| **Case Studies:** | |
| 1 | https://8weeksqlchallenge.com/ |
| 2 | https://docs.oracle.com/cd/E16338_01/gateways.112/e12069/ch4.htm#GMSWN300 |

| **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** | **Rubrics** | **Marks** |
|---|---|---|
| 1 | Multiple Choice Questions (Quiz) 5 | 05 marks |
| 2 | Literature review of papers/journals | 05 marks |
| 3 | Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject | 05 marks |
| 4 | Wins in the event/competition/hackathon pertaining to the course | 10 marks |
| 5 | Case Study, Presentation, group discussion, technical debate on recent trends in the said course | 10 marks |
| 6 | Project-based Learning and evaluation / Extra assignment / Question paper solution | 10 marks |
| 7 | NPTEL/ Coursera/ Udemy/any MOOC Certificate course for 4 weeks | 10 marks |
| 8 | Content beyond syllabus presentation 10 | 10 marks |
| 9 | Creating Proof of Concept 10 | 10 marks |
| 10 | Mini Project / Extra Experiments/ Virtual Lab 10 | 10 marks |
| 11 | GATE Based on Assignment tests/Tutorials etc 10 | 10 marks |
| 12 | Peer Review and participation | 05/10marks |
| *For sr.no.7, the date of the certification exam should be within the term, and in case a student is unable to complete the certification, the grading has to be done accordingly. | | |
| **Indirect Assessment** | | |
| 1 | Mock Viva | |
| 2 | Skill Enhancement Lecture | |
| 3 | Extra Assignments/lecture | |

| **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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# Institute of Technology

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## Department of Electronics and Computer Science

## COURSE NAME: - QUALITATIVE ANALYSIS

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE404 | Qualitative Analysis (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |
| Total Credits | | | | | | | | 04 |

# 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

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE404 | Qualitative Analysis (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NOE404 | Qualitative Analysis (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Objectives:** | |
| 1 | Emphasize the importance and application of quantitative methods in various fields. |
| 2 | Equip students with the skills necessary for effective data collection, organization, and management. |
| 3 | Train students in the application of inferential statistics to make predictions and generalizations about populations from sample data. |
| 4 | Teach students to calculate probabilities and apply probability distributions to real- world scenarios. |
| 5 | Ensure students can perform various data analysis tasks using these tools effectively. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Grasp the fundamental concepts and techniques of quantitative analysis. |
| 2 | Acquire skills in collecting, organizing, and summarizing data. |
| 3 | Apply probability concepts and various statistical methods to analyze data. |
| 4 | Understand the applications of mathematical models in real-world scenarios. |
| 5 | Understand the application of software tools in analyzing and visualizing data. |

# QUALITATIVE ANALYSIS (THEORY)

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Basic Concepts, Operation Research and its role in Decision Making** | **06** |
| 1.1 | Introduction to Quantitative Analysis: Basic concepts and its role in decision making, Nature of OR problem, steps in OR problem, Formulation of LP problems, Solution of L.P.P. by Graphical Method, Computer Output. | |
| | | |
| **2** | **Duality and Sensitivity Analysis** | **06** |
| 2.1 | Duality and its implications, Sensitivity analysis (Computer Output Analysis), Introduction to Integer programming, Goal programming problems (Only formulation and solution of two variable cases). | |
| | | |
| **3** | **Transportation and Network Problems** | **06** |
| 3.1 | Transportation Models, Initial Basic Feasible Solution and Optimal Solution, Assignment Problem and Travelling Salesman Problem, Network Models: minimum Spanning Tree Problems, Shortest Route and Maximal Flow Technique. | |
| | | |
| **4** | **Queuing Theory and Simulation Models** | **06** |
| 4.1 | Queuing theory: Single Channel Queuing Model with Poisson arrivals and Exponential Service Times (M/M/1) , Simulation Modelling, Markov Analysis. | |
| | | |
| **5** | **Software Usages** | **06** |
| 5.1 | Practical Module: Use of Excel Solver/TORA software to solve above problems and teaching the above concepts using at least one case in each topic. | |
| | | |
| **6** | **Data & Statistics** | **09** |
| 6.1 | An Overview: Visualizing Data, Probability, Describing Distributions with Numbers, Normal Distributions ,Sampling Distributions, Interval Estimation for a Population Mean, Hypothesis Testing for a Population Mean (σ known), Hypothesis Testing for a Population Mean (σ unknown) | |
| | | |
| **Total** | | **39** |

| | |
|---|---|
| **Reference books:** | |
| 1 | Barry Render, Ralph M. Stair, Jr., Michael E. Hanna, T N Badri, Quantitative Analysis for Management, Pearson. |
| 2 | Vohra N. D., Quantitative Techniques in Management, Tata McGraw Hill. |
| 3 | J. K. Sharma, Operation Research – Theory & Applications, MACMILLAN. |
| | |
| **Access to software and virtual labs:** | |
| 1 | Excel, R, Python |

| | |
|---|---|
| **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 | Rubrics | 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 |

| | |
|---|---|
| **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

## COURSE NAME: - WEB DEVELOPMENT

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE405 | Web Development (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |
| Total Credits | | | | | | | | 04 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NOE405 | Web Development (Theory) | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NOE405 | Web Development (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Objectives:** | |
| 1 | Understand the foundational concepts of web development including front-end and back-end distinctions, and basic technologies like HTML, CSS, and JavaScript. |
| 2 | Develop proficiency in creating static web pages using HTML and CSS, including structuring documents, working with links, images, and forms, and applying CSS styling techniques. |
| 3 | Gain knowledge and skills in responsive web design principles and practices, including media queries, flexible grids, and CSS frameworks like Bootstrap. |
| 4 | Acquire fundamental understanding of JavaScript programming, covering variables, data types, control structures, functions, DOM manipulation, and event handling. |
| 5 | Explore backend development concepts with Firebase and Node.js, including setup, database integration, web server creation, and RESTful API development. |
| 6 | Familiarize with tools and technologies for Express web development, including Gatsby, GraphQL, static site generation, styling, optimization, and deployment strategies. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Demonstrate the ability to create basic static web pages using HTML and CSS, incorporating links, images, forms, and applying styling techniques. |
| 2 | Design responsive web layouts utilizing media queries, flexible grids, and CSS frameworks, ensuring compatibility across various devices and screen sizes. |
| 3 | Implement interactive features on web pages using JavaScript, including dynamic content updates, event-driven behavior, and user interaction. |

| | |
|---|---|
| 4 | Develop backend solutions using Firebase and Node.js, integrating authentication, databases, and RESTful APIs to support dynamic web applications. |
| 5 | Construct and deploy web applications using Express.js, employing routing, middleware, and server-side logic for efficient handling of HTTP requests and responses. |
| 6 | Utilize Gatsby and associated technologies for building optimized, serverless web applications, leveraging GraphQL, static site generation, and deployment best practices. |

## WEB DEVELOPMENT (THEORY)

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Introduction to Web Development** | **06** |
| 1.1 | Introduction to the World Wide Web, Front-end vs. back-end development, Overview of HTML, CSS, and JavaScript, Introduction to version control with Git, Setting up development environment (text editor, browser, Git). | |
| | | |
| **2** | **HTML and CSS Fundamentals** | **07** |
| 2.1 | HTML basics: tags, elements, attributes, Document structure: headings, paragraphs, lists, Working with links and images, Forms, CSS fundamentals: selectors, properties, values, Styling text, colors, backgrounds, and borders, CSS box model: margin, padding, border, Layout techniques: floats, positioning, flexbox. | |
| | | |
| **3** | **Responsive Web Design** | **06** |
| 3.1 | Introduction to responsive web design principles, using media queries to create responsive layouts, Flexible grids and fluid images, CSS frameworks for responsive design (e.g., Bootstrap), Testing and debugging responsive websites. | |
| | | |
| **4** | **Introduction to JavaScript** | **07** |
| 4.1 | Introduction to JavaScript: Variables, data types, operators, Control structures: loops and conditionals, Functions and scope, DOM manipulation: selecting elements, modifying content and attributes, Event handling: responding to user actions. | |
| | | |
| **5** | **Introduction to Backend Development** | **09** |
| 5.1 | Introduction to Firebase, Firebase Authentication, Realtime Database or Firestore. | |

| | | |
|---|---|---|
| 5.2 | **Introduction to backend development and Node.js**, Setting up a Node.js development environment, Building a simple web server with Node.js, Introduction to Express.js framework, Routing and middleware in Express.js, Handling HTTP requests and responses, Introduction to RESTful APIs. | |
| | | |
| **6** | **Tools for Express Web Development** | **04** |
| 6.1 | Gatsby :GraphQL, Static Site Generation (SSG), Plugins, Styling in Gatsby, Optimization Techniques. Deployment, Serverless Functions. | |
| | | |
| **Total** | | **39** |

| | |
|---|---|
| **Textbooks:** | |
| 1 | Ralph Moseley, M.T. Savliya, "Developing Web Applications", Willy India, Second Edition, ISBN: 978-81-265-3867-6 |
| 2 | Web Technology Black Book, Dremtech Press, First Edition, 978-7722-997 |
| 3 | Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014 (http://www.ebooksbucket.com/uploads/itprogramming/javascript/Learning_PHP_MySQL_Javascript_CSS_HTML5 Robin_Nixon_3e.pdf) |
| 4 | Dana Moore, Raymond Budd, Edward Benson,Professional Rich Internet Applications: AJAX and Beyond Wiley publications. https://ebooks-it.org/0470082801-ebook.htm |
| 5 | Alex Banks and Eve Porcello, Learning React Functional Web Development with React and Redux,OREILLY, First Edition |
| | |
| **Reference books:** | |
| 1 | Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, Internet and World Wide Web - How To Program, Fifth Edition, Pearson Education, 2011. |
| 2 | Achyut S Godbole and AtulKahate, ―Web Technologies, Second Edition, Tata McGraw Hill, 2012. |
| 3 | Thomas A Powell, Fritz Schneider, ―JavaScript: The Complete Reference, Third Edition, Tata McGraw Hill, 2013 |
| 4 | Masse, M. (2011). REST API Design Rulebook. Germany: O'Reilly Media. |
| 5 | Porcello, E., Banks, A. (2018). Learning GraphQL: Declarative Data Fetching for Modern Web Apps. China: O'Reilly Media. |
| | |
| **Useful Links:** | |
| **Resources** | |
| 1 | MDN Web Docs - JavaScript |
| 2 | React Documentation |

| | |
|---|---|
| 3 | Node.js Documentation |
| 4 | Express.js Documentation |
| 5 | MongoDB Documentation |
| 6 | PostgreSQL Documentation |
| | |
| **AI Tools:** | |
| 1 | Code Generation and Assistance: GitHub Copilot, TabNine |
| 2 | Testing and Debugging: DeepCode, Snyk |
| 3 | Automated Code Review: Codacy, SonarQube |
| 4 | Performance Optimization: LightStep, Datadog APM |
| 5 | Front-End Development: Figma with AI Plugins, Adobe XD with AI Features |
| 6 | Back-End Development: AWS CodeGuru, Kite |
| 7 | Database Management: DataRobot, OtterTune |
| 8 | DevOps and Deployment: Ansible with AI, Harness.io |
| 9 | Project Management and Collaboration: Asana with AITrello with AI Plugins |
| 10 | Documentation: Jasper (formerly Jarvis), Scribe |

| **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 | Rubrics | 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 |

| 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. |

# 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 |
| NECEM42 | Introduction to Innovation and Entrepreneurship for Engineers (Theory) | --- | --- | 02 | --- | --- | 02 | 02 |
| Total Credits | | | | | | | | 02 |

## Department of Electronics and Computer Science

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECEM 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 | | | | |
| NECEM 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)<br>Provides entrepreneurship education, training, and research programs, as well as workshops and seminars on various aspects of entrepreneurship. |
| 2 | Harvard Business Review (hbr.org)<br>Offers articles, case studies, and insights on innovation, entrepreneurship, and business strategy from industry experts and thought leaders. |
| 3 | Khan Academy (khanacademy.org)<br>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.<br>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: - SIMULATION LAB FOR SIGNAL PROCESSING

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECVEL 41 | Simulation Lab for Signal Processing | --- | 02 | 01 | --- | 01 | 01 | 02 |
| Total Credits | | | | | | | | 02 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NECVEL 41 | Simulation Lab for Signal Processing | --- | 02 | 01 | --- | 01 | 01 | 02 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NECVEL 41 | Simulation Lab for Signal Processing | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Course Objectives:** | |
| 1 | To provide students with real experience in the MATLAB technical computing environment. |
| 2 | To teach students how to use a high-level programming language MATLAB, to solve scientific problems using engineering applications and examples. |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| 1 | Understand the fundamentals of MATLAB, its technical computing environment and use its basic functionalities. |
| 2 | Learn how to use the for-loop, while-loop, conditional statement control flow constructs, and implementing user-defined functions in MATLAB. |
| 3 | Acquire good data visualisation skills by experimenting with different graphing methods and their customisations. |
| 4 | Build a graphical user interface (GUI) using App Designer in MATLAB. |

# SIMULATION LAB FOR SIGNAL PROCESSING (Tutorial)

| Module | Contents | Hrs |
|---|---|---|
| **1** | **Introduction to MATLAB** | **04** |
| 1.1 | Getting Started, Scripts, Making Variables, Manipulating Variables, Basic Plotting, Debugging M-files | |
| 1.2 | Visualization and Programming: Functions, Flow Control, Line Plots, Image/Surface Plots, Efficient Codes, Debugging | |
| | | |
| **2** | **Solving Equations, Curve Fitting, and Numerical Techniques** | **02** |
| 2.1 | Control flow and operators, Array operations and Linear equations, Linear Algebra, Polynomials, Optimization, Differentiation, Integration, Differential Equations, Symbolic math toolbox. | |
| | | |
| **3** | **Advanced Methods** | **02** |
| 3.1 | Probability and Statistics, Data Structures, Basic Image processing, File I/O. | |
| | | |
| **4** | **Various Functions and Toolboxes** | **05** |
| 4.1 | Documentation, Miscellaneous Useful Functions, Graphical User Interfaces, Simulink, Image Processing, Hardware Interface | |
| | | |
| **Total** | | **13** |

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Institute of Technology

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**Department of Electronics and Computer Science**

# SIMULATION LAB FOR SIGNAL PROCESSING LAB

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NECVEL 41 | Simulation Lab for Signal Processing | --- | 02 | --- | --- | 01 | 01 | 02 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NECVEL 46 | Simulation Lab for Signal Processing | --- | --- | --- | 25 | 25 | 50 |

| | |
|---|---|
| **Lab Prerequisite:** A fundamental understanding of computer programming principles such as variables, constants, expressions, statements and basics of engineering mathematics. | |
| **Lab Objectives:** | |
| 1 | To provide students with real experience in the MATLAB technical computing environment. |
| 2 | To teach students how to use a high-level programming language MATLAB, to solve scientific problems using engineering applications and examples. |
| **Lab Outcomes:**<br>After successful completion of the lab course students will be able to: | |
| 1 | Utilize MATLAB basic functionalities. |
| 2 | Develop expertise with the use of MATLAB's control flow constructs and implementing user-defined functions to extend MATLAB's capabilities. |
| 3 | Use for-loop, while-loop, and conditional statement control flow constructs in MATLAB. |
| 4 | Apply good data visualisation skills by experimenting with different graphing methods and their customisations. |
| 5 | Use MATLAB Simulink to design systems with multidomain models and simulate them. |
| 6 | Create graphical user interface (GUI) using App Designer in MATLAB. |

| **Suggested Experiments:** Students are required to complete at least 08 experiments. | |
|---|---|
| **Sr.No.** | **Name of the Experiments** |
| 1 | Basic Operations on Matrices. |
| 2 | Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc. |
| 3 | Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power. |
| 4 | Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal. |
| 5 | Convolution for Signals and sequences. |
| 6 | Auto Correlation and Cross Correlation for Signals and Sequences. |
| 7 | Verification of Linearity and Time Invariance Properties of a given Continuous /Discrete System. |
| 8 | Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties. |
| 9 | Gibbs Phenomenon Simulation. |
| 10 | Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum. |
| 11 | Waveform Synthesis using Laplace Transform. |
| 12 | Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function. |
| 13 | Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function. |
| 14 | Verification of Sampling Theorem. |
| 15 | Removal of noise by Autocorrelation / Cross correlation. |
| 16 | Extraction of Periodic Signal masked by noise using Correlation. |
| 17 | Checking a Random Process for Stationarity in Wide Sense. |

**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 |
| NECFP 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 |
| NECFP 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 | | | | |
| NECFP 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).**<br>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).**<br>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:**<br>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:**<br><br>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.<br><br>**Project Topic selection and approval: -**<br>1. The group may be of maximum **FOUR (04)** students.<br>2. The students are required to visit industry/community/library to identify the problem statement and be able to provide the proof of interaction.<br>3. Topic selection and approval by **2 Expert** faculty from department at the start of semester.<br>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.<br>5. **Suggested steps for project selection and implementation as per scheme A.**<br>a. Identify Project Goals and Objectives<br>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.)<br>c. Research and Explore Options<br>d. Formulate Problem Statements<br>e. Evaluate Feasibility<br>f. Select Project Scope<br>g. Develop Project Plan<br>h. Prototype Development (for Hardware Projects) Software Development (for Software Projects)<br>i. Testing and Validation<br>j. Monitoring and Evaluation<br>k. Documentation and Reporting |
| **2** | **Project Report Format:**<br><br>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:**<br>1. At the end of semester, the above 2 expert faculty who have approved the topic will internally **evaluate the performance**.<br>2. Students have to give a presentation and demonstration on the Field Project.<br>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.<br>**4. <u>Distribution of 25 Marks for Term Work</u>:**<br>• **Initial Stage:** Field study report and Project Proposal = **05 Marks**<br>• **Prototype development and Testing = 05 Marks**<br>• **Project report** = **05 Marks**<br>**Prototype Demonstration and final presentation** = **10 Marks** |
| 5 | **Project selection, implementation and report writing with reference to Course Description B.**<br>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.<br>**<u>Distribution of 25 Marks for Term Work in scheme B is as follows:</u>**<br>**1.** Assessment of case study report with analysis prepared by student groups: **10 marks**<br>2. Presentation by student groups and Q&A: **10 marks**<br>Suggestions given for improvement in the present Processes/ Systems / Operations, innovation identification: **05 marks.** |