



**Prof. Ram Meghe Institute of Technology And Research  
Badnera –Amravati**

**An Autonomous Institute Affiliated to Sant Gadge Baba Amravati University,  
Amravati, Maharashtra (India)**

**B.Tech  
Multidisciplinary Minor (MDM)  
2023-24**

**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati (An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology Choice Based Credit System (Semester Pattern) Branch: All Branches**  
**Batch Admitted AY2023-24 \*MULTI-DISCIPLINARY MINOR (MDM) BASKET OF COURSES for 4th Semester**

| Track Name                                | Semester | Course Code | Course Name                                  | Teaching Scheme |          |     |                                |                    |         | Examination Scheme      |                      |               |    |       |                           | Offered by the Department of                  |
|-------------------------------------------|----------|-------------|----------------------------------------------|-----------------|----------|-----|--------------------------------|--------------------|---------|-------------------------|----------------------|---------------|----|-------|---------------------------|-----------------------------------------------|
|                                           |          |             |                                              | Hours / Week    |          |     | MDM Applicable to              | Total Hours / Week | Credits | THEORY                  |                      |               |    |       |                           |                                               |
|                                           |          |             |                                              | Lecture         | Tutorial | P/D |                                |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal      |    | Total | Overall Min Passing Marks |                                               |
|                                           |          |             |                                              |                 |          |     |                                |                    |         |                         | Max. Marks MSE/ MSIE | Max. Marks TA |    |       |                           |                                               |
| Artificial Intelligence                   | IV       | 4SAMDM1     | Artificial Intelligence and Expert Systems   | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Data Science                              | IV       | 4SAMDM5     | Programming for Data Science                 | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Civil Engineering                         | IV       | 4SCMDM1     | Introduction to Environmental Engineering    | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Construction Technology                   | IV       | 4SCMDM5     | Building Planning                            | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Computer Science and Engineering          | IV       | 4SKMDM1     | Fundamentals of Data Structures              | 3               | --       | --  | CE, EXTC, IIoT, ME             | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Software Engineering                      | IV       | 4SKMDM5     | Software Requirements Engineering            | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Electronics and Communication Engineering | IV       | 4SEMDM1     | Electronic Instrumentation                   | 3               | --       | --  | AI&DS, CE, CSE, IT, IIoT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Telecommunication Engineering             | IV       | 4SEMDM5     | Basic Electronic Communication Systems       | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Information Technology                    | IV       | 4SNMDM1     | Data Transmission and Information Technology | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| Cyber Security                            | IV       | 4SNMDM5     | Introduction to Cyber Security               | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| IoT                                       | IV       | 4STMDM1     | Fundamentals of IoT                          | 3               | --       | --  | AI&DS, CE, CSE, IT, ME         | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Industrial IoT                                |
| Mechanical Engineering                    | IV       | 4SMMDM1     | Energy Engineering                           | 3               | --       | --  | CE, CSE, EXTC, IIoT, ME        | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |
| Robotics and Automation Engineering       | IV       | 4SMMDM5     | Mechatronics                                 | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |

\* indicates that the Track for MDM will be decided by respective Board of Studies (BoS)

**B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**  
**Multidisciplinary Minor (Track: Artificial Intelligence)**

| Course Code | Course Title                               | L  | T  | P  | C  |
|-------------|--------------------------------------------|----|----|----|----|
| 4SAMDM1     | Artificial Intelligence And Expert Systems | 03 | 00 | 00 | 03 |

**Course Objectives:**

The course will enable the learners to:

1. Understand the role of intelligent agents, perception, natural language processing, and various search strategies in AI.
2. Familiarize about adversarial search, decision-making processes, and logical reasoning using propositional and first-order logic
3. Master the concepts of uncertainty, probability notation, and probabilistic reasoning to make decisions under uncertainty.
4. Explore planning problems, partial order planning, and strategies for non-deterministic domains.
5. Develop decision trees, neural networks, and reinforcement learning techniques for knowledge acquisition.
6. Gain proficiency to Define expert systems, their features, and knowledge representation methods, and study specific expert systems like Prospector and MYCIN.

**Course Outcomes:**

1. Describe intelligent agents and apply uniformed and informed search strategies to solve problems in AI.
2. Analyze to Implement adversarial search techniques, make decisions using logical reasoning, and perform inference in first-order logic.
3. Synthesize probability theory and Bayes' rule to perform probabilistic reasoning and make decisions in uncertain environments.
4. Develop and implement plans using partial order planning and address challenges in nondeterministic environments.
5. Construct decision trees, apply neural networks, and use reinforcement learning methods for effective learning and decision-making.
6. Evaluate expert systems and their components, and apply knowledge representation techniques using tools like MYCIN.

|               |                                                                                                                                                                                                                                                         |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (4SAMDM1) Artificial Intelligence and Expert Systems</b>                                                                                                                                                                                    | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to AI:</b> Intelligent agents – Perception – Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies, Informed search strategies.                                                 | <b>07</b> |
| <b>Unit-2</b> | <b>Knowledge and Reasoning:</b> Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic. | <b>07</b> |
| <b>Unit-3</b> | <b>Uncertain Knowledge and Reasoning:</b> Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye’s rule – Probabilistic reasoning – Making simple decisions.                                                | <b>07</b> |
| <b>Unit-4</b> | <b>Planning:</b> Planning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains.                                                                                                                                | <b>07</b> |
| <b>Unit-5</b> | <b>Learning:</b> Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.                                                                                                             | <b>07</b> |
| <b>Unit-6</b> | <b>Expert Systems:</b> Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.                                                     | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                            | <b>42</b> |

#### **Text Book:**

1. Stuart Russel and Peter Norvig, “Artificial Intelligence A Modern Approach”, Second Edition, Pearson Education, 2003 / PHI.
2. Donald A. Waterman, “A Guide to Expert Systems”, Pearson Education.

#### **Reference Books:**

1. George F. Luger, “Artificial Intelligence – Structures and Strategies for Complex Problem Solving”, Fourth Edition, Pearson Education, 2002.
2. Elain Rich and Kevin Knight, “Artificial Intelligence”, Second Edition Tata McGraw Hill, 1995.
3. Janakiraman, K. Sarukesi, “Foundations of Artificial Intelligence and Expert Systems”, Macmillan Series in Computer Science.
4. W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, 2003

**B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**  
**Multidisciplinary Minor (Track: Data Science)**

| Course Code | Course Title                 | L  | T  | P  | C  |
|-------------|------------------------------|----|----|----|----|
| 4SAMDM5     | Programming for Data Science | 03 | 00 | 00 | 03 |

**Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Introduction to Python by being able to do each of the following:

1. Understand a strong foundational understanding of the Python programming language including its basic concepts.
2. Discuss Python data types, operators, and control flow structures.
3. Learn decision-making structures and loops in Python for control flow and iterative tasks.
4. Gain proficiency in working with strings, functions, and various data structures such as lists, tuples, and dictionaries.
5. Acquire skills in file handling, data manipulation using Pandas and NumPy, and object-oriented programming principles.

**Course Outcomes:**

After Successful completion of this course, the student will be able to:

1. Define the basic concepts of Python, including variables, data types, and operators.
2. Explain different string manipulation techniques and functions.
3. Use different data structures in python to perform various operations on data.
4. Implement the concepts and procedures of file handling in Python for real-world scenarios.
5. Utilize the Pandas library to manipulate and analyze data effectively.
6. Demonstrate the application of object-oriented programming principles in Python.

|               | Subject: (4SAMDM5) Programming for Data Science                                                                                                                                                                                                                                                   | L  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-1</b> | <b>Introduction:</b> Basic concepts of Python, Difference between core Python and advanced Python, Variables, Data types, Operators, Conditional Statements, Control Statements, Looping statement: while loop, for loop nested loops.                                                            | 07 |
| <b>Unit-2</b> | <b>Strings and Functions Strings:</b> String Manipulation, Accessing Strings, Basic Operations, String slices. <b>Function:</b> Functions, defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Add documentation to functions using docstrings. | 07 |

|               |                                                                                                                                                                                                                                                                                               |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Data Structures in Python:</b> Lists, Tuple, Dictionaries: Introduction, accessing data structure, operations related to data structure, working with data structures, function related to data structure and advance data structure.                                                      | 07        |
| <b>Unit-4</b> | <b>Working with Data in Python:</b> NumPy library and Manipulation of Data with Pandas, Install Python 3 and set up your programming environment, Run and edit python scripts, Interact with raw input from users, Find and use modules in Python Standard Library and third-party libraries. | 07        |
| <b>Unit-5</b> | <b>File Handling:</b> Opening and closing file, Reading and writing files, Date and Time with its functions, Introduction to Modules and packages, Identify and handle errors and exceptions in your code.                                                                                    | 07        |
| <b>Unit-6</b> | <b>Classes, Objects and Django Concepts:</b> Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Builtin Class Attributes, Inheritance, Overloading, Overriding, Data hiding, Introduction to Django Framework and it's uses.                | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                  | <b>42</b> |

#### Text Book:

1. Martin C Brown, —Python: The Complete Reference, McGraw Hill
2. Mueller, J., & Massaron, L. (2019). Python for data science. 2nd edition. Hoboken, NJ, John Wiley & Sons, Inc

#### Reference Books:

1. Michał Jaworski, Tarek Ziadé, —Expert Python Programming, Packt Publishing Ltd., Third Edition, ISBN, 9781789808896, 2019 Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8.
2. Larry Lutz, —Python for Beginners: Step By Step Guide to Learning Python Programming, CreateSpace Independent Publishing Platform, First edition, ISBN, 1717410588, 9781717410580, 2018.
3. Nicholas Ayden, —Python Programming, Independently Published, First Edition, ISBN, 1707051933, 9781707051939, 2019.

## **B.Tech. Fourth Semester (CIVIL)**

| Course Code | Course Title                              | L | T | P | C |
|-------------|-------------------------------------------|---|---|---|---|
| 4SCMDM1     | Introduction to Environmental Engineering | 3 | 0 | 0 | 3 |

### **Course Objectives:**

1. The water requirements and their estimation.
2. The different processes of water treatment.
3. Detailed study of solid wastes and air pollution.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Explain the concept of water treatment.
2. Classify the different processes related to water treatment and wastewater treatment.
3. Apply knowledge to overcome the problem of air pollution and solid waste.
4. Discover knowledge regarding characteristics of solid waste.
5. Discover knowledge regarding air pollution and its effects.
6. Discover knowledge regarding noise pollution.

|               |                                                                                                                                                                                                                                                                                                                                                                |   |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | <b>Subject: Introduction to Environmental Engineering</b>                                                                                                                                                                                                                                                                                                      | L |
| <b>Unit-1</b> | <b>Quantity Estimation of Water</b> - Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population. Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection. | 7 |

|               |                                                                                                                                                                                                                                                                                                                                  |    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-2</b> | <b>Water quality</b> - Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works.                                         | 7  |
| <b>Unit-3</b> | <b>Water Treatment Processes</b> - Aeration, Sedimentation, Flocculation, Filtration and Disinfection, working, their uses, maintenance.                                                                                                                                                                                         | 7  |
| <b>Unit-4</b> | <b>Characteristics of solid waste</b> - Physical, chemical and biological analysis. Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins. Disposal of solid wastes:- Different methods, sanitary landfill, composting, incineration. | 7  |
| <b>Unit-5</b> | <b>Air Pollution</b> - Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources.                                                                                                                                             | 7  |
| <b>Unit-6</b> | <b>Noise Pollution</b> - Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise  | 7  |
| Total         |                                                                                                                                                                                                                                                                                                                                  | 42 |

#### **Text Book:**

1. “Water Supply and Sanitary Engineering” by Birde G. S., Dhanpat Rai and Sons, Delhi.
2. “Water Supply Engineering”. By Punmia B. C. Laxmi publication.
3. Water Supply Engineering, by Garg S.K. Khanna Publishers.

#### **References:**

1. “Water Supply and Sewerage” by Steel E. W, Mc-Graw Hill.
2. “Water Supply Engineering”, by Kshirsagar S. R., Roorkee Pub house, Roorkee



| Course Code | Course Title      | L | T | P | C |
|-------------|-------------------|---|---|---|---|
| 4SCMDM5     | Building Planning | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Concepts related to building components and foundation.
2. Application and use of different building components.
3. Application of different masonry.
4. Understand need of engineering drawings and methods to draw it.
5. Learn about various planning principles and able to apply on residential buildings.
6. Know regional rules regulation related to building construction.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Understand Load bearing and Frame structure.
2. Know the types of staircase, doors, windows and other related fixtures.
3. Recognize the various bonds in brick masonry.
4. Understand layout of civil Engineering Drawing.
5. Plan Residential building using different principal of planning.
6. know about Bylaws, Town development authority rules and terms

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | <b>Subject: Building Planning</b>                                                                                                                                                                                                                                                                                                                                                                                                                  | L |
| <b>Unit-1</b> | <b>Types of Buildings</b> - Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing structure & framed structures, their relative advantages & disadvantages. Foundation: Definition and necessity, loads on foundation. Types of foundation – shallow foundation & deep foundations for buildings, spread footings for walls & columns and Raft foundations. | 7 |
| <b>Unit-2</b> | <b>Building Components</b> - Stairs: Functions, technical terms and types of staircases, Types of Floors: Basement floor, ground floor and upper floors, Roofs: Flat & pitched roof, steel roof trusses – types and suitability, Doors: Purpose, size of door, door frames & its types, Windows: Purpose, types of windows & their suitability.                                                                                                    | 7 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-3</b> | <b>Brick Masonry</b> - Classification of bricks, tests on bricks, properties of burnt bricks, Brick masonry construction: Technical terms, general principles, commonly used types of bonds and their suitability.                                                                                                                                                                                                                                                                          | 7  |
| <b>Unit-4</b> | <b>Building drawing</b> - Importance of building drawing for Civil Engineering in construction & industry, estimation, Selection of scales for various drawings. Types of line and their application. Methods of dimensioning in architectural drawing. Abbreviations and graphical symbols used in Civil Engineering Drawing as per IS: 962. Layout of sheet for civil engineering drawing. Requirements of drawing and documents as per plan sanctioning authorities. Define FSI and TDR. | 7  |
| <b>Unit-5</b> | <b>Planning of residential building</b> - Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement. Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post-office (On Graph Paper).                                                                                                                        | 7  |
| <b>Unit-6</b> | <b>Building Bye-laws</b> - Building Bye-laws and Development Control Rules for D Class Municipal Corporations in the Maharashtra State under the provisions of the Maharashtra Regional. Conversion of land to nonagricultural lands, layout for a housing project. Types of public building and their requirements, planning of public building.                                                                                                                                           | 7  |
| Total         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 42 |

#### **Text Books:**

1. Sushilkumar: Building Construction, Standard Publishers Distributors.
2. Shah, Kale & Patki, Building Planning & Drawing, Tata McGraw-Hill publication

#### **Reference Books:**

1. Mackay W.B.: Building Construction, Vol. I, Longmans.
2. Punmia B.C.: Building Construction.

| Course code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 4SKMDM1     | Fundamentals of Data Structures | 03 | 00 | 00 | 03 |

### Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

### Course Outcomes:

After Successful completion of this course, the student will be able to:

1. Describe basics of Data Structures and algorithms.
2. Explain Data Structures array and link list.
3. Illustrate with example stack and queues operations.
4. Examine the binary tree traversal methods.
5. Construct Graph and shortest path algorithm in graph.
6. Inspect various sorting and searching techniques.

|               | Subject: Fundamentals of Data Structures                                                                                                                                                                                               | L         |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 1</b> | Introduction to Data Structures: Introduction to Algorithms and Data Structures, Algorithms, Asymptotic Notation, Introduction to Data Structures, Types of Data Structures, Data Structure Operations.                                | <b>07</b> |
| <b>Unit 2</b> | Array & Linked List: Arrays: Introduction, Types of Arrays, Representation of One-Dimensional Array in Memory, Array Traversal, Insertion and Deletion, Linked List: Introduction, Linked Lists - Basic Concept, Types of Linked List. | <b>07</b> |
| <b>Unit 3</b> | Stack and Queue: Stacks: Introduction to Stacks, Stack Operations. Queues: Introduction, Queues - Basic Concept, Queue Operations, Basics of Circular Queues and Priority Queues.                                                      | <b>07</b> |
| <b>Unit 4</b> | Trees: Introduction, Basic Concept, Binary Tree, Binary Tree Representation, Binary Tree Traversal.                                                                                                                                    | <b>07</b> |

|               |                                                                                                                                                           |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 5</b> | Graphs: Introduction, Basic Concept, Graph Terminology, Graph Implementation and Graph Traversal.                                                         | <b>07</b> |
| <b>Unit 6</b> | Sorting and Searching: Introduction, Sorting Techniques: Selection Sort, Insertion Sort, Bubble Sort. Searching Techniques: Linear Search, Binary Search. | <b>07</b> |

#### **Text Books:**

1. "Data Structures" by Seymour Lipschutz, Schaum's Outline Series, McGraw-Hill, International Editions.
2. "An Introduction to Data Structures with Applications" by Trembley, Sorenson, McGraw Hill.

#### **Reference Books:**

1. "Fundamentals of Data Structures" by Ellis Horowitz, Sartaj Sahni, CBS Publications.
2. "Data Structure Using C" by Balagurusamy.
3. "Data Structures in Java" by Standish, Pearson Education.

| Course code | Course Title                     | L  | T  | P  | C  |
|-------------|----------------------------------|----|----|----|----|
| 4SKMDM5     | Software Requirement Engineering | 03 | 00 | 00 | 03 |

**Course Objectives:**

1. To gain a clear understanding of Requirement Engineering (RE), its definition, and its pivotal role in software development.
2. To differentiate between Functional and Non-Functional requirements, and comprehend their significance in software specification and design.
3. To learn the RE Process
4. To develop proficiency in various techniques such as Interviews, Surveys, Workshops, Observations, and Stakeholder Analysis for effective requirement elicitation.

**Course Outcomes:**

After Successful completion of this course, the student will be able to:

1. Define Requirement Engineering and explain its importance in software development.
2. Summarize various techniques for requirement elicitation such as Interviews, Surveys, and Workshops.
3. Apply techniques for analyzing and prioritizing requirements based on given criteria.
4. Create structured requirement specification documents, including Use Case Specifications and User Stories.
5. Analyze and critique different techniques for validating requirements, such as Prototyping and Review Processes.
6. Evaluate tools and strategies for managing changes to requirements

|               |                                                                                                                                                                                                                                                          |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: Software Requirement Engineering</b>                                                                                                                                                                                                         | <b>L</b>  |
| <b>Unit 1</b> | <b>Introduction to Requirement Engineering</b> , Definition and Importance of Requirements, Role of Requirement Engineering in Software Development, Types of Requirements: Functional vs Non-Functional, Requirements Engineering Process and Lifecycle | <b>07</b> |
| <b>Unit 2</b> | <b>Requirement Elicitation</b> : Techniques for Elicitation: Interviews, Surveys, Workshops, Observations, Stakeholder Identification and Analysis, Elicitation Challenges and Solutions, Use Case Modeling and Scenarios                                | <b>07</b> |
| <b>Unit 3</b> | <b>Requirement Analysis</b> : Analyzing and Prioritizing Requirements, Requirement Classification and Categorization, Conflict Resolution and Negotiation, Quality Attributes of Requirements                                                            | <b>07</b> |
| <b>Unit 4</b> | <b>Requirement Specification</b> , Writing Clear and Unambiguous Requirements, Requirements Specification Documents: Structure and Content, Use Case Specification, User Stories and Acceptance Criteria                                                 | <b>07</b> |
| <b>Unit 5</b> | <b>Requirement Validation</b> , Techniques for Validating Requirements, Review and Inspection Processes, Prototyping for Validation, Traceability and Change Management                                                                                  | <b>07</b> |
| <b>Unit 6</b> | <b>Requirement Management</b> , Managing Changes to Requirements, Requirement Traceability and Tracking, Tools for Requirement Management, Version Control and Configuration Management                                                                  | <b>07</b> |

#### **Text Books:**

- 1) "Software Requirements" by Karl Wieggers and Joy Beatty
- 2) "Requirements Engineering: From System Goals to UML Models to Software Specifications" by Axel van Lamsweerde
- 3) "Mastering the Requirements Process" by Suzanne Robertson and James Robertson

## **B.Tech. MDM Track 1: Electronics and Communication Engineering**

| Course Code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 4SEMDM1     | ELECTRONIC INSTRUMENTATION | 03 | 00 | 00 | 03 |

### **Pre-requisites: Basic Mathematics**

**Course Objectives:** This course will enable the students to

1. Learn the characteristics of various types of measurement systems and errors in measuring instruments
2. Understand characteristics of Transducers and Bridges
3. Analyze the circuits for the measurement of Resistance, Capacitance, Inductance, and Frequency
4. Impart with the basic concepts of CRO and its usage for the measurement of various parameters
5. Understand the signal generator circuits for the generation of various waveforms
6. Understand the importance of Display Devices and Recorders in practical fields

**Course Outcomes:** At the end of the course students will be able to:

CO1: Analyze instrument characteristics, errors and generalized measurement system

CO2: Analyze characteristics of Transducers and Bridges

CO3: Use the Ammeters and Voltmeters for the measurement of R, L, C, F, I, V etc.

CO4: Use the CRO and DSO for measurement

CO5: Elaborate signal generator circuits for the generation of various waveforms CO6:

Understand and use different display devices and recorders

| Unit No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | No. of Lectures Required |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1        | <b>Measurements and Statistical Parameters With Measurement Errors:</b><br><b>Measurements:</b> introduction, Significance of measurements, methods of measurements, instruments and measurement systems. <b>Static characteristics:</b> Accuracy, Precision, Sensitivity, Threshold, Resolution, Repeatability and Hysteresis.<br><b>Errors:</b> Gross error, Systematic error, Random error, Limiting error. Statistical Parameters: Arithmetic mean Average deviation Standard deviation. Probable error, Histogram. | 06                       |
| 2        | <b>Transducer classification:</b> Active/Passive. Primary/Secondary. Analog/ Digital and transduction Principles. Basic Signal conditioning Circuits. Current/Voltage Sensitive Wheatstone bridges.                                                                                                                                                                                                                                                                                                                     | 06                       |

|       |                                                                                                                                                                                                                                                                                                                        |               |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 3     | <b>Ammeters, Voltmeter and Mustimeters:</b> Introduction, DC ammeter principle, DC voltmeter, Loading, Peak responding and True RMS voltmeters.<br><b>Digital Voltmeters:</b> Dual slope integrating type (V–T), integrating type (V–F).<br><b>Digital Instruments:</b> Block diagram of a Basic Digital Multi- meter. | 06            |
| 4     | <b>Oscilloscopes:</b> Block diagram and working of Dual beam and dual trace CRO.<br><b>Analog Storage Oscilloscopes:</b> Block diagram and working of each CRT, Need for trace storage, bi-stable storage CRT, Variable persistence storage CRT.<br><b>Digital storage oscilloscopes:</b> Basic DSO operation.         | 06            |
| 5     | <b>Signal Generators:</b> Introduction, Fixed and variable AF oscillator, Standard signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator.                                                                                                                                | 06            |
| 6     | <b>Display Devices and Recorders:</b><br><b>Segmental Displays:</b> Seven segmental display, dot matrices, LED and LCD.<br><b>Recorders:</b> Recording requirements, analog recorders- Graphic recorders, strip chart recorders, X-Y recorder, Magnetic & Digital tape recorders.                                      | 06            |
| Total |                                                                                                                                                                                                                                                                                                                        | 36 – Lectures |

#### Text Books:

1. “Electronic Instrumentation”, H. S. Kalsi, TMH, 2004 (Module- 2, 3 & 4)
2. “Electronic Instrumentation and Measurements”, David A Bell, PHI / Pearson Education 2006/ Oxford Higher Education, 2013. (Module 1 & 3)
3. Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, 17th Edition (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004. (Module- 1 & 5)

#### Reference Books:

1. “Principles of Measurement Systems”, John P. Beatley, 3rd Edition, Pearson Education, 2000
2. “Modern Electronic Instrumentation and Measuring Techniques”, Cooper D & A D Helfrick, PHI, 1998.



## **B.Tech. MDM Track 2: Telecommunication Engineering**

| Course Code | Course Title                           | L  | T  | P  | C  |
|-------------|----------------------------------------|----|----|----|----|
| 4SEMDM5     | Basic Electronic Communication Systems | 03 | 00 | 00 | 03 |

### **Pre-requisites:**

Applied Physics

### **Course Objectives:**

This course will enable the students to:

1. Understand the basics of Electronic Communication System
2. Elaborate the AM transmitter working
3. Explain the working of AM receiver and its parameters
4. Understand the working of FM transmitter and receiver
5. Discuss basic building blocks of digital communication system
6. Explain and analyze different digital modulation techniques

### **Course outcomes:**

At the end of the subject the students will be able to:

CO1. Demonstrate the basics of Electronic Communication systems

CO 2. Understand the working of AM transmitter

CO 3. Demonstrate the working of AM receiver

CO 4. Demonstrate the working of FM transmitter and receiver

CO 5. Understand basic building blocks of digital communication system and formatting of digital signal

CO 6. Analyze the performance of different digital modulation techniques

| Unit No. | Content                                                                                                                                                                                                                 | No. of Lectures Required |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1        | <b>Electronic Communication System:</b><br>Introduction Basic block diagram of Communication System, Modulation, Need for Modulation, Noise: Internal and external Noise. (No numerical expected)                       | <b>06</b>                |
| 2        | <b>AM Transmitter:</b><br>Amplitude Modulation Theory, Frequency Spectrum of AM, Representation of AM, Mathematical Expression of AM wave (derivation, Fundamental numerical).<br>Definitions of Modulation Index, SNR. | <b>06</b>                |
| 3        | <b>AM Receiver:</b><br>TRF Radio Receiver, Block diagram of Superheterodyne radio Receiver, Comparison.<br>Definitions of Selectivity, Sensitivity and Fidelity                                                         | <b>06</b>                |

|   |                                                                                                                                                                                                                                       |                      |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 4 | <b>FM Transmitter and Receiver:</b><br>Frequency Modulation Theory, Frequency Spectrum of FM, Wideband and Narrowband FM. Advantages of FM over AM. FM Receiver block diagram, Single Slope detector and foster seelay discriminator. | <b>06</b>            |
| 5 | <b>Digital Communication System:</b><br>Sampling Theorem, Nyquist criteria, Types of sampling. Functional Blocks of Digital Communication System, Line Coding: Need and properties of Line Coding, Types of Line Coding.              | <b>06</b>            |
| 6 | <b>Digital Modulation:</b><br>ASK, FSK, PSK, QPSK generation and reception, Comparison of various Digital modulation systems.                                                                                                         | <b>06</b>            |
|   | Total                                                                                                                                                                                                                                 | <b>36 – Lectures</b> |

#### **Text Books:**

1. Electronic Communication Systems, George Kennedy and Bernard Davis, Fourth Edition. Tata McGraw Hill Publishing Company Ltd.
2. Analog and Digital Communication Engineering, J. S. Chitode, Technical Publications.
3. Shanmugam K.S., “Digital & Analog Communication Systems”, John Wiley & Sons, New York, 1996.
4. Lathi B. P., “Modern Digital and Communication Systems”, Holt Rinchart and Winston Inc., New York, 1993.
5. Simon Haykin, “Digital Communication”, John Wiley and Sons, Pvt. Ltd., Singapore.

#### **Reference Books:**

1. Communication Systems, 3rd Edition, Simon Haykin, John Wiley & Sons.
2. Telecommunications Principles Circuits Systems and Experiments, S. Ramabhadran, Khanna Publishers, Sixth Edition, 1997.
3. Wayne Tomasi, “Electronic Communication Systems” Pearson Education, (Fifth Edition).
4. Wozencraft J. M. and Jacobs I. M., “Principles of Communication Engineering” John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., “Digital Communication”, Kluwer Academic Publishers, 2004.

## **B. Tech. Fourth Semester**

### **Multidisciplinary Minor Course (MDM1)**

#### **IT Department Track 1: Information Technology**

| <b>Course Code</b> | <b>Course Title</b>                                 | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-----------------------------------------------------|----------|----------|----------|----------|
| <b>4SNMDM1</b>     | <b>Data Transmission and Information Technology</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Nil

**Course Learning Objectives: -**

Students will

1. Learn the digital domain
2. Discuss fundamentals of computer hardware & software
3. Discuss concept of digital multimedia
4. Learn about the transmission of Information
5. Learn the basics of computer networking
6. Learn the telephony & wireless multimedia

**Course Outcomes:**

After successful completion of this course, the students will be able to:

1. Know the digital domain
2. Understand the computer hardware and software
3. Explain the concept of digital multimedia
4. Describe the transmission information system
5. Summarize the OSI model and concepts of networking
6. Understand the telephony & wireless multimedia

## Syllabus

|                | <b>Course Title:<br/>Data Transmission and<br/>Information Technology</b>                                                                                                                                                                                                                                                                                   | L (Hrs) |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Unit-1</b>  | <b>Introduction to Information Technology:</b> Information Technology, Understanding the Digital Domain, Representing Number and Text in Binary and Hexadecimal number system.                                                                                                                                                                              | 07      |
| <b>Unit-2</b>  | <b>Fundamentals of Computers:</b> Computer Hardware, Introduction, Digital Logic, Fundamentals components, Factors that affect performance, Inside a Typical computer, Types of Computer & Applications, Storage Technologies. <b>Software,</b> Introduction, Programming Languages, Types of Software, Software Development process, Open-source software. | 07      |
| <b>Unit-3</b>  | <b>Creating Digital Multimedia:</b> Creating sound, Amplitude, Frequency and Phase properties of Sound. Digitizing Sound, Analog to Digital Conversion, Pulse code Modulation, Nyquist Sampling Theorem, Quantization Error. Digital Image and Video Formats                                                                                                | 07      |
| <b>Unit-4</b>  | <b>Transmission of Information:</b> Fundamentals of Communications, Fiber Optics, Wireless Communication.                                                                                                                                                                                                                                                   | 07      |
| <b>Unit-5</b>  | <b>Introduction to Computer Networking:</b> LAN, WAN, Communication Protocols, OSI model, TCP/IP Protocol Suite.                                                                                                                                                                                                                                            | 07      |
| <b>Unit -6</b> | <b>Telephony and Wireless Multimedia:</b> The Telephone System, Public Switched Telephone Network, Transmission Facilities, Switching, Telecommunications Principles, PCM, Multiplexing, FDM, TDM, WDM, Wireless Multimedia Devices                                                                                                                         | 07      |
|                | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                | 42      |

### Recommended Text Book :-

1. Introduction to Information Technology, by Pelin Aksoy, Laura DeNardis. Course Technology, Cengage Learning.

### Reference Books:-

1. Introduction to Information Technology, ITL Education Solutions Ltd. Pearson Education
2. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", fifth Edition, Pearson Education.
3. William L. Schweber: "Data Communication", Mc-graw Hill.

**B. Tech. Fourth Semester**  
**Multidisciplinary Minor Course (MDM1)**  
**IT Department Track 2: Cyber Security**

| <b>Course Code</b> | <b>Course Title</b>                   | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|---------------------------------------|----------|----------|----------|----------|
| <b>4SNMDM5</b>     | <b>Introduction to Cyber Security</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Nil

**Course Learning Objectives:** - Students

will

1. Understand the fundamental components of computer, network, and information security.
2. Identify various security threats, vulnerabilities, and encryption techniques used in cybersecurity.
3. Discuss the management principles, risk assessment, and compliance with security laws and standards.
4. Learn the essentials of information and network security, including IDS/IPS, firewalls, VPNs, and security in multimedia networks.
5. Understand the principles of secure system design, application security, and secure data handling techniques.
6. Identify vulnerabilities in operating systems and wireless networks, and implement appropriate security measures.

**Course Outcomes:**

After successful completion of this course, the students will be able to:

1. Implement effective security policies and utilize access control matrices to enhance information security practices.
2. Apply cryptographic methods and tools to secure communication and data transmission effectively.

3. Use robust security policies and procedures to ensure organizational compliance and resilience.
4. Implement comprehensive security measures across diverse computing platforms and network environments.
5. Develop and deploy secure operating systems, applications and database solutions to mitigate cybersecurity risks.
6. Manage and secure operating systems and wireless networks to protect against emerging cybersecurity threats.

## Syllabus

|               | <b>Course Title:</b><br><b>Introduction to Cyber Security</b>                                                                                                                                                                                                                                                                                                                                                                | L (Hrs) |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Unit-1</b> | <b>Basics of Communication Systems:</b> Transmission Media, Topology and Types of Networks, TCP/IP Protocol Stacks, Wireless Networks, The Internet, Information Security Overview: Background and Current Scenario, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, Steganography.                                                                                                           | 07      |
| <b>Unit-2</b> | <b>Security Threats, Vulnerabilities, Cryptography &amp; Encryption:</b> Overview of Security threats, Weak / Strong Passwords and Password Cracking, Insecure Network connections, Malicious Code, Programming Bugs, Cyber crime and Cyber terrorism, Information Warfare and Surveillance, Introduction to Cryptography / Encryption, Digital Signatures, Public Key infrastructure, Applications, Tools and techniques.   | 07      |
| <b>Unit-3</b> | <b>Security Management and Security Laws:</b> Overview of Security Management, Information Classification Process, Security Policy, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance, Security Laws, IPR, International Standards, Security Audit, SSE-CMM / COBIT etc                                                          | 07      |
| <b>Unit-4</b> | <b>Information and Network Security:</b> Overview of Identification and Authorization, Overview of IDS, Intrusion Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features, VPN Security, Security in Multimedia Networks, Various Computing Platforms: HPC, Cluster and Computing Grids, Virtualization and Cloud Technology and Security. | 07      |
| <b>Unit-5</b> | <b>System and Application Security:</b> Designing Secure Operating Systems, Controls to enforce security services, Information Security Models, Desktop Security, email security: PGP and SMIME, Web Security: web authentication, SSL and SET, Database Security.                                                                                                                                                           | 07      |

|                |                                                                                                                                                                                                                                                                                       |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit -6</b> | <b>Wireless Network and OS Security:</b> OS Security Vulnerabilities, updates and patches, OS integrity checks, Anti-virus software, Configuring the OS for security, OS Security Vulnerabilities, updates and patches, Components of wireless networks, Security issues in wireless. | 07 |
|                | <b>Total</b>                                                                                                                                                                                                                                                                          | 42 |

**Recommended Text Book :-**

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies “Security in Computing ” Prentice Hall, 5<sup>th</sup> edition
2. Behrouz A Fourouzan, Debdeep Mukhopadhyay “Cryptography and Network Security ” McGraw Hill, 2<sup>nd</sup> Edition
3. William Stallings “Cryptography and Network Security: Principles and Practice ” Pearson, 5<sup>th</sup> edition

## **B.Tech. Second Year (IIoT)**

| Course Code | Course Title        | L  | T  | P  | C  |
|-------------|---------------------|----|----|----|----|
| 4STMDM1     | Fundamentals of IoT | 03 | 00 | 00 | 03 |

**Pre-Requisite:** Nil

### **Course Objectives:**

1. To Understand fundamentals of IoT, including its definitions, characteristics, and architectures, with enabling technologies in IoT and various IoT applications.
2. To explore the predecessors of IoT and understand the emergence of IoT through concepts such as Wireless Sensor Networks, Machine-to-Machine Communications, and Cyber Physical Systems.
3. To provide a foundation in networking basics and network security, focusing on addressing, TCP/IP transport layer, and security measures relevant to IoT.
4. To understand IoT architecture, including state-of-the-art models, reference architectures, and deployment considerations.
5. To introduce students to IoT communication protocols transport protocols, sensor network topologies.
6. To explore real-world IoT applications such as Smart Home automation, Agricultural Systems, and Smart Parking.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Understand the foundational concepts of IoT, including its definitions, characteristics, and architectures and comprehend the knowledge of various IoT applications across different domains.
2. Comprehend the knowledge about the predecessors of IoT and understand the IoT related concepts such as M2M, CPS, and WoT, and appreciate the technological dependencies shaping IoT ecosystems.
3. Acquire skills in networking basics and network security relevant to IoT, including addressing, TCP/IP transport layer, and security protocols.
4. Understand IoT architectures, including state-of-the-art models and reference architectures, and understand deployment considerations.
5. Understand IoT communication protocols such as MQTT, CoAP, and transport protocols like BLE and Li-Fi, sensor network topologies.
6. Demonstrate practical understanding real-world IoT applications such as Smart Home automation, Agricultural Systems, and Smart Parking.



|               |                                                                                                                                                                                                                                                                                                                        |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Course : Fundamentals of IoT</b>                                                                                                                                                                                                                                                                                    | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to IoT:</b><br>Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures Enabling Technologies in IoT, IoT Applications, IoT Challenges                                                                                                                               | 07        |
| <b>Unit-2</b> | <b>Predecessors &amp; Emergence of IoT:</b><br>Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems, Architectural components of CPS, IoT versus M2M, IoT versus CPS, IoT versus WoT, Enabling IoT and the Complex Interdependence of                                     | 07        |
|               | Technologies, IoT Networking Components, Addressing Strategies in IoT                                                                                                                                                                                                                                                  |           |
| <b>Unit-3</b> | <b>Basics of Networking &amp; Basics of Network Security:</b><br>Network Types, Layered Network Models, Addressing , Internet of Things TCP/IP Transport layer, Security ,Network Confidentiality, Cryptography, Message Integrity and Authenticity, Digital signatures, Key Management, Internet Security & Firewall. | 07        |
| <b>Unit-4</b> | <b>Unit IV: IoT Architecture -State of the Art</b><br>Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model, and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View                 | 07        |
| <b>Unit-5</b> | <b>IoT Communication Protocols:</b><br>Messaging Protocols: MQTT, CoAP, XMPP; Transport Protocols: Introduction of BLE, Introduction to Li-Fi, Basics of Sensor Network Topologies: Point to Point Topology, Mesh topology, Ring topology, Star Topology                                                               | 07        |
| <b>Unit-6</b> | <b>Applications of IoT:</b><br>Overview, Block Diagram and Working of real world IoT applications : Smart Home automation, Agricultural System and Smart Parking                                                                                                                                                       | 07        |
| <b>Total</b>  |                                                                                                                                                                                                                                                                                                                        | <b>42</b> |

**Text Books:**

1. David Hanes, Gonzelo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Hentry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Pres, 2017.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applicationsand Protocols”, Wiley, 2012.
3. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet ofThings”, Springer, 2011.

**Reference Books:**

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-On-Approach)”, 1st Edition, VPT, 2014
2. Cuno Pfister, Getting Started with the Internet of Things, O’Reily Media, 2011, ISBN: 978-1- 4493-9357-1

## B.Tech. Fourth Semester (Mechanical Engg)

| Course Code | Course Title       | L  | T  | P  | C  |
|-------------|--------------------|----|----|----|----|
| 4SMMDM1     | Energy Engineering | 03 | 00 | 00 | 03 |

### Pre-requisites:

1. An introductory background of physics is needed.
2. An introductory background of chemistry is needed.

### Course Learning Objectives:

- 1: To study the power generation scenario.
- 2: To study the components and working principle of power generation systems.
- 3: To study the Impact of Energy on Environment.

### Course Outcomes:

At the end of course, Learner will be able to

1. Understand the Present Energy Scenario.
2. Analyze thermal & gas turbine power plant.
3. Analyze Nuclear & Hydro power plant.
4. Understand the concepts of Renewable energy plants.
5. Understand Non Conventional Energy Systems.
6. Understand the Impact of Energy on Environment

|                 |                                                                                                                                                                                                                         |          |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                 | <b>Subject:</b> Energy Engineering                                                                                                                                                                                      | <b>L</b> |
| <b>UNIT I</b>   | <b>Introduction to Energy:</b> Energy and Development, Present Energy Scenario: World, India, Maharashtra and future prospects. Energy forms and Conversions, Energy and Power, Dimensions and unit of energy and power | 7        |
| <b>UNIT II</b>  | <b>Steam Power Plant:</b> Layout, site selection, disposal of ash and dust, major plant components: Boiler, Turbine, condensers, pump and cooling towers                                                                | 7        |
| <b>UNIT III</b> | <b>Nuclear Power Plants:</b> Location, component of nuclear plants, types of reactors, Uranium enrichment, safety, disposal of nuclear waste, comparison with thermal plants                                            | 7        |
| <b>UNIT IV</b>  | <b>Solar Power Plant:</b> flat plate collector, solar ponds, parabolic solar collector, heliostat, solar chimney, SPV cell based plants: working principal, solar photovoltaic systems, applications                    | 7        |

|                |                                                                                                                                                                                     |           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>UNIT V</b>  | <b>Non Conventional Energy Systems</b><br>Tidal Power Plant: components, single basin and double basin systems, wind power generation and Biogas                                    | 7         |
| <b>UNIT VI</b> | <b>Energy and Environment</b><br>Impact of Energy on Environment, Flow of Energy in Ecological System, Environmental Degradation due to energy and Control of Pollution from Energy | 7         |
|                | <b>Total</b>                                                                                                                                                                        | <b>42</b> |

**Text Books :**

1. Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi.
2. D L Klass, Biomass for Renewable Energy, Fuels, and Chemicals, Academic Press, Elsevier, 2006.
3. G.D.Rai, Non-Conventional Energy Sources, Khanna Publishers, Delhi S.P.Sukhatme, Solar Energy|| Tata McGraw-Hill Publications, New Delhi

**Reference Books :**

1. Frederick T. Morse “Power Plant Engineering” East West Press.
2. EI-Wakil M.M, “Power Plant Technology,” Tata McGraw-Hill
3. P.K. Nag “Power Plant Engineering” Tata McGraw Hill, New Delhi

## **B.Tech. Fourth Semester (Mechanical Engg)**

| Course Code | Course Title | L  | T  | P  | C  |
|-------------|--------------|----|----|----|----|
| 4SMMDM5     | Mechatronics | 03 | 00 | 00 | 03 |

### **Pre-requisites:**

1. An introductory background of physics is needed.

### **Course Learning Objectives:**

1. To study various types of switches, sensors, motors and their working.
2. To study various parts of mechatronic system.
3. To study various types of valves and their working.
4. To understand and create pneumatic and hydraulic circuits for various industrial applications.

### **Course Outcomes:**

At the end of course, Learner will be able to

1. Understand the importance and principles of various sensors
2. Understand the working & applications of actuators for pneumatic & hydraulic systems in mechatronics
3. Understand the computer processes, electronics circuits, and controllers for mechatronics system
4. Understand the working principles of various control valves in mechatronics systems
5. Design pneumatic circuits for various industrial applications.
6. Design hydraulic circuits for various industrial applications

|                 | <b>Subject: Mechatronics</b>                                                                                                                                                                                                                                                                                                                                                                           | <b>L</b> |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I</b>   | <b>Introduction to Mechatronics –</b><br>Definition, Block diagram & Example, Basics of Sensors, Position & Speed Sensors, Proximity Sensors & Switches, LVDT, Digital optical encoder, Temperature Sensors, Piezoelectric Transducers.                                                                                                                                                                | 7        |
| <b>UNIT II</b>  | <b>Actuators-</b><br>Functions, Electromagnetic Principles, Solenoids and Relays, working of DC motors and stepper motors, hydraulic and pneumatic actuators.                                                                                                                                                                                                                                          | 7        |
| <b>UNIT III</b> | <b>Data Acquisition in Mechatronic system:</b> Analog signal processing using operational amplifier- Introduction, types of amplifiers, sample and hold circuit, introduction to data acquisition, Analog to digital conversion, Analog to digital convertor, Digital to analog conversion, sequential logic, flip-flops, application of flip-flops, micro-controllers, Programmable logic controller. | 7        |

|                |                                                                                                                                                                                                                                                                      |           |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>UNIT IV</b> | <b>Control Valves –</b><br>Study of different control components and pneumatic & Hydraulic system- Construction, working and function of Directional control valve, Flow control valves, Pressure relief valve, pressure reducing valve, sequence valve with symbols | 7         |
| <b>UNIT V</b>  | <b>Pneumatic System –</b><br>Design and analysis of pneumatic circuits, Synchronizing, Power chucking operations, controlling the rate of speed of piston, circuit to move with piece around a corner, circuit to move a work piece at a constant speed.             | 7         |
| <b>UNIT VI</b> | <b>Hydraulic System –</b><br>Design analysis of Hydraulic systems-Sequencing, pneumo-hydraulic, regeneration circuit, circuit to control tool movement on lathers, grinders                                                                                          | 7         |
|                | <b>Total</b>                                                                                                                                                                                                                                                         | <b>42</b> |

### **Books Recommended :**

#### **TEXT BOOKS:**

1. Introduction to Mechatronics and Measurement systems- 2/e by Aciatore and M.B.Histant, Tata McGraw Hill edition.
2. Pneumatics and Hydraulics by H.L.Stewart.
3. Mechatronics, M.D. Singh, J.G. Joshi, PHI 2006
4. A Textbook of Mechatronics By RK Rajput

#### **REFERENCE BOOKS:**

- 1) Introduction to Mechatronics by Appus Kuttan K.K.- Oxford University Press.
- 2) Mechatronics – A multidisciplinary approach 4/e by W.Bolton- Pearson Publication,
- 3) Automation, Production systems and CIM by M.PGroover- Pearson Publication.

**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati (An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology Choice Based Credit System (Semester Pattern) Branch: All Branches**  
**Batch Admitted AY2023-24 \*MULTI-DISCIPLINARY MINOR (MDM) BASKET OF COURSES for 5th Semester**

| Track Name                                | Semester | Course Code | Course Name                                  | Teaching Scheme |          |     |                                |                    |         | Examination Scheme      |                      |               |    |       |                           | Offered by the Department of                  |
|-------------------------------------------|----------|-------------|----------------------------------------------|-----------------|----------|-----|--------------------------------|--------------------|---------|-------------------------|----------------------|---------------|----|-------|---------------------------|-----------------------------------------------|
|                                           |          |             |                                              | Hours / Week    |          |     | MDM Applicable to              | Total Hours / Week | Credits | THEORY                  |                      |               |    |       |                           |                                               |
|                                           |          |             |                                              | Lecture         | Tutorial | P/D |                                |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal      |    | Total | Overall Min Passing Marks |                                               |
|                                           |          |             |                                              |                 |          |     |                                |                    |         |                         | Max. Marks MSE/ MSIE | Max. Marks TA |    |       |                           |                                               |
| Theory                                    |          |             |                                              |                 |          |     |                                |                    |         |                         |                      |               |    |       |                           |                                               |
| Artificial Intelligence                   | V        | 5SAMDM2     | Applied Artificial Intelligence              | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Data Science                              | V        | 5SAMDM6     | Business Intelligence and Analytics          | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Civil Engineering                         | V        | 5SCMDM2     | Introduction to Water Resource Engineering   | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Construction Technology                   | V        | 5SCMDM6     | Construction Materials                       | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Computer Science and Engineering          | V        | 5SKMDM2     | Introduction to Algorithms                   | 3               | --       | --  | CE, EXTC, IIoT, ME             | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Software Engineering                      | V        | 5SKMDM6     | Software Architecture                        | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Electronics and Communication Engineering | V        | 5SEMDM2     | Electronic Devices and Circuits              | 3               | --       | --  | AI&DS, CE, CSE, IT, IIoT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Telecommunication Engineering             | V        | 5SEMDM6     | Introduction to Wireless Communication       | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Information Technology                    | V        | 5SNMDM2     | Data Communication Networks                  | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| Cyber Security                            | V        | 5SNMDM6     | Fundamentals of Cryptography                 | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| IoT                                       | V        | 5STMDM2     | Sensors and Actuators                        | 3               | --       | --  | AI&DS, CE, CSE, IT, ME         | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Industrial IoT                                |
| Mechanical Engineering                    | V        | 5SMMDM2     | Automobile Engineering and Electric Vehicles | 3               | --       | --  | CE, CSE, EXTC, IIoT, ME        | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |
| Robotics and Automation Engineering       | V        | 5SMMDM6     | Rapid Prototyping                            | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |

\* indicates that the Track for MDM will be decided by respective Board of Studies (BoS)

### B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 5SAMDM2     | Applied Artificial Intelligence | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Programming Knowledge, Artificial Intelligence and Data Structures.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Applied Artificial Intelligence by being able to do each of the following:

1. To apply Artificial Intelligence techniques to solve real-world problems.
2. To integrate Artificial Intelligence models into practical applications such as natural language processing (NLP), computer vision, and robotics.
3. To evaluate the ethical implications and societal impact of Artificial Intelligence technologies.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the evolution of Artificial Intelligence and explain basic search strategies and intelligent agent behaviors.
2. Explain machine learning techniques including classification, regression, clustering, and reinforcement learning.
3. Examine deep learning models using neural networks and pre-trained architectures like CNNs.
4. Investigate NLP techniques such as text classification, sentiment analysis, and sequence modeling using LSTM or Transformers.
5. Recommend Artificial Intelligence applications in key industries and formulate planning problems with classical and real-world techniques.
6. Evaluate ethical considerations and the societal impact of AI technologies and propose strategies for responsible Artificial Intelligence use.

|        | Subject: (5SAMDM2) Applied Artificial Intelligence                                                                                                               | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Artificial Intelligence:</b> Definition and History of AI, Machine Learning vs Deep Learning, Applications of AI in the Modern World, Problem | 07 |



|               |                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | Solving Agents, Search Strategies: Depth-first, Breadth-first, Heuristic Search.                                                                                                                                                                                                                                                                                                                                                              |           |
| <b>Unit-2</b> | <b>Machine Learning Fundamentals:</b> Supervised Learning (Regression, Classification), Unsupervised Learning (Clustering, Association), Reinforcement Learning, Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, ROC-AUC, Overfitting and Underfitting, Cross-Validation.                                                                                                                                                          | <b>07</b> |
| <b>Unit-3</b> | <b>Deep Learning and Neural Networks:</b> Basics of Neural Networks and Deep Learning, Backpropagation, Convolutional Neural Networks (CNN) for Image Recognition, Transfer Learning and Pre-trained Models, Introduction to Tools and Libraries for Deep Learning.                                                                                                                                                                           | <b>07</b> |
| <b>Unit-4</b> | <b>Natural Language Processing (NLP):</b> Text Preprocessing and Tokenization, Sentiment Analysis and Text Classification, Named Entity Recognition (NER), Sequence Models for NLP (LSTM, Transformers), NLP Applications: Chatbots, Machine Translation, and Text Summarization.                                                                                                                                                             | <b>07</b> |
| <b>Unit-5</b> | <b>AI in Real-world Applications and Planning:</b> AI in Healthcare: (Diagnosis, Drug Discovery, and Personalized Medicine), AI in Finance: (Fraud Detection, Algorithmic Trading, Credit Scoring), AI in Agriculture: (Crop Monitoring, Precision Farming, Pest Detection)<br><br>Planning Problem Formulation, Classical Planning Techniques (STRIPS, Partial Order Planning), Planning and Acting in the Real World (Uncertainty Handling) | <b>07</b> |
| <b>Unit-6</b> | <b>AI Ethics and Future Trends:</b> Ethical Issues in AI: Bias, Privacy, and Accountability, Social and Economic Impact of AI Technologies, Autonomous Systems and Decision-Making, AI in Governance, Security, and Privacy, Future Directions in AI: AGI, AI in Robotics, AI for Sustainability.                                                                                                                                             | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>42</b> |

#### **Text Book:**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education / Prentice Hall Publication, 2020, ISBN: 978-0134610993.
2. François Chollet, "Deep Learning with Python" (Second Edition), Publisher: Manning Publications, Publication Year: 2021, ISBN: 978-1617296864.

#### **Reference Books:**

1. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans, Farrar, Straus and Giroux Macmillan Publication, 1st Edition, 2019, ISBN: 978-0374257835
2. Mariya Yao, Adelyn Zhou and Marlene Jia, "Applied Artificial Intelligence: A Handbook for Business Leaders", TOPBOTS Publication, 1st Edition, 2018.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, Inc. Publication, 2019.

**B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title                        | L  | T  | P  | C  |
|-------------|-------------------------------------|----|----|----|----|
| 5SAMDM6     | Business Intelligence and Analytics | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Programming for Data Science, Introduction to Python Programming and Basic Knowledge of Programming.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Business Intelligence and Analytics by being able to do each of the following:

1. To Study and Explain the Business Intelligence, Analytics and Decision Support system.
2. To study List the technologies for Decision making, automated decision systems.
3. Illustrate multi-criteria Decision-making systems, predictive modelling techniques.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Explain the components and architecture of Business Intelligence systems and their integration with decision support systems.
2. Describe the phases of decision-making to solve business problems using data-driven approaches.
3. Examine data warehousing solutions and use ETL tools effectively for business analytics.
4. Use data mining techniques and sentiment analysis tools to generate actionable insights for business applications.
5. Assess mathematical and spreadsheet-based models for model-driven decision support in uncertain environments.
6. Demonstrate the use of automated decision systems and expert systems in real-world business scenarios, including knowledge representation and inference techniques.

|        | Subject: (5SAMDM6) Business Intelligence and Analytics                                                                                                                                                                                                                                                                | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Overview of Business Intelligence and Analytics:</b> Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Decision Making:</b> Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.                                                                          | <b>07</b> |
| <b>Unit-3</b> | <b>Descriptive and Predictive Analytics:</b> Data Warehousing Definitions and Concepts, Process Overview, Architectures, ETL Process, Data Warehouse Development and Implementation Issues. Data Mining Concepts, Applications, Process, Methods.                                                                                                                     | <b>07</b> |
| <b>Unit-4</b> | <b>Business Reporting and Performance Management:</b> Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, Emergence of Data Visualization and Visual, Performance Dashboards, Business Performance Management and measurement, Balanced Scorecards, Six Sigma as a Performance Measurement System. | <b>07</b> |
| <b>Unit-5</b> | <b>Model-Based Decision Making:</b> Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making with Pairwise Comparisons.                                             | <b>07</b> |
| <b>Unit-6</b> | <b>Automated Decision Systems and Expert Systems:</b> Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems, Introduction to Knowledge Management.                                                       | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                          | <b>42</b> |

**Text Book:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang and David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013.

**Reference Books:**

1. Edward Mize, "Data Analytics: The Ultimate Beginner's Guide to Data Analytics", Venture Ink Publication, 2017.
2. Rick Sherman, "Business Intelligence Guidebook: From Data Integration to Analytics", Morgan Kaufmann Publication.
3. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", Wiley Publication.
4. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publication.
5. Russell Glass and Sean Callahan, "The Big Data-Driven Business: How to Use Big Data to Win Customers, Beat Competitors, and Boost Profits", Wiley Publication.

**B.Tech. Fourth Semester (Civil)**  
**Multidisciplinary Minor (Track: Civil Engineering)**

| Course Code | Course Title                                | L  | T  | P  | C  |
|-------------|---------------------------------------------|----|----|----|----|
| 5SCMDM2     | Introduction To Water Resources Engineering | 03 | 00 | 00 | 03 |

**Course Prerequisite : Nil**

**Course Objectives:**

Students will be taught -

1. To study the different hydrological parameters.
2. To understand crop irrigation.
3. To understand the various types of Dams.

**Course Outcomes:**

Students will be able to -

1. Estimate hydrological parameters.
2. Estimate crop water requirements of a command area.
3. Maintain irrigation structures.
4. Execute the Minor and Micro Irrigation Schemes.
5. Select the relevant Diversion Head works for the specific site conditions.
6. Design, construct and maintain simple Canal structures.

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | <b>Subject: Introduction To Water Resources Engineering</b>                                                                                                                                                                                                                                                                                                                                                                             | L  |
| <b>Unit-1</b> | <b>Introduction:</b> Irrigation and its Classification on the basis of purpose and surface. Hydrology: Definition and Hydrological cycle, Rain Gauge: Symons rain gauge, automatic rain gauge, Methods of calculating average rainfall: Arithmetic mean, Isohyetal, and Thiessen polygon method. Runoff, Factors affecting Run off, Computation of run-off. Maximum Flood Discharge measurement: Rational method and empirical methods. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Crop Water requirement:</b> Cropping seasons, Crop period, base period, Duty, Delta, CCA, GCA, intensity of irrigation, factors affecting duty. Methods of application of irrigation water and its assessment. Surveys for irrigation project, data collection for irrigation project. Area capacity curve. Silting of reservoir: Rate of silting, factors affecting silting and control measures. Control levels in reservoir. Numerical problems on Fixing Control levels.             | 07        |
| <b>Unit-3</b> | <b>Dam and its classification:</b> Earthen dams and Gravity dams (masonry and concrete). Earthen Dams -Components with function, typical cross section, seepage through embankment and foundation and its control. Methods of construction of earthen dam, types of failure of earthen dam and preventive measures. Gravity Dams -Forces acting on dam, Theoretical and practical profile, typical cross section, drainage gallery, joints in gravity dam, concept of high dam and low dam. | 07        |
| <b>Unit-4</b> | <b>Bandhara irrigation:</b> Layout, components, construction and working, solid and open bandhara. Percolation Tanks - Need, selection of site. Lift irrigation scheme-Components and their functions, lay out. Drip and Sprinkler Irrigation-Need, components, Layout, operation and Maintenance. Farm ponds, Jalayukt shivar schemes. Well irrigation: types of wells, yield of well, advantages and disadvantages of well irrigation.                                                    | 07        |
| <b>Unit-5</b> | <b>Weirs:</b> components parts, types. K.T. weir-components and construction. Diversion head works - layout, components and their function. Barrages - components and their functions. Difference between weir and Barrage.                                                                                                                                                                                                                                                                 | 07        |
| <b>Unit-6</b> | <b>Canals Classification:</b> alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth. Design of most economical canal section. Canal lining - Purpose, material used and its properties, advantages. Canal regulators- Head regulator, Cross regulator, Escape, Falls and Outlets. Canal maintenance.                                                                                               | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>42</b> |

#### **Text Books:**

1. Irrigation and Water Power Engineering by B.C. Punmia - Brij Basi Lal Pande

#### **Reference Books:**

1. Irrigation Engineering by Sharma, R. K. and Sharma T. K.
2. Irrigation Engineering by Basak, N.N.
3. Irrigation and Water resource Engineering by Asawa, G.L.

**B.Tech. Fourth Semester (Civil)**  
**Multidisciplinary Minor (Track: Construction Technology)**

| Course Code | Course Title           | L | T | P | C |
|-------------|------------------------|---|---|---|---|
| 5SCMDM6     | Construction Materials | 3 | 0 | 0 | 3 |

**Course Prerequisite : Nil**

**Course Learning Objectives:**

1. Identify various building materials and their structural requirements.
2. Explain the significance of cement and lime in construction.
3. Identify the suitable material for construction and various building components.
4. Review different types of Cement concrete.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe important properties of building materials used in civil engineering construction
2. Identify clay based products for use in building constructions based on its properties.
3. Select appropriate rock / stone products for different uses in building construction
4. Appreciate the uses of lime and Pozzolan products in building construction
5. Select appropriate ingredients of proper quality for cement concrete as per required BIS codes
6. Explain different types of advanced building materials and their uses in construction.

|               |                                                                                                                                                                                                 |   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | <b>Subject: Construction Materials</b>                                                                                                                                                          | L |
| <b>Unit-1</b> | <b>Introduction:</b> Physical, chemical and engineering properties of building materials. Application of building materials Alternative materials for the given items in building construction. | 7 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                         |    |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-2</b> | <b>Clay Products:</b> Classification of clay, Types of bricks, manufacturing process of bricks, Test on bricks, Standard requirements and grades of bricks as per BIS, Types of clay tiles and its uses.                                                                                                                                                                                                | 7  |
| <b>Unit-3</b> | <b>Rocks And Stones:</b> Classification of rocks, Rock products, Characteristics of stones - Structure, texture , strength , gravity , porosity, absorption, hardness, durability, weight.. etc. Important stones used in construction with its suitability.                                                                                                                                            | 7  |
| <b>Unit-4</b> | <b>Lime and Pozzolana:</b> Sources and classification of Lime, Uses of lime with specific field situation, Types of pozzolanic materials, Advantages of addition of pozzolonic material.                                                                                                                                                                                                                | 7  |
| <b>Unit-5</b> | <b>Cement Concrete:</b> Types of cement with their specific use, Grade of cement as per BIS, Engineering properties of cement, Field and laboratory test of cement as per BIS, Methods of storing the cement, Types of aggregate as per BIS, Engineering properties of aggregate, Test on aggregate.                                                                                                    | 7  |
| <b>Unit-6</b> | <b>Timber and Miscellaneous Construction Materials :</b> Types of timber, Uses and application of timber, Defects in timber and wood, specific uses Plastics and PVC, Ceramic products, Paints and Varnish, Materials for damp proofing, water proofing, Materials for anti termite treatment, Glass and fiber, Steel and iron materials, Materials used for false ceiling, Asbestose, Concrete blocks. | 7  |
| Total         |                                                                                                                                                                                                                                                                                                                                                                                                         | 42 |

**Text Books:**

1. Building materials, S. K. Duggal, New Age International Publication

**Reference Books:**

1. Construction material, Agrawal & Arora
2. Building construction, Sushil Kumar, standard publisher.

### B.Tech Fifth Semester (Computer Science & Engineering)

| Course code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 5SKMDM2     | Introduction to Algorithms | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Data Structures

**Course Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:

1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

**Course Outcomes (Expected Outcome):** On completion of the course, the students will be able to:

1. Understand and identify different algorithms for calculating time and space complexity using asymptotic notations.
2. Implement the divide-and-conquer strategy for design and analysis of various algorithms.
3. Apply greedy methods to various algorithms in order to compute optimal solutions and devise asymptotic notation.
4. Interpret and analyze dynamic programming approach for designing graph and matrix-based algorithms.
5. Demonstrate the concept of backtracking for search and traversal algorithms.
6. Utilise the knowledge gained to infer the efficiency of algorithms considering time and space trade off.

|               | Course: Introduction to Algorithms                                                                                                                                                       | L         |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Iterative Algorithm Design Issue</b><br>Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies          | <b>07</b> |
| <b>Unit-2</b> | <b>Divide and Conquer</b><br>Introduction, Multiplication Algorithm and its analysis, Merge sort, Quick sort algorithms Where D & C Fails , Characteristics for which D&C is unsuitable. | <b>07</b> |
| <b>Unit-3</b> | <b>Greedy Methods</b><br>Introduction , Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm,                                 | <b>07</b> |
| <b>Unit-4</b> | <b>Dynamic Programming</b><br>Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Single Source Shortest Paths.                                                  | <b>07</b> |
|               | <b>Backtracking</b>                                                                                                                                                                      |           |



|               |                                                                                                                                                                                       |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, efficiency of backtracking and examples .                                                    | <b>07</b> |
| <b>Unit-6</b> | <b>Efficiency of Algorithm</b><br>Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Various Sorting algorithms: Bucket, Radix, Quick, Heap, Merge | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                          | <b>42</b> |

**Text Book:** Dave and Dave: “Design and Analysis of Algorithms” Pearson Education.

**Reference Books:**

1. Aho, Hopcroft & Ullman “The Design & Analysis of Computer Algorithms”, Addison-Wesley
2. G. Brassard, P. Bratley: “Fundamentals of Algorithmics”, PHI
3. Horowitz & Sahani: “Fundamental Algorithms”, Galgotia.
4. Cormen, T.H, Lierson & Rivest: “Introduction to Algorithms”, Mc Graw-Hill

**B.Tech Fifth Semester (Computer Science & Engineering)**

| Course code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 5SKMDM6     | Software Architecture | 03 | 00 | 00 | 03 |

**Course Prerequisites:** Software Requirements Engineering

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the software architecture.

1. Explain the role of software architecture in the software development life cycle and distinguish between different architectural styles such as layered, microservices, and event-driven.
2. Create multiple architectural models for a software system to support stakeholder communication.
3. Evaluate the effectiveness of a software architecture using quality attributes such as performance, scalability, modifiability, and security.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Recall key concepts and quality attributes of software architecture.
2. Explain software development methodologies and architecture evolution.
3. Apply architectural styles to develop structural and process models.
4. Analyze implementation technologies and ADLs in software architecture.
5. Evaluate economic and tradeoff analysis methods for architecture design.
6. Relate principles and templates for software architecture document

|        | Course: Software Architecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to software architecture:-</b> What Software Architecture Is and What It Isn't, Architectural Structures and Views, Architectural Patterns, What Makes a "Good" Architecture?, Software architecture Important: Inhibiting or Enabling a System's Quality Attributes, Reasoning About and Managing Change Predicting System Qualities, Enhancing Communication among Stakeholders, Carrying Early Design Decisions, Defining Constraints on an Implementation, Influencing the Organizational Structure, Enabling Evolutionary Prototyping | 07 |
| Unit-2 | <b>Software architecture methodology :-</b> Overview of Software development methodology and software quality model, different models of software development and their issues. evolution of software architecture, software components and connectors, common software architecture frameworks, Architecture business cycle, reference model.                                                                                                                                                                                                             | 07 |
| Unit-3 | <b>Software architecture models:-</b> Structural models, framework models, dynamic models, process models. Architectures styles: dataflow architecture, pipes and filters architecture, call-and return architecture, data-centered architecture, layered architecture, agent based architecture, Micro-services architecture, Reactive Architecture, Representational                                                                                                                                                                                     | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | state transfer architecture etc.                                                                                                                                                                                                                                                                                                                                                                                               |           |
| <b>Unit-4</b> | <b>Software architecture implementation technologies:-</b> Software Architecture Description Languages (ADLs), Struts, Hibernate, Node JS, Angular JS, J2EE – JSP, Servlets, EJBs; middleware: JDBC, JNDI, JMS, RMI and CORBA etc. Role of UML in software architecture.                                                                                                                                                       | <b>07</b> |
| <b>Unit-5</b> | <b>Software Architecture analysis and design:-</b> Requirements for architecture and the life-cycle view of architecture design and analysis methods, architecture-based economic analysis: Cost Benefit Analysis Method (CBAM), Architecture Tradeoff Analysis Method (ATAM). Active Reviews for Intermediate Design (ARID), Attribute Driven Design method (ADD), architecture reuse, Domain specific Software architecture. | <b>07</b> |
| <b>Unit-6</b> | <b>Software Architecture documentation:-</b> Principles of sound documentation, refinement, context diagrams, variability, software interfaces. Documenting the behavior of software elements and software systems, documentation package using a seven-part template.                                                                                                                                                         | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>42</b> |

### Text Books

1. Bass, L., P. Clements, & R. Kazman, “Software Architecture in Practice”, 2 Ed, Prentice-Hall.
2. Jim Keogh, “J2EE – Complete Reference”, Tata McGraw Hill.
3. Dikel, David, D. Kane, and J. Wilson, “Software Architecture: Organizational Principles and Practices”, Prentic -Hall.

### Reference Books

1. Bennett, Douglas, “Designing Hard Software: The Essential Tasks”, Prentice-Hall, 1997.
2. Clements, Paul, R. Kazman, M. Klein, “Evaluating Software Architectures: Methods and Case Studies”, Addison Wesley, 2001.
3. Albin, S. “The Art of Software Architecture”, Indiana: Wiley, 2003.
4. Robert Mee, & Randy Stafford, “Patterns of Enterprise Application Architecture”, Addison-Wesley, 2002.
5. Witt, B., T. Baker and E. Meritt, “Software Architecture and Design: Principles, Models and Methods”, Nostrand Reinhold, 1994.

**B.Tech. MDM Track 1: Electronics and Communication Engineering**

| <b>Course Code</b> | <b>Course Title</b>                     | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|-----------------------------------------|-----------|-----------|-----------|-----------|
| <b>5SEMMDM2</b>    | <b>Electronics Devices and Circuits</b> | <b>03</b> | <b>00</b> | <b>00</b> | <b>03</b> |

**Pre- Requisites:**

1. Basic knowledge of Semiconductor Physics

**Course Learning Objectives:**

1. To understand the characteristics and applications of PN junction diode, and various types of transistors including BJT, JFET, and MOSFET.
2. To analyze the configurations and stabilization techniques of BJT, and explore the role of feedback in amplifier circuits.
3. To study the working of BJT as a single-stage amplifier and oscillator, and evaluate the construction and operation of field-effect transistors.

**Course Outcomes:** After completion of this course the students should able to,

1. Understand the fundamentals and working of PN junction diode, application of diode as rectifier.
2. Learn the working of BJT and its characteristics.
3. Analyze various stabilization techniques
4. Learn the concept of Feedback
5. Learn the concept of Amplifier and Oscillator
6. Understand the working of JFET and MOSFET

| <b>Unit No</b> | <b>Course: Electronics Devices and Circuits</b>                                                                                                                                                                                              | <b>No. of lectures required</b> |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>1</b>       | <b>PN Junction Diode:</b> Formation of P-N junction, biasing the diode, its V-I characteristics, Application of diode as Half wave rectifier (HWR), Full wave rectifier (FWR) Introduction to Various LC & RC filters circuits. Zener diode. | <b>08</b>                       |
| <b>2</b>       | <b>Bipolar Junction Transistor:</b> Operation of PNP and NPN transistor, CB,CE and CC configuration, transistor as switch, Transistor as an Amplifier.                                                                                       | <b>06</b>                       |
| <b>3</b>       | <b>Biasing &amp; Stabilization Techniques in BJT:</b> its need, various biasing methods of stabilization.                                                                                                                                    | <b>06</b>                       |
| <b>4</b>       | <b>Feedback:</b> Feedback concept, types of feedback, effect of Negative feedback on various parameters of Amplifier like Gain, Bandwidth, Distortion etc.                                                                                   | <b>08</b>                       |
| <b>5</b>       | <b>Sinusoidal Oscillators:</b> Barkhausen criteria for oscillation, LC oscillators (Hartley and Colpitts) RC oscillators (Wein Bridge & RC phase shift) and Crystal oscillator                                                               | <b>08</b>                       |
| <b>6</b>       | <b>JFET &amp; MOSFET:</b> Construction, characteristics and comparison.                                                                                                                                                                      | <b>06</b>                       |
|                | <b>Total</b>                                                                                                                                                                                                                                 | <b>42</b>                       |

#### **Text Books:**

1. V.K.Mehta: "Principle of Electronics" S. Chand & Company, Delhi
2. Milimam and Halkies: "Integrated Electronics", Tata McGraw Hill, New Delhi

#### **Reference Books:**

1. Robert L. Boylestad " Electronics Devices and Circuit Theory" Pearson Education.
2. Donald A Neamen " Electronics Circuit analysis and Design" Tata McGraw Hill, New Delhi

## **B.Tech. MDM Track 2: Telecommunication Engineering**

| Course Code | Course Title                           | L  | T  | P  | C  |
|-------------|----------------------------------------|----|----|----|----|
| 5SEMDM06    | Introduction to Wireless Communication | 03 | 00 | 00 | 03 |

### **Pre-requisites:**

1. Wireless Communication Fundamentals

### **Course Learning Objectives:**

1. To be aware of evolution in wireless technology.
2. To study the fundamentals of cellular radio system.
3. To understand operation of various 2nd and 3rd generation cellular systems; GSM, IS95, CDMA2000, WCDMA.
4. To study wireless data communication networks.

### **Course Outcomes:**

After successfully completing the course, the students will be able to

1. To understand basics of wireless communication system.
2. To understand basics of cellular communication system.
3. To understand mobile communication standard GSM.
4. To understand operation of various 2, 3 generation cellular systems; GSM, IS95, CDMA2000, WCDMA
5. To study various wireless data communication networks WLAN.
6. To study various wireless personalised area networks Bluetooth.

| Unit No. | Course: Introduction to Wireless Communication                                                                                                                                                                                                                                                                                                         | No. of Lectures Required |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1        | <b>Overview of Wireless Networks:</b> Evolution of voice oriented and data oriented wireless networks, different generations of wireless networks (1G, 2G, 3G & beyond), comparison of wired and wireless media, radio propagation mechanism, Effects of multipath and Doppler: multipath fading, multiple delay spread, Doppler spectrum.             | 07                       |
| 2        | <b>Cellular Technology:</b> Cellular Topology- cellular concept, cellular hierarchy, cell fundamentals, Evolution of Mobile Systems (1G, 2G, 3G), Signal-to-interference ratio. Capacity Expansion: cell splitting and cell sectoring. Channel allocation techniques: Fixed, Dynamic & Hybrid channel allocation, channel borrowing technique. Handoff | 07                       |

|   |                                                                                                                                                                                                                                                                                                                         |           |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|   | Management: Architectural issues in handoff, types of handoff, handoff algorithms.                                                                                                                                                                                                                                      |           |
| 3 | <b>GSM System:</b> GSM Network Architecture, GSM Call Procedures: Registration procedure, call establishment, Handoff in GSM, GSM Signalling Protocol Architecture: Physical layer: power and power control, physical packet burst, frame hierarchy in GSM, Hand Off Procedures, Logical channels in GSM.               | 07        |
| 4 | <b>CDMA Digital Cellular Standard (IS-95):</b> IS-95 Forward Channel, IS-95 Reverse Channel, packet and frame formats, mobility and radio resource management: soft handoff and power control. CDMA2000 and WCDMA: Forward and Reverse Channel in CDMA2000 and WCDMA, Hand Off and Power Control in CDMA2000 and WCDMA. | 07        |
| 5 | <b>Wireless Local Area Network (WLAN):</b> IEEE 802 architecture, IEEE 802.11 architecture and Services, IEEE 802.11 medium access control, MAC frame format, 802.11 physical layer, 802.11 standards.                                                                                                                  | 07        |
| 6 | <b>Wireless PAN (WPAN-802.15):</b> Overview of 802.15, Bluetooth, Bluetooth protocol stack, usage models, piconets and scatternets, radio specification, baseband specifications: physical links, packets, payload format, error correction, logical channels, channel control, link manager specification.             | 07        |
|   | <b>Total</b>                                                                                                                                                                                                                                                                                                            | <b>42</b> |

#### Text Books:

1. Theodore S. Rappaport, "Wireless Communications: Principles & Practice", Second edn., Pearson Edn. (2002).
2. K. Pahlavan and P. Krishnamurthy, "Principles of Wireless Networks", Pearson Educn. Asia Publication (2002)
3. T. L. Singal, "Wireless Communication". McGraw Hill Education.
4. A. F. Molisch, "Wireless Communications", Second Edition, Wiley Publication.

#### Reference Books:

1. G. S. Rao, "Mobile Cellular Communication", Pearson Education.
2. Upena Dalal, "Wireless communication", Oxford University Press.
3. William CY Lee, "Mobile Cellular Telecommunications", (second edition) McGraw Hill Inc.

**B.Tech. Fifth Semester (IT Department)**

**Multidisciplinary Minor (Track: Information Technology)**

| Course Code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 5SNMDM2     | Data Communication and Networks | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Computer Network

**Course Learning Objectives:**

1. Understand the fundamental concepts of Data Communication and computers
2. Familiarize the students with basic taxonomy and terminology of data communication.
3. Discuss types of signals, Transmission Impairment, Data Rate Limits & Line coding Schemes
4. Study Multiplexing and Logical addressing, DNS, Remote logging and HTTP.

**Course Outcomes:**

After successful completion of this course, students will be able to-

1. Understand the principles and fundamental concepts of computer networks.
2. Understand and explain data communication systems with its techniques and applications.
3. Identify types of signals, Transmission Impairment, Data Rate Limits.
4. Evaluating the Line coding Schemes.
5. Understand Multiplexing and Logical addressing.
6. Understand DNS, Remote logging and HTTP.

|               | <b>Subject:</b> Data Communication and Network                                                                                                                                      | L<br>(Hrs) |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit-1</b> | <b>Introduction:</b> Data Communications, Networks; The Internet, Protocols and Standards, Transmission Media.                                                                      | <b>07</b>  |
| <b>Unit-2</b> | <b>Network Models:</b> Layered Tasks, The OSI model, Layers in the OSI model, TCP/IP Protocol Suite, Addressing                                                                     | <b>07</b>  |
| <b>Unit-3</b> | <b>Data and Signals:</b> Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance                                       | <b>07</b>  |
| <b>Unit-4</b> | <b>Digital Transmission:</b> Line Coding, Line coding Schemes (Unipolar, Polar, Bipolar), Analog to Digital Conversion, Transmission modes, Analog to analog conversion             | <b>07</b>  |
| <b>Unit-5</b> | <b>Multiplexing,</b> Frequency division, Wavelength and Time Division Multiplexing, Statistical TDM<br><br><b>Network Layer: Logical Addressing:</b> IPV4 Addresses, IPV6 Addresses | <b>07</b>  |



|                |                                                                                                                                                        |           |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit -6</b> | <b>Domain Name System:</b> Name Space, Domain Name Space, DNS in the Internet Layout, Remote Logging, Electronic mail and File Transfer. WWW and HTTP. | <b>07</b> |
|                | <b>Total</b>                                                                                                                                           | <b>42</b> |

**Recommended Textbook :**

1. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw-Hill, Publications.
2. Andrew S. Tenenbaum, "Computer Networks", PHI, ISBN 81-203-2175-8.

**Reference Books:**

1. William Stallings, "Data & Computer Communications", (6/e) Pearson Education.
2. Wehrle, Klaus, Gunes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", Springer, ISBN: 978-3-642-12330-6
3. J.Freey, "Computer Communication & Networks", AEW Press.
4. Bhushan Trivedi, "Computer Networks" OXFORD.

**B.Tech. Fifth Semester (IT Department)**

**Multidisciplinary Minor (Track: Cyber Security)**

| Course Code | Course Title                 | L  | T  | P  | C  |
|-------------|------------------------------|----|----|----|----|
| 5SNMDM6     | Fundamentals of Cryptography | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Computer Network

**Course Learning Objectives:**

1. Understand the basic concepts and principles of cryptography techniques
2. Analyze and evaluate the security of cryptographic techniques to real-world problems.
3. To Learn various Authentication protocols
4. Understand the importance key management and distribution

**Course Outcomes:**

After successful completion of this course, students will be able to-

1. Explain the fundamental concepts of cryptography, including confidentiality, integrity, and authenticity
2. Describe and analyze various cryptographic algorithms, including symmetric and asymmetric encryption, digital signatures, and hash functions
3. Evaluate the security of cryptographic systems and protocols
4. Apply cryptographic techniques to design and implement secure communication systems and protocols
5. Describe and analyze various Authentication protocols
6. Understand the key management and distribution

|        | Subject: Fundamentals of Cryptography                                                                                                                                                                                                                                                                                                                              | L<br>(Hrs) |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Unit-1 | <b>Introduction to Cryptography:</b> - Overview of cryptography, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques                                                                                                                                                                                        | 07         |
| Unit-2 | <b>Block Ciphers and the Data Encryption Standard:</b> - Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles, <b>Advanced Encryption Standard:</b> - Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example, AES Implementation. | 07         |
| Unit-3 | <b>Public-Key Cryptography and RSA:</b> - Principles of Public-Key Cryptosystems, The RSA Algorithm, <b>Other Public-Key Cryptosystems:</b> - Diffie-Hellman Key Exchange                                                                                                                                                                                          | 07         |

|                |                                                                                                                                                                                                                                     |           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b>  | <b>Cryptographic Hash Functions:</b> - Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3        | <b>07</b> |
| <b>Unit-5</b>  | <b>Message Authentication Codes:</b> Message Authentication Requirements, Message Authentication Functions, Digital Signatures, NIST Digital Signature Algorithm.                                                                   | <b>07</b> |
| <b>Unit -6</b> | <b>Key Management and Distribution:-</b> Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. | <b>07</b> |
|                | <b>Total</b>                                                                                                                                                                                                                        | <b>42</b> |

### **Recommended Textbook :**

Textbook

1. "Cryptography and Network Security: Principles and Practice" by William Stallings.

References

1. "Introduction to Cryptography with Java Applets" by David Bishop
2. "Cryptography: Theory and Practice" by Douglas R. Stinson
3. "Handbook of Applied Cryptography" by Alfred J. Menezes, Paul C. van Oorschot, and Scott A. Vanstone
4. Various online resources and research papers on cryptography and network security

**B.Tech. Fifth Semester (Mechanical Engg)**

| Course Code | Course Title                                 | L  | T  | P  | C  |
|-------------|----------------------------------------------|----|----|----|----|
| 5SMMDM2     | Automobile Engineering and Electric Vehicles | 03 | 00 | 00 | 03 |

Course Prerequisites:

1. Basic knowledge of Physics

Course Learning Objectives:

1. To study the Introduction of automobiles and types of fuel feed system and cooling system.
2. To study the electrical system, transmission system, suspension system and Basics of lubrication.
3. To study the braking system and steering system and understand the concept of Electric Vehicle

Course Outcomes:

Students will be able to –

1. Understand the basics of automobile engineering and its components.
2. Analyze & develop the cooling system, fuel feed system and its function.
3. Understand basic concept of Electrical system and lubrication used in automobile.
4. Apply the knowledge of suspension and transmission system.
5. Understand the working of braking system and basic concept of steering system
6. Understand the concept of Electric vehicle.

|                 | <b>Subject:</b> Automobile Engineering and Electric Vehicles                                                                                                                                                                                                          | <b>L</b> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I</b>   | Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, Multiple cylinder engines                                                                                                                              | 07       |
| <b>UNIT II</b>  | Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems (MPFI) and Common Rail Diesel Injection Systems (CRDI). Cooling system: purpose, Air cooling and water cooling system, antifreeze mixtures. | 07       |
| <b>UNIT III</b> | The electrical system:- Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Introduction to Ignition system. Introduction of charging unit for electric vehicle. Lubrication: Types of lubricants and their applications in automobile.    | 06       |
| <b>UNIT IV</b>  | Transmission system:- Layout, Working principle of clutch, working of Gear Box:- Sliding mesh, Propeller shaft, Principle of differential. Suspensions system: shock absorbers and independent suspension system.                                                     | 07       |
| <b>UNIT V</b>   | Braking system: Working of Mechanical and hydraulic brakes. Steering system:- Function. Introduction of camber, castor, king pin inclination, toe-in& toe-out & their effects. Introduction to power                                                                  | 07       |

|                |                                                                                                                 |    |
|----------------|-----------------------------------------------------------------------------------------------------------------|----|
|                | steering.                                                                                                       |    |
| <b>UNIT VI</b> | Introduction to Electric Vehicle, need, Types of Electric vehicle, components, working, advantages, limitations | 06 |
|                | <b>Total</b>                                                                                                    | 40 |

**Text Books :**

- 1 Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
- 2 Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi
- 3 Electric and Hybrid Vehicles; Husain, I. CRC Press

**Reference Books :**

- 1 Automotive Mechanics; Crouse & Anglin; TMH
- 2 Automotive Mechanics; J. Heitner; East West Press
- 3 Automotive Mechanics; S. Srinivasan; TMH. 4. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

**B.Tech. Fifth Semester (Mechanical Engg)**

| Course Code | Course Title      | L  | T  | P  | C  |
|-------------|-------------------|----|----|----|----|
| 5SMMDM6     | Rapid Prototyping | 03 | 00 | 00 | 03 |

**Course Prerequisites:**

1. Basic knowledge of Manufacturing Processes.
2. Preliminary knowledge of Engineering Graphics and Solid Modelling.

**Course Learning Objectives:**

1. Comprehend the Fundamentals and Evolution of Rapid Prototyping.
2. Explore the RP Processes, Data Formats, and Software Tools.
3. Explore the RP Processes, Data Formats, and Software Tools.

**Course Outcomes:**

Students will be able to –

1. Understand a prototype and its types also the importance of compression in product development timelines.
2. Comprehend the fundamental principles of Rapid Prototyping including pre-processing, processing, and post-processing.
3. Understand the process physics and principle of material deposition in different RP systems also Compare the applications, limitations, and advantages of various RP processes.
4. Familiarize with Data Formats and software tools used in RP.
5. Explore Virtual prototyping, Computer Aided Engineering and concept of Reverse Engineering.
6. Explore the use of RP in the in functional, testing models and Rapid Toolings

|                 |                                                                                                                                                                                                                                                                                                                                                                                                             |          |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                 | <b>Subject:</b> Rapid Prototyping                                                                                                                                                                                                                                                                                                                                                                           | <b>L</b> |
| <b>UNIT I</b>   | <b>Introduction:</b> Definition of Prototype, Types of prototype, Need for the compression in product development time span, History of Rapid Prototyping (RP) systems, Survey of applications, Growth of RP industry, and classification of RP systems.                                                                                                                                                    | 6        |
| <b>UNIT II</b>  | <b>Introduction to Rapid Prototyping:</b><br>Fundamentals of Rapid Prototyping, Process Chain, Classification of RP systems, Dawn of slice age, benefits, applications, important issues in Rapid Prototyping. Traditional Prototyping Vs. Rapid Prototyping.<br>Pre and Post Processing in RP.<br><b>Errors in RP Processes:</b> Pre-processing, processing, post-processing errors, Part building errors. | 7        |
| <b>UNIT III</b> | <b>RP Processes:</b> Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes, <b>Photopolymerization</b> (Stereolithography, SL), <b>Powder Bed Fusion</b> (Selective laser Sintering (SLS), Electron Beam melting (EBM)), <b>Extrusion Based</b>                                                 | 8        |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                | <b>RP Systems, 3D Printing, Sheet Lamination</b> (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), <b>Beam Deposition</b> (Laser Engineered Net Shaping process (LENS))                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| <b>UNIT IV</b> | <b>Rapid Prototyping Data Formats and Software:</b><br>STL format, STL file problems, consequences of building valid and invalid tessellated models, STL file repairs: Generic solution, other translators, newly proposed formats.<br><b>Software for RP:</b> Overview of Solid view, magics, mimics, magic communicator, Velocity2, Rhino, View expert, 3D Doctor. etc.<br>Internet based software, Collaboration tools.                                                                                                                                                                                                      | 7  |
| <b>UNIT V</b>  | <b>Virtual Prototyping and Testing:</b><br>Difference between physical prototype and virtual prototype.<br><b>Geometric modeling:</b> Types of Geometric models and Solid Models<br><b>Reverse engineering:</b> Acquiring Point Data, Constructing 3D model and Applications.<br><b>Virtual augmented reality:</b> Requirement of devices and technologies and applications<br><b>Computer Aided Engineering:</b> Application of FEA in Engineering, the concept of discretization, steps in FEA and automatic mesh generation.<br><b>Design for X:</b> Design for manufacture and design for assembly and other facets of DFX. | 7  |
| <b>UNIT VI</b> | <b>Application of Rapid Prototyping and Technology:</b> Functional models, pattern for investment and Vacuum casting, medical models, Art models, Engineering analysis models.<br><b>Rapid Tooling:</b> Introduction, Conventional tooling Vs Rapid tooling, need for Rapid tooling. Direct and Indirect Rapid toolings. Soft and Hard Toolings.                                                                                                                                                                                                                                                                                | 7  |
|                | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 42 |

#### Textbooks:

1. Rapid Prototyping by Amitabh Ghosh, Affiliated East-West Press Pvt.Ltd.
2. Additive Manufacturing Technologies 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Straker, First Edition, Springer, 2010
3. Rapid Prototyping Technology : Selection and Application by Cooper K. G. Prentice Hall of India

#### Reference Books:

1. Rapid Prototyping: Principles and Applications, Chua CK, Leong KF and Lim CS, 2nd Edition, World Scientific Publishers, 2003
2. Rapid Prototyping: Principles and Applications in manufacturing, Noorani R, John Wiley and Sons

**B.Tech Fourth Semester CSE(IoT)**

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 5STMDM2     | Sensors and Actuators | 03 | 00 | 00 | 03 |

**Course Pre-requisite:** 4STMDM1 - Fundamentals of IoT

**Course Objectives:**

1. Understand the fundamental principles of sensors and actuators, including their working mechanisms and applications.
1. Analyze the performance characteristics of various sensors and actuators, focusing on their behaviour in real-world scenarios.
2. Design and interface sensor-actuator systems with embedded controllers, integrating signal conditioning and power management techniques.

**Course Outcomes:**

After successfully completing the course, students will be able to-

| Sr. no. | CO ID     | Description                                                                                                                          | Blooms Level  |
|---------|-----------|--------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1       | 5STMDM2.1 | Identify and describe various types of sensors and actuators, including their principles and applications.                           | Understanding |
| 2       | 5STMDM2.2 | Analyze the static and dynamic characteristics of measurement systems, including response times and accuracy.                        | Analyzing     |
| 3       | 5STMDM2.3 | Evaluate the performance metrics of digital and semiconductor-based sensors, considering factors like sensitivity and noise.         | Applying      |
| 4       | 5STMDM2.4 | Understand the principles, components, and applications of smart sensors in various systems.                                         | Understanding |
| 5       | 5STMDM2.5 | Analyze the role and implementation of sensors in diverse applications such as automotive, healthcare, and environmental monitoring. | Analyzing     |
| 6       | 5STMDM2.6 | Evaluate the functioning and applications of various actuators, including pneumatic, hydraulic, mechanical, and electrical systems.  | Evaluating    |

|        | Course Name: Sensors and Actuators                                                                                                                                                                                                      | Lect Hrs. |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| UNIT I | <b>Introduction to Sensors and Actuators:</b><br>Overview of measurement systems and terminology, Classification of sensors and actuators, Static and dynamic characteristics of measurement systems, Signal conditioning fundamentals. | 7         |



|          |                                                                                                                                                                                                                      |           |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| UNIT II  | <b>Resistive and Reactive Sensors:</b><br>Potentiometers, strain gauges, and thermistors, Capacitive and inductive sensors, Signal conditioning techniques for resistive and reactive sensors.                       | 7         |
| UNIT III | <b>Self-Generating Sensors:</b><br>Thermoelectric, piezoelectric, and photovoltaic sensors, Signal conditioning for self-generating sensors, Applications in real-world systems.                                     | 7         |
| UNIT IV  | <b>Smart Sensors:</b><br>Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.     | 7         |
| UNIT V   | <b>Sensors Applications:</b><br>Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Medical Diagnostic Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring. | 7         |
| UNIT VI  | <b>Actuators:</b><br>Pneumatic and Hydraulic Actuation Systems, Valves, Rotary actuators, Mechanical Actuation Systems Electrical Actuation Systems.                                                                 | 7         |
|          | <b>Total</b>                                                                                                                                                                                                         | <b>42</b> |

#### **Text Book:**

1. Nathan Ida, *Sensors, Actuators, and their Interfaces*, 1st ed., SciTech Publishing, 2014.
2. Prof. Banibrata Mukherjee, *Embedded Sensing, Actuation and Interfacing Systems*, NPTEL Course, IIT Kharagpur.

#### **Reference Books:**

1. Patranabis-Sensors and Actuators- 2<sup>nd</sup> Ed., PHI, 2013.
2. Jacob Fraden, *Handbook of Modern Sensors: Physics, Designs, and Applications*, 4th ed., Springer, 2010.
3. Robert H. Bishop-The Mechatronics Handbook, 2<sup>nd</sup> Ed., Mechatronic Systems, Sensors and Actuators, fundamentals and modelling.

**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati (An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology Choice Based Credit System (Semester Pattern) Branch: All Branches**  
**Batch Admitted AY2023-24 \*MULTI-DISCIPLINARY MINOR (MDM) BASKET OF COURSES for 6th Semester**

| Track Name                                | Semester | Course Code | Course Name                                | Teaching Scheme |          |     |                                |                    |         | Examination Scheme      |                      |               |    |       |                           | Offered by the Department of                  |
|-------------------------------------------|----------|-------------|--------------------------------------------|-----------------|----------|-----|--------------------------------|--------------------|---------|-------------------------|----------------------|---------------|----|-------|---------------------------|-----------------------------------------------|
|                                           |          |             |                                            | Hours / Week    |          |     | MDM Applicable to              | Total Hours / Week | Credits | THEORY                  |                      |               |    |       |                           |                                               |
|                                           |          |             |                                            | Lecture         | Tutorial | P/D |                                |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal      |    | Total | Overall Min Passing Marks |                                               |
|                                           |          |             |                                            |                 |          |     |                                |                    |         |                         | Max. Marks MSE/ MSIE | Max. Marks TA |    |       |                           |                                               |
| Theory                                    |          |             |                                            |                 |          |     |                                |                    |         |                         |                      |               |    |       |                           |                                               |
| Artificial Intelligence                   | VI       | 6SAMDM3     | Generative Artificial Intelligence         | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Data Science                              | VI       | 6SAMDM7     | Data Engineering                           | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Civil Engineering                         | VI       | 6SCMDM3     | Introduction to Transportation Engineering | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Construction Technology                   | VI       | 6SCMDM7     | Basics of Surveying                        | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Computer Science and Engineering          | VI       | 6SKMDM3     | Database Management System                 | 3               | --       | --  | CE, EXTC, IIoT, ME             | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Software Engineering                      | VI       | 6SKMDM7     | Software Project Management                | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Electronics and Communication Engineering | VI       | 6SEMDM3     | Analog and Digital Communication           | 3               | --       | --  | AI&DS, CE, CSE, IT, IIoT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Telecommunication Engineering             | VI       | 6SEMDM7     | Introduction to Mobile Computing           | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Information Technology                    | VI       | 6SNMDM3     | E-Commerce                                 | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| Cyber Security                            | VI       | 6SNMDM7     | Basics of Ethical Hacking                  | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| IoT                                       | VI       | 6STMDM3     | Single Board Computers                     | 3               | --       | --  | AI&DS, CE, CSE, IT, ME         | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Industrial IoT                                |
| Mechanical Engineering                    | VI       | 6SMMDM3     | Industrial Engineering                     | 3               | --       | --  | CE, CSE, EXTC, IIoT, ME        | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |
| Robotics and Automation Engineering       | VI       | 6SMMDM7     | Automation Engineering                     | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |

\* indicates that the Track for MDM will be decided by respective Board of Studies (BoS)

**B.Tech. Sixth Semester (Artificial Intelligence & Data Science)**

| Course Code | Course Title                       | L  | T  | P  | C  |
|-------------|------------------------------------|----|----|----|----|
| 6SAMDM3     | Generative Artificial Intelligence | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Python Programming, Artificial Intelligence and Expert System Design.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Generative Artificial Intelligence by being able to do each of the following:

1. To introduce the foundational concepts of artificial intelligence, neural networks, and natural language processing relevant to generative models.
2. To explore advanced architectures such as GANs, VAEs, LSTMs, and Transformers, and understand their role in generative AI systems.
3. To provide knowledge of real-world applications, training strategies, and challenges in deploying large-scale generative models, including GPT-based architectures.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the evolution of Artificial Intelligence and deep learning.
2. Explain Advanced Neural Network Architectures for tasks like image recognition and sequence modeling.
3. Analyze data preprocessing and training techniques for neural networks.
4. Investigate practical solutions using advanced neural networks for diverse applications.
5. Inspect the performance and limitations of large language models.
6. Design and Test GPT-based applications in tasks such as text generation and intelligent customer support systems.

|        | Subject: (6SAMDM3) Generative Artificial Intelligence                                                                                                                                                                                                                                                        | L  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | Foundations of AI and Neural Networks History and evolution of AI/ML, Deep learning revolution, Transfer learning, History of Neural, Natural Language Processing, Structure of Artificial Neural Networks, Steps in Training an Artificial Neural Network, Parameters and Hyperparameters, Backpropagation. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                               |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | Advanced Neural Network Architectures Generative Artificial Intelligence (Generative AI): Concepts and Comparison with Traditional AI, (GANs): Architecture and Working Principle, Components of GANs: Generator and Discriminator, Challenges, and Performance Issues in GANs, Applications of GANs in Image, Video Generation, and Other Real-World Domains | <b>07</b> |
| <b>Unit-3</b> | Data Preprocessing Variational Autoencoders (VAEs), Transformers, Attention Mechanism in detail Long Short-Term Memory Networks (LSTMs). Probability and Statistics, Data Preprocessing Techniques, Model Training Techniques                                                                                                                                 | <b>07</b> |
| <b>Unit-4</b> | Generative AI Applications Applications in Various Fields: Art and Creativity, Image and Video Generation, Text Generation, Music Composition, Healthcare Finance. Real-world use cases and challenges in deploying generative AI models                                                                                                                      | <b>07</b> |
| <b>Unit-5</b> | Introduction to Large Language Models Overview of Generative AI and Large Language Models. Basics of attention mechanisms and Transformer architecture. Pre-training techniques and transfer learning strategies.                                                                                                                                             | <b>07</b> |
| <b>Unit-6</b> | GPT Models and Applications Study of GPT architecture and variants. Applications of GPT models in text generation and dialogue systems. Case study-based implementation of GPT-based tasks. GPT-based chatbot enhances E-Shop's customer support service                                                                                                      | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                  | <b>42</b> |

#### **Text Book:**

1. Altaf Rehmani, "Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology", Independently Published, 2023, ISBN: 9798392038019
2. Numa Dhamani, "Introduction to Generative AI", Kindle Edition, 2024, ASIN: B0CVRDXF1T.

#### **Reference Books:**

1. Josh Kalin, "Generative Adversarial Networks Cookbook: Over 100 Recipes to Build Generative Models Using Python, TensorFlow, and Keras", Packt Publishing, 2018, ISBN: 9781789139907.
2. Jesse Sprinter, "Generative AI in Software Development: Beyond the Limitations of Traditional Coding", Independently Published, 2024, ISBN: 9798321819017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer, 2018, ISBN: 9783319944623.
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2017, ISBN: 9780262035613.

**B.Tech. Sixth Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title     | L  | T  | P  | C  |
|-------------|------------------|----|----|----|----|
| 6SAMDM7     | Data Engineering | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Programming Knowledge, Python Programming and Business Intelligence and Analytics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Engineering by being able to do each of the following:

1. Understand the foundational concepts of data-intensive applications, including scalability, reliability, and maintainability of modern data systems.
2. Analyze different data models (relational, document, graph) and their appropriate use cases in real-world applications.
3. Explore the internals of storage engines, indexing methods, and transaction mechanisms that drive high-performance databases.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the fundamental principles of data engineering, including data ingestion, storage, transformation, and pipeline orchestration using Python.
2. Explain techniques for data ingestion from APIs and web scraping, and work with SQL and NoSQL databases.
3. Illustrate data cleaning and transformation using Python libraries such as Pandas.
4. Identify data modeling techniques and utilize databases (relational and NoSQL) for efficient data storage and retrieval.
5. Inspect datasets using Python libraries to derive meaningful insights for data-driven decision-making.
6. Design and deploy end-to-end data engineering solutions addressing real-world problems while adhering to best practices in data governance and security.

|  |                                            |          |
|--|--------------------------------------------|----------|
|  | <b>Subject: (6SAMDM7) Data Engineering</b> | <b>L</b> |
|--|--------------------------------------------|----------|

|               |                                                                                                                                                                                            |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | Introduction to Data Engineering: What is Data Engineering? Data lifecycle and data-driven decision-making, Introduction to databases and file formats (CSV, JSON, Parquet)                | <b>07</b> |
| <b>Unit-2</b> | Data Collection and Storage: Data ingestion techniques, Working with APIs and Web scraping (basic), Introduction to SQL and NoSQL databases (MongoDB, PostgreSQL).                         | <b>07</b> |
| <b>Unit-3</b> | Data Cleaning and Transformation: Handling missing and inconsistent data, Data wrangling with Pandas, Introduction to ETL pipelines.                                                       | <b>07</b> |
| <b>Unit-4</b> | Data Warehousing and Cloud Storage: Introduction to data warehouses, Basics of cloud storage (Google BigQuery, AWS S3 – concept only), Structured vs unstructured data.                    | <b>07</b> |
| <b>Unit-5</b> | Data Pipelines and Automation: Building simple pipelines with Python, Introduction to Airflow and basic scheduling, Introduction to stream vs batch processing.                            | <b>07</b> |
| <b>Unit-6</b> | Applications and Tools: Real-world applications in different domains (healthcare, IoT, etc.), Overview of tools: Tableau/Power BI, Jupyter Notebooks, Ethics and privacy in data handling. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                               | <b>42</b> |

**Text Book:**

1. Paul Crickard, "Data Engineering with Python", Publisher: Packt Publishing.

**Reference Books:**

1. Tyler Akidau, Slava Chernyak and Reuven Lax, "Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing", Publisher: O'Reilly Media.
2. Martin Kleppmann, "Designing Data-Intensive Applications", O'Reilly Media.
3. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Publisher: Pearson.
4. Rajkumar Buyya, Rodrigo N. Calheiros and Amir Vahid Dastjerdi, "Big Data: Principles and Paradigms", Publisher: Morgan Kaufmann.

**B.Tech. Fourth Semester (Civil)**  
**Multidisciplinary Minor (Track: Civil Engineering)**

| Course Code | Course Title                               | L  | T  | P  | C  |
|-------------|--------------------------------------------|----|----|----|----|
| 6SCMDM3     | Introduction to Transportation Engineering | 03 | 00 | 00 | 03 |

**Course Prerequisite : Nil**

**Course Learning Objectives:**

1. About basics of Road construction like surveys, alignment principles, types of roads.
2. Study and understand various road studies for safe road design principles and essential geometry.
3. Learn about various road pavements, its construction and maintenance procedure.
4. Learn about railway transportation and terms related to it.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Identify type of roads and its utility.
2. Understand the application of various road studies at time of survey and actual construction.
3. Design the various types of road pavements.
4. Understand rules regulations, signals, type of gauges and railway sleepers density.
5. Recognize the airport features and design concept of components for aero plains movement.
6. Identify types and components of tunnels and bridges and its design components.

|        | Subject : Introduction to Transportation Engineering                                                                                           | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Highway:</b> Road Transport characteristics, classification of Roads, Road Patterns, Alignment principles, Survey for highway.              | 07 |
| Unit-2 | <b>Geometric Design:</b> Cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, | 07 |

|               |                                                                                                                                                                                                                                                                                              |    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | PIEV Theory, stopping sight distance, overtaking sight distance, super elevation.                                                                                                                                                                                                            |    |
| <b>Unit-3</b> | <b>Pavement and Traffic Engineering:</b> Components of Flexible and Rigid pavement, Traffic Characteristics, Traffic Studies, Road parking system, traffic control devices and 3 E's of traffic.                                                                                             | 07 |
| <b>Unit-4</b> | <b>Railway:</b> Railway transportation, Embankment & cutting. Points and crossing Left & right Hand turnouts. Permanent way, gauges, components of permanent way, Sleeper density, Rail fixtures & fastening. Rail types and functions.                                                      | 07 |
| <b>Unit-5</b> | <b>Airport:</b> Agencies controlling national & international aviation, various surveys to be conducted, airport site selection, Aeroplane component parts, Aircraft characteristics. Airport obstructions: Zoning laws, wind rose diagram, Apron layout, Aircraft parking & parking system. | 07 |
| <b>Unit-6</b> | <b>Tunnel &amp; Bridge Engineering:</b> Tunnels- necessity, types, tunnel alignment, Size and shape of tunnels, and Tunnel Lining. Tunnel drainage, ventilation & lighting of tunnels. Bridge Engineering-Components, classification and identification, abutments, piers and wing wall.     | 07 |
| Total         |                                                                                                                                                                                                                                                                                              | 42 |

#### **Text Books:**

1. Khanna S.K. & Justo C.E.: Highway Engineering
2. Rao G.V.: Principles of Transportation & Highway Engg.
3. Dr.Kadiyali L.R. : Traffic Engg. & Transport Planning.

#### **Reference Books:**

1. Bindra S.P. : Principles & Practice of Bridge Engg.
2. Saxena & Arora : Railway Engineering.
3. Agrawal M.M. : Railway Engineering.
4. Khanna S.K., Arora M.G., Jain S.S.: Airport Planning & Design,
5. Sharma S.K. : Principles, Practice & Design of Highway Engg.
6. Duggal A.K. & Puri V.P. : Laboratory Manual in Highway Engg.



**B.Tech. Fourth Semester (Civil)**

**Multidisciplinary Minor (Track: Construction Technology)**

| Course Code | Course Title        | L | T | P | C |
|-------------|---------------------|---|---|---|---|
| 6SCMDM7     | BASICS OF SURVEYING | 3 | 0 | 0 | 3 |

**Course Prerequisite : Nil**

**Course Learning Objectives:**

1. The term surveying, various instruments and possible error.
2. The Linear Measurement methods and way of conduction.
3. The measurement at elevation and of Directions, contour development process.
4. The principle of Plane table surveying.

.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Develop a sound knowledge of fundamental principles of Surveying.
2. Find out the vertical, horizontal, linear and angular measurements to arrive at solutions to basic surveying problems.
3. Determine the reduced levels of the points from staff readings using auto level and create contour maps.
4. Make use of magnetic bearings for traversing using compass.
5. Determine angle measurement, distance measurement, and co-ordinate measurement by Traversing.
6. To perform survey at elevation and conduct Plane Table survey.

|               | Subject: Basics of surveying                                                                                                                                                                                                                                                                                                                     | L |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Unit-1</b> | <b>Introduction:</b><br>Plane and geodetic surveys. Methods of location of a point- classification of surveys; principles of surveying, Errors in measurements- sources, types of errors and their treatment. Surveying instruments-temporary and permanent adjustment concept, principle of reversal. conventional symbols, and generalization. | 7 |

|               |                                                                                                                                                                                                                                                                                                                                     |    |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-2</b> | <b>Linear Measurements</b><br>Direct and indirect methods; Chain and tape measurements- corrections to tape measurements; Electronic methods- EDMs, Introduction and purpose of total stations.                                                                                                                                     | 7  |
| <b>Unit-3</b> | <b>Measurement of Elevations:</b><br>Various terms; Methods of height determination; Spirit leveling- different types of levels and staves; booking and reduction of data, classification and permissible closing error; profile leveling and cross sectioning; curvature & refraction and collimation errors; reciprocal leveling. | 7  |
| <b>Unit-4</b> | <b>Measurement of Directions:</b><br>Bearings and angles; Compass surveying- magnetic bearings, declination, local attraction errors and adjustments.                                                                                                                                                                               | 7  |
| <b>Unit-5</b> | <b>Traversing:</b><br>Purpose and classifications; Compass and theodolite traverses, theodolites- different types, uses, methods of observation and booking of data.                                                                                                                                                                | 7  |
| <b>Unit-6</b> | <b>Plane Tabling:</b><br>Merits and demerits, accessories; orientation and resection; methods of plane tabling; three-point problem and solutions.                                                                                                                                                                                  | 7  |
| Total         |                                                                                                                                                                                                                                                                                                                                     | 42 |

**Text Books:**

1. T.P. Kanetkar& Kulkarni: Surveying & Levelling, Part I & II.
2. B.C. Punmia : Surveying I & II.

**Reference Books:**

1. N.N. Basak : Surveying & Levelling
2. D. Clarke: Plane and Geodatic Surveying, Volume I & II

| Course code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 6SKMDM3     | Database Management System | 03 | 00 | 00 | 03 |

### Course Learning Objective

1. To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
2. To study the primary data model (relational model) for commercial data processing applications.
3. To study the standard structured query language and retrieve the information from the database in various ways.
4. 4. To study the integrity and security constraints of the database by enforcing constraints.

### Course Outcomes:

At the end of course, students will be able to:

1. Understand and apply the theoretical concept of database management system
2. Differentiate DDL, DML, DCL and TCL SQL commands to store and retrieve.
3. Describe normal forms with various integrity constraints
4. Explain query processing and query optimization
5. Apply ACID properties to ensure consistency of system
6. Analyze concurrency control protocol for error free transaction

|        | Subject:Database Management System                                                                                                                                                                                                                                  | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | Introduction to DBMS: Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators                                                                                          | 07 |
| Unit-2 | SQL: Structure of Relational Databases, Database schema, keys, SQL data definition, Basic Structure of SQL queries, Set Operations, Null Values, Aggregate Functions, Modification of the Database , Joins                                                          | 07 |
| Unit-3 | Relational Database Design: Integrity Constraints, Authorization,Features of good relational designs, Functional dependency theory, atomic domains and First Normal Form, Second Normal Form, Third Normal Form, BCNF, decomposition using functional dependencies, | 07 |
| Unit-4 | Query Processing Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Evaluation of Expressions                                                                                                                                          | 07 |
| Unit-5 | Transaction Management: Transaction Concept, Simple transaction model, ACID properties, Serializability: Conflict and View, Recoverability.                                                                                                                         | 07 |

|        |                                                                                                                                                         |           |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit-6 | Concurrency Control and recovery system: Lock-Based Protocols, 2PL, Types of 2PL, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols | 07        |
|        | <b>Total</b>                                                                                                                                            | <b>42</b> |

**Text Book:** Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

**Reference Books:**

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education

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## B.Tech Sixth Semester (Computer Science & Engineering)

| Course code | Course Title                | L  | T  | P  | C  |
|-------------|-----------------------------|----|----|----|----|
| 6SKMDM7     | Software Project Management | 03 | 00 | 00 | 03 |

**Course Prerequisites:** Software Architecture

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Software Project Management.

1. To understand the fundamental principles of software project management.
2. To be familiar with the different methods and techniques used for software project management.
3. To have a good knowledge of the responsibilities of a project manager.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Recall the principles, methodologies, and steps involved in software project evaluation and planning.
2. Explain software process models, effort estimation techniques, and productivity models.
3. Apply activity planning, scheduling, and risk management techniques to software projects
4. Analyze project progress using cost monitoring, earned value analysis, and configuration management.
5. Demonstrate effective team management, communication, and leadership strategies in software projects.
6. Implement software deployment processes and methodologies following best practices.

|        | Course:Software Project Management                                                                                                                                                                                                                                                                                                                                                                                | L  |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Software Project Evaluation and Planning :-</b> Importance of SPM ,Activities, Methodologies, Categorization of Software Projects, Setting Objectives, Management Principles, Management Control, Project Portfolio Management, Cost-benefit Evaluation Technology, Risk Evaluation , Strategic Program Management , Stepwise Project Planning.                                                                | 07 |
| Unit-2 | <b>Software Project Life Cycle and Effort Estimation :</b> Software process and Process Models, Choice of Process models, Rapid Application development, Agile Methods, Dynamic System Development Method, Extreme Programming, Managing interactive processes, Basics of Software estimation ,Effort and Cost estimation techniques , COSMIC Full function points , COCOMO II , a Parametric Productivity Model. | 07 |
| Unit-3 | <b>Activity Planning and Risk Management :</b> Objectives of Activity planning , Project schedules , Activities , Sequencing and scheduling , Network Planning models , Formulating Network Model , Forward Pass & Backward Pass techniques , Critical path                                                                                                                                                       | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                          |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | (CRM) method , Risk identification , Assessment , Risk Planning , Risk Management , PERT technique , Monte Carlo simulation , Resource Allocation , Creation of critical paths , Cost schedules.                                                                                                                                                                                         |           |
| <b>Unit-4</b> | <b>Software Project Management and Control:</b> Framework for Management and control Collection of data Visualizing progress , Cost monitoring Earned Value Analysis , Prioritizing Monitoring , Project tracking , Change control Software Configuration Management , Managing contracts , Contract Management.                                                                         | <b>07</b> |
| <b>Unit-5</b> | Staffing in Software Projects : Managing people , Organizational behavior , Best methods of staff selection,Motivation , The Oldham Hackman job characteristic model , Stress , Health and Safety , Ethical and Professional concerns , Working in teams Decision making Organizational structures Dispersed and Virtual teams , Communications genres, Communication plans, Leadership. | <b>07</b> |
| <b>Unit-6</b> | <b>Software Deployment:-</b> Software Deployment,Importance of Software Deployment,Software Deployment vs Software Release,Software Deployment Methodologies,Software Deployment Processes, Best Practices for Software Deployment.                                                                                                                                                      | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>42</b> |

#### **Text Book:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management , Fifth Edition, McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki —Effective Software Project Management , Wiley Publication, 2011.
3. Walker Royce: —Software Project Management- Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, —Managing Global Software Projects , McGraw Hill Education (India), Fourteenth Reprint 2013

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## **B.Tech. MDM Track 1: Electronics and Communication Engineering**

| <b>Course Code</b> | <b>Course Title</b>                     | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|-----------------------------------------|-----------|-----------|-----------|-----------|
| <b>6SEMDM3</b>     | <b>Analog and Digital Communication</b> | <b>03</b> | <b>00</b> | <b>00</b> | <b>03</b> |

### **Pre-requisites:**

1. Applied Mathematics-III,
2. Base Band Signals

### **Course Learning Objectives:**

1. To understand and analyze various analog and digital modulation and demodulation techniques, including AM, FM, and pulse modulation systems.
2. To study the fundamental concepts of digital communication systems, including sampling, quantization, baseband transmission, and digital modulation techniques.
3. To explore the building blocks of digital communication systems

### **Course Outcomes:**

After successfully completing the course, the students will be able to:

1. Understand the necessity of modulation and identify the various components of analog and digital communication systems.
2. Understand different modulation and demodulation schemes in analog communication systems and to compare the strengths and weaknesses of various analog communication systems.
3. Analyze the performance of various pulse modulation schemes.
4. Understand basic building blocks of digital communication system and function of each one.
5. To understand the different functional blocks of digital communication system.
6. To analyze and compare the performance of studied digital modulation techniques.

| <b>Unit No.</b> | <b>Course: Analog and Digital Communication</b>                                                                                                                                                                                                                                                                                   | <b>No. of Lectures Required</b> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>1</b>        | <b>AM Transmitters and Receivers:</b> Modulation, need of modulation, AM Modulation (Mathematical expression) concept of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSB-FC Transmitter. Super-heterodyne receiver, Types of AGC & its need, Receiver Characteristics: Selectivity, Sensitivity & Fidelity. | <b>08</b>                       |
| <b>2</b>        | <b>FM Transmitters and Receivers:</b> FM Modulation, FM generation using                                                                                                                                                                                                                                                          | <b>08</b>                       |

|   |                                                                                                                                                                                                                      |           |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|   | FET. Narrow Band and Wide Band FM, their comparison, Pre-emphasis and De-emphasis. <b>FM Discriminator:</b> FM Receiver block diagram, Single Slope, Balanced slope detector and Ratio detectors.                    |           |
| 3 | <b>Analog Pulse Modulation:</b> Band limited & time limited signals, Sampling Theorem statement, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect, PAM, PWM & PPM.          | 08        |
| 4 | <b>Pulse Code Modulation:</b> Digital representation of Analog signal, PCM Generation and Reconstruction, Quantization (basic working), Quantization Noise, Companding, Delta Modulation, Adaptive Delta Modulation. | 07        |
| 5 | <b>Introduction to Digital Communication System:</b> Functional Blocks of Digital Communication System, and working of each block                                                                                    | 05        |
| 6 | <b>Digital Modulation:</b> BPSK, BFSK and ASK generation and reception, QPSK Transmitter and Receiver, Comparison of Digital modulation systems                                                                      | 06        |
|   | <b>Total</b>                                                                                                                                                                                                         | <b>42</b> |

#### **Text Books:**

1. Kennedy G. "Electronic Communication System" Tata Mc-Graw Hill Co., New Delhi (Third Ed).
2. Taub and Schilling D.L., "Principles of Communication Systems", Mc-Graw Hill Co., New Delhi (Second Ed.).
3. Shanmugam K.S., "Digital & Analog Communication Systems", John Wiley & Sons, New York, 1996.
4. Lathi B. P., "Modern Digital and Communication Systems", Holt Rinchart and Winston Inc., New York, 1993.
5. Simon Haykin, "Digital Communication", John Wiley and Sons, Pvt. Ltd., Singapore.

#### **Reference Books:**

1. Proakis J. K., "Digital Communication", Mc-Graw Hill Book Co., London (Second Edition).
2. Glover and Grant, "Digital Communication", Prentice Hall Publication
3. Collins Dennis, Collins John, "Electronic Communications" PHI.
4. Wayne Tomasi, "Electronic Communication Systems" Pearson Education, (Fifth Edition).
5. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering" John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication", Kluwer Academic Publishers, 2004



## **B.Tech. MDM Track 2: Telecommunication Engineering**

| <b>Course Code</b> | <b>Course Title</b>                     | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|-----------------------------------------|-----------|-----------|-----------|-----------|
| <b>6SEMDM7</b>     | <b>Introduction to Mobile Computing</b> | <b>03</b> | <b>00</b> | <b>00</b> | <b>03</b> |

### **Pre-requisites:**

1. Wireless Communication Fundamentals

### **Course Learning Objectives:**

1. To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. To understand the Cellular Concept and typical mobile networking infrastructure through a popular GSM, GPRS protocols.
3. To understand the platforms and protocols used in mobile environment

### **Course Outcomes:**

After completion of this course, student will be able

1. To understand concepts of Mobile Computing.
2. To comprehend various Cellular concepts of Mobile Communication..
3. To analyze Telecommunication System using GSM & GPRS protocol.
4. To understand IP and TCP layers of Mobile Communication.
5. To Analyze Wireless Application Protocol for mobile communication networks.
6. To understand concept of 5G in Mobile Communication.

| <b>Unit No</b>  | <b>Course: Introduction to Mobile Computing</b>                                                                                                                                                                                                                                   | <b>No. of Lectures Required</b> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Unit I</b>   | <b>Introduction of Mobile Computing:</b><br>History, Types, Benefits, Application, Evolution, Security Concern regarding Mobile Computing, Different Propagation Modes, Wireless Architecture and its types, needs of mobile user                                                 | <b>07</b>                       |
| <b>Unit II</b>  | <b>The cellular concept:</b><br>Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies, Distance to frequency reuse ratio                                                                                                         | <b>07</b>                       |
| <b>Unit III</b> | <b>Telecommunication System:</b><br><b>GSM:</b> - Channel allocation; call routing Architecture, PLMN interface, addresses and identifiers, authentication and security, Handoffs Technique.<br><b>GPRS:</b> network operation, data services, Applications, Billing and charging | <b>07</b>                       |
| <b>Unit IV</b>  | <b>Mobile Network Layer &amp; Transport Layer</b><br>Mobile IP – Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics. Traditional TCP, Mobile TCP                                                                                                    | <b>07</b>                       |
| <b>Unit V</b>   | <b>Wireless Application Protocol:</b>                                                                                                                                                                                                                                             | <b>07</b>                       |

|                |                                                                                                                   |           |
|----------------|-------------------------------------------------------------------------------------------------------------------|-----------|
|                | Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAP                    |           |
| <b>Unit VI</b> | <b>Introduction to 5G :</b><br>Introduction, features and challenges, Applications of 5G, 5G network architecture | <b>07</b> |
|                | <b>Total</b>                                                                                                      | <b>42</b> |

#### **TEXT BOOKS:**

1. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2003.
2. William Stallings, “Wireless Communications and Networks”, Pearson Education, 2002.

#### **REFERENCE BOOKS:**

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007
4. Asoke K. Talukdar, “Mobile Computing”, Tata McGraw-Hill Education, 2010.
5. Mohammad Ilyas, Imad Mahgoub, “Mobile Computing Handbook”, AUERBACH, 2004.
6. Vilas S. Bagad, “Mobile Computing Introduction”, Technical Publications, 2014
7. DR SANJAY Sharma, “Mobile Computing”, S.K. Kataria & Sons Publication, 2014.
8. Dr. Ashish N. Jani, Dr. N.N. Jani, Neeta Kanabar, “Mobile Computing - Technologies and Applications”, 2010
9. Pattnaik, Prasant Kumar, Mall, Rajib, “Fundamentals Of Mobile Computing”, Second Edition, PHI Learning Pvt. Ltd., 2015.

**B.Tech. Fifth Semester (IT Department)**

**Multidisciplinary Minor (Track: Information Technology)**

| Course Code | Course Title | L  | T  | P  | C  |
|-------------|--------------|----|----|----|----|
| 6SNMDM3     | E-Commerce   | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil

**Course Learning Objectives:**

1. Understand the Fundamentals of E-Commerce.
2. Analyse E-Commerce Business Models.
3. Understand E-Commerce Infrastructure.
4. Design and Develop E-Commerce Websites.

**Course Outcomes:**

After successful completion of this course, students will be able to-

1. Develop an Understanding of E-Commerce and E-Business.
2. Evaluate Different E-Commerce Business Models.
3. Understand E-Commerce Infrastructure.
4. Design and Build E-Commerce Websites.
5. Implement Security Measures and Payment Systems.
6. Apply E-Commerce Marketing Strategies.

|               | Subject: E-Commerce                                                                                                                                                                                                                                                                                                                           | L<br>(Hrs) |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit-1</b> | <b>E-Commerce:</b> The difference between E-commerce and Business, Why study E-commerce? Eight unique features of Ecommerce Technology, Types of E-Commerce, Growth of the Internet and the web, Origins and Growth of E-commerce, Ecommerce - A brief History.                                                                               | <b>07</b>  |
| <b>Unit-2</b> | <b>E-commerce Business Models and Concepts:</b> E-Commerce business Model-eight Key elements of a Business Model, Major Business-to-Consumer (B2C) Business Models, Major Business -Business (B2B) Business Models: Business Models emerging E-Commerce areas, How the Internet and the WEB change Business; Strategy, Structure and Process. | <b>07</b>  |
| <b>Unit-3</b> | <b>E-Commerce Infrastructure:</b> The Internet: Technology Background, The Internet Today, Internet II; The future infrastructure, The World Wide Web, The Internet and the Web Features.                                                                                                                                                     | <b>07</b>  |
| <b>Unit-4</b> | <b>Building an E-Commerce Web Site:</b> Building and E-Commerce Web Site- A strategic approach, Choosing Server Software, Choosing the Hardware for an E-Commerce site, Other Ecommerce Site Tools.                                                                                                                                           | <b>07</b>  |

|                |                                                                                                                                                                                                                                   |           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b>  | <b>Online Security and payment Systems:</b> The E-Commerce Security Environment, Security threads in the E-commerce environment, Technology solutions, Management Policies, business procedures and public laws, payment systems. | <b>07</b> |
| <b>Unit -6</b> | <b>E-Commerce Marketing Concepts:</b> Cosumer online; The Internet Audience and Consumer behaviour, Basic Marketing Concepts, Internet Marketing Technologies, B2C and B2C E-Commerce marketing and Branding strategies.          | <b>07</b> |
|                | <b>Total</b>                                                                                                                                                                                                                      | <b>42</b> |

**Text Book:**

1. Keneth C. Laudon, Carol Gurcio Trave”e-commerce, business, technology, Society” (Pearson)

**References:**

1. Dave Chaffley “E-Business and E-commerce management” (3rd Edition) Pearson.
2. Kalkakofa Whirttoton, “Frontiers of E-Commerce” Pearson.

**B.Tech. Fifth Semester (IT Department)**

**Multidisciplinary Minor (Track: Cyber Security)**

| Course Code | Course Title              | L  | T  | P  | C  |
|-------------|---------------------------|----|----|----|----|
| 6SNMDM7     | Basics of Ethical Hacking | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic concepts in networking and programming

**Course Learning Objectives:**

1. To learn about the hacker mindset and the history of hackers.
2. To understand basic networking and security technologies.
3. To gain a basic understanding of security policy.
4. To explore various vulnerability analysis techniques & firewalls.

**Course Outcomes:**

After successful completion of this course, students will be able to

1. Develop the core foundations of ethics and cryptography in regards to computer security.
2. Analyze the vulnerability with respect to hacking.
3. Analyze DDOS attack and session hijacking.
4. Classify various types of malware and sniffing attacks on network.
5. Analyze various attacks scenario and remedies.
6. Detecting the attack with IDS.

|        | Subject: Basics of Ethical Hacking                                                                                                                                                                                               | L<br>(Hrs) |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Unit-1 | <b>Introduction and Ethics:</b> Ethical Hacking, Types of Hackers, Phases of Ethical Hacking, Fundamentals of computer networking. TCP/IP protocol stack, IP addressing and routing, Common Network Threats/Attacks              | 07         |
| Unit-2 | <b>Cryptography:</b> Introduction to cryptography, private-key encryption, public-key encryption, Key exchange protocols, cryptographic hash functions, applications, Digital signatures, Attacks on cryptosystems               | 07         |
| Unit-3 | <b>Vulnerability Analysis &amp; System Hacking:</b> Vulnerability Analysis, Types of Vulnerability Analysis, Vulnerability Assessment Tools, System Hacking, Password Cracking, Penetration testing, Hiding Files, Clearing logs | 07         |
| Unit-4 | <b>DoS and Session Hijacking:</b> DoS attack, DDoS attack, Common symptoms of DoS/DDoS attack, Categories of DoS/DDoS Attack Vectors, session hijacking, Application and Network level session hijacking                         | 07         |

|                |                                                                                                                                                                                                                                          |           |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b>  | <b>Sniffing:</b> Malware and its propagation ways, Malware components, Types of malware, Concept of sniffing, Types of sniffing, Types of sniffing attacks                                                                               | <b>07</b> |
| <b>Unit -6</b> | <b>IDS &amp; Firewall:</b> Intrusion Detection System (IDS), Types of Intrusion Detection Systems, Introduction to Firewalls, Types of Firewalls, Introduction to Honeypots, Case studies: various attacks scenarios and their remedies. | <b>07</b> |
|                | <b>Total</b>                                                                                                                                                                                                                             | <b>42</b> |

**Recommended Textbooks:**

1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, 2nd Edition, Patrick Engbreton, ISBN: 0124116442

**Reference Books:**

1. Penetration Testing: A Hands-On Introduction to Hacking, Georgia Weidman, ISBN: 1593275641
2. ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking, Hein Smith, Hilary Morrison

**B.Tech. Sixth Semester (Mechanical Engg)**

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 6SMMDM3     | Industrial Engineering | 03 | 00 | 00 | 03 |

Course Prerequisites:

1. Basic knowledge of Industrial Management.
2. Knowledge of general mathematics.

Course Learning Objectives:

1. To learn the basics of Industrial Engineering, plant location and plant layout.
2. To study the importance of ergonomics in designing of products and production planning.
3. To study the concepts of quality control and total quality management.

Course Outcomes:

Students will be able to –

1. Understand the concepts productivity and productivity measurement approaches.
2. Apply the knowledge on the basic principles in facilities planning and plant location.
3. Understand and apply the sales forecasting techniques.
4. Understand and analyze the various material handling problems.
5. Apply and analyze work study and ergonomic principles to design workplaces for the improvement of human performance.
6. Understand and evaluate the value of Statistical Process Control, Total Quality Management and six sigma limits.

|                 | <b>Subject: Industrial Engineering</b>                                                                                                                                                                                                                                                                                                                              | <b>L</b> |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I</b>   | <b>INTRODUCTION :</b><br>Concepts of Industrial Engineering, History and development of Industrial Engineering, Applications of Industrial Engineering, Production Management Vs Industrial Engineering, Production System, Input Output Model, Productivity, Factors affecting Productivity, Increasing Productivity of resources, Kinds of Productivity measures. | 7        |
| <b>UNIT II</b>  | <b>PLANT LOCATION AND LAYOUT:</b><br>Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout– Plant Layout procedure – Line Balancing                                                                                                                             | 6        |
| <b>UNIT III</b> | <b>PRODUCTION PLANNING AND CONTROL:</b><br>Objectives of sales forecasting- Types of forecasting- Factors affecting forecasting- Methods of sales forecasting – Types of production – Economic Batch Quantity– Loading – Scheduling and control of production                                                                                                       | 7        |
| <b>UNIT IV</b>  | <b>MATERIAL HANDLING EQUIPMENTS:-</b> Scope and functions of material handling, Manual mechanical handling ratio, Principles of material handling, Analysis of material handling problem, Classification of material handling system, Salient features and                                                                                                          | 7        |

|                |                                                                                                                                                                                                                                                                                                                                                                                                               |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                | applications of general purpose material handling Equipments, Material handling in stores and warehouses, Optimum allocation of material handling equipment.                                                                                                                                                                                                                                                  |    |
| <b>UNIT V</b>  | <b>WORK STUDY &amp; ERGONOMICS:</b><br>Definition and Concept of work study, Principles of Motion Economy, Method study, Recording techniques of method study, Work Measurement procedures, Time Study, Ergonomics and its areas of application in the work system.                                                                                                                                           | 7  |
| <b>UNIT VI</b> | <b>STATISTICAL QUALITY CONTROL:</b><br>Definition and Concepts, Fundamentals of Control Charts for variables, Control Charts for attributes, Acceptance Sampling, Single sampling plan- Double sampling plan.<br><b>TOTAL QUALITY MANAGEMENT:</b><br>Total Quality Management (TQM)- philosophical concepts. Concept of six sigma and its application, Concept and applications of Kaizen and Quality Circle. | 6  |
|                | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                  | 40 |

Textbooks:

1. O.P.Khanna, 2018, Industrial Engineering and Management, Dhanpat Rai Publications
2. Martand Telsang, 2006, Industrial Engineering and Production Management, S. Chand and Company

Reference Books:

1. Ravi Shankar, 2009, Industrial Engineering and Management, Galgotia Publications & Private Limited
2. C.Natha Muni Reddy, Industrial Engineering (IE) and Management, New age international Publishers
3. Industrial engineering & production Management by M. Mahajan (Dhanpat Rai & Co.)
4. Production and operations management- concepts models and Behavior by Everett E. Adam, Jr., & Ronald J. Ebert (Prentice- Hall of India)



**B.Tech. Sixth Semester (Mechanical Engg)**

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 6SMMDM7     | Automation Engineering | 03 | 00 | 00 | 03 |

Course Prerequisites:

1. Preliminary knowledge of production processes and manufacturing techniques.
2. Basic knowledge of computer languages and logic.

Course Learning Objectives:

1. To learn the concepts of Automation in industries.
2. To study the NC/CNC systems and its applications.
3. To study the functioning of FMS and CIM.

Course Outcomes:

Students will be able to –

1. Understand the concepts of automation and its importance in industries.
2. Apply the knowledge of NC/CNC programming.
3. Understand and apply the knowledge of robotics in industries.
4. Understand the concept of Group Technology and apply the knowledge of CAPP.
5. Understand the concepts of FMS and ASRS and apply the knowledge of AGVS.
6. Understand the concept of CIM.

|                 | <b>Subject: Automation Engineering</b>                                                                                                                                                                                                                                                                                                                    | <b>L</b> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I</b>   | <b>INTRODUCTION:</b> Automation & its types, Automation for mass manufacturing and assembly, Reasons for automating, Automation strategies, Automated flow lines, Control function, General terminology and analysis of automated flow line, Partial automation, Line balancing.                                                                          | 6        |
| <b>UNIT II</b>  | <b>NC/CNC:-</b> Basic concept, N.C. controls- point to point , straight cut and continuous path control, machine control units, open and closed loop system, NC machine components, CNC & DNCs, Manual part programming formats, Various Programming codes, Manual part programming for drilling, Milling and turning operations.                         | 7        |
| <b>UNIT III</b> | <b>ROBOTICS:-</b> Evolution of industrial robots, Robots anatomy, Arm geometry, drive system and end efforts, sensors, Evolution of geometrical configurations for robots, Programming techniques of Robots, Applications of Robots in manufacturing- part handling, part processing and part building.                                                   | 7        |
| <b>UNIT IV</b>  | <b>GROUP TECHNOLOGY AND PROCESS PLANNING:</b> Introduction-Part families, part classification and coding systems, Group technology machine cells, advantage of group technology, the planning function, retrieval type process planning system, Generative process planning systems, Benefits of CAPP, Expert systems and expert system approach to CAPP. | 7        |

|                |                                                                                                                                                                                                                                                                                                                                                              |    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>UNIT V</b>  | <b>FLEXIBLE MANUFACTURING SYSTEMS (FMS):</b> Introduction, schematic of FMS, FMs cells, Components of FMS, Relation of Group Technology, with FMS, Planning, Simulation and analysis of FMS, Applications of FMS. Material handling : Automated storage and Retrieval system (ASRS), Automated Guided Vehicle (AGV)etc.                                      | 6  |
| <b>UNIT VI</b> | <b>COMPUTER INTEGRATED MANUFACTURING (CIM):</b> Introduction, Sequence of functions in CIM, elements of CIM system, CIM Wheel, Structure of CIM database system. Guidelines for CIM development, Benefits of CIM, Introduction to automated inspection, Advantages over traditional method, On-line & offline inspection, CMM construction, types & working. | 7  |
|                | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                 | 40 |

Textbooks:

1. Production system, Automation and CIM, Mikhal Groover, Pearson Publications.
2. CNC Machines; M.Adithan & B.S.Pabla; New Age International.
3. Robotics; Yarem Koren, Mcgraw Hill

Reference Books:

1. Industrial Robotics by M.P. Groover, McGraw Hill
2. CAD/CAM/CIM ; Radhakrishnan & Subramanium; New age International.
3. Computer aided Manufacturing; P.N.Rao, N.K.Tiwari and & T.K.Kundra; Tata Mcgraw Hill

### **B.Tech Fourth Semester CSE(IoT)**

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 6STMDM3     | Single Board Computers | 03 | 00 | 00 | 03 |

**Course Pre-requisite:** 1. 4STMDM1 Fundamentals of IoT  
2. 5STMDM2 Sensors and Actuators

**Course Objectives:**

1. To understand the fundamentals of Single Board Computers (SBCs).
2. To comprehend the knowledge of the architectures and components of various SBCs.
3. To evaluate the applications and limitations of SBCs in real-world scenarios.

**Course Outcomes:**

After successfully completing the course, students will be able to-

- 1 Define Single Board Computers and explain their evolution and applications in IoT.
- 2 Discuss the features and functionalities of various Arduino models, including UNO, Mega, and Nano.
- 3 Explain the System on Chip (SoC) architecture of Raspberry Pi and its core components.
- 4 Analyze the performance of SBCs in various IoT scenarios.
- 5 Evaluate and mitigate security vulnerabilities in SBCs to ensure robust and ethical deployment in real-world applications.
- 6 Assess the scalability and interoperability of SBC-based IoT systems in real-world scenarios.

|          | Course Name: Single Board Computers                                                                                                                                                                                                                                | Lect Hrs. |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| UNIT I   | <b>Introduction to Single Board Computers:</b><br>Definition and evolution of SBCs, Comparison with traditional desktop computers, Overview of: Raspberry Pi, Arduino, BeagleBone, Tinker Board, Compare Arduino and Raspberry Pi.                                 | 7         |
| UNIT II  | <b>Arduino Architecture and Components :</b><br>Overview of Arduino Models: UNO, Mega, Nano, ATmega328 microcontroller architecture & their features, Digital and analog input/output pins functions, Serial communication (UART, I2C, SPI).                       | 7         |
| UNIT III | <b>Raspberry Pi Architecture and Components :</b><br>Comparative analysis of different Rpi models. System on Chip (SoC) Architecture: Understanding the core components, Peripheral Interfaces and networking, Operating Systems: Raspberry Pi OS and alternatives | 7         |

|         |                                                                                                                                                                                                                                                                                                       |           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| UNIT IV | <b>Internet of Things (IoT) with SBCs:</b><br>Introduction to IoT concepts, Connecting SBCs to the internet, Using MQTT and HTTP protocols, Cloud platforms and data visualization, Building IoT applications.                                                                                        | 7         |
| UNIT V  | <b>Challenges and Considerations:</b><br>Security Concerns: Address vulnerabilities in SBCs and strategies for securing devices, Scalability Issues, Interoperability (Examine the need for standardization and compatibility among different SBCs and systems), Regulatory and Ethical Implications. | 7         |
| UNIT VI | <b>Applications of SBCs:</b><br>Overview, Block Diagram and Working of real world applications with the use of SBCs: Healthcare, Smart home automation, in industry and in Education.                                                                                                                 | 7         |
|         | <b>Total</b>                                                                                                                                                                                                                                                                                          | <b>42</b> |

**Text Book:**

1. "Arduino Cookbook" by Michael Margolis
2. "Raspberry Pi User Guide" by Eben Upton and Gareth Halfacree

**Reference Books:**

1. "Getting Started with Arduino" by Massimo Banzi, a comprehensive introduction to the Arduino platform.
2. "The Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti  
Explores the integration of SBCs in IoT applications.
3. "An Internet of Things" by Rahul Dubey (Cengage).

**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati (An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology Choice Based Credit System (Semester Pattern) Branch: All Branches**  
**Batch Admitted AY2023-24 \*MULTI-DISCIPLINARY MINOR (MDM) BASKET OF COURSES for 7th Semester**

| Track Name                                | Semester | Course Code | Course Name                                          | Teaching Scheme |          |     |                                |                    |         | Examination Scheme      |                      |               |    |       |                           | Offered by the Department of                  |
|-------------------------------------------|----------|-------------|------------------------------------------------------|-----------------|----------|-----|--------------------------------|--------------------|---------|-------------------------|----------------------|---------------|----|-------|---------------------------|-----------------------------------------------|
|                                           |          |             |                                                      | Hours / Week    |          |     | MDM Applicable to              | Total Hours / Week | Credits | THEORY                  |                      |               |    |       |                           |                                               |
|                                           |          |             |                                                      | Lecture         | Tutorial | P/D |                                |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal      |    | Total | Overall Min Passing Marks |                                               |
|                                           |          |             |                                                      |                 |          |     |                                |                    |         |                         | Max. Marks MSE/ MSIE | Max. Marks TA |    |       |                           |                                               |
| Theory                                    |          |             |                                                      |                 |          |     |                                |                    |         |                         |                      |               |    |       |                           |                                               |
| Artificial Intelligence                   | VII      | 7SAMDM4     | Safe and Responsible Artificial Intelligence Systems | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Data Science                              | VII      | 7SAMDM8     | Ethics in Data Science                               | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Artificial Intelligence and Data Science      |
| Civil Engineering                         | VII      | 7SCMDM4     | Basics of Structural Analysis                        | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Construction Technology                   | VII      | 7SCMDM8     | Basics of Geotechnical Engineering                   | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Civil Engineering                             |
| Computer Science and Engineering          | VII      | 7SKMDM4     | Basics of Enterprise Resource Planning               | 3               | --       | --  | CE, EXTC, IIoT, ME             | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Software Engineering                      | VII      | 7SKMDM8     | Software Testing and Quality Assurance               | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Computer Science and Engineering              |
| Electronics and Communication Engineering | VII      | 7SEMDM4     | Electronic Circuit Design                            | 3               | --       | --  | AI&DS, CE, CSE, IT, IIoT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Telecommunication Engineering             | VII      | 7SEMDM8     | Satellite and Optic Fiber Communication              | 3               | --       | --  | CE, CSE, EXTC, IT, IIoT, ME    | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Electronics and Telecommunication Engineering |
| Information Technology                    | VII      | 7SNMDM4     | Management Information Systems                       | 3               | --       | --  | AI&DS, CSE, EXTC, IT, IIoT, ME | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| Cyber Security                            | VII      | 7SNMDM8     | Blockchain Technology                                | 3               | --       | --  | AI&DS, CE, EXTC, IT, IIoT, ME  | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Information Technology                        |
| IoT                                       | VII      | 7STMDM4     | Industrial Internet of Things                        | 3               | --       | --  | AI&DS, CE, CSE, IT, ME         | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Industrial IoT                                |
| Mechanical Engineering                    | VII      | 7SMMDM4     | Industrial Automation                                | 3               | --       | --  | CE, CSE, EXTC, IIoT, ME        | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |
| Robotics and Automation Engineering       | VII      | 7SMMDM8     | Robotics and industrial Application                  | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, ME   | 3                  | 3       | 3                       | 60                   | 30            | 10 | 100   | 40                        | Mechanical Engineering                        |

\* indicates that the Track for MDM will be decided by respective Board of Studies (BoS)

### B.Tech. Seventh Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                                         | L  | T  | P  | C  |
|-------------|------------------------------------------------------|----|----|----|----|
| 7SAMDM4     | Safe and Responsible Artificial Intelligence Systems | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Artificial Intelligence, Machine Learning, Data Science, Statistics, and basic Software Engineering concepts.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Safe and Responsible Artificial Intelligence Systems by being able to do each of the following:

1. Understand the principles of safe, responsible, and human-centered AI systems including governance and ethical frameworks.
2. Analyze technical and ethical risks in AI systems such as accuracy, robustness, fairness, privacy, and sustainability.
3. Apply SAFE-AI framework concepts to evaluate and design responsible AI solutions.

**Course Outcomes:** After successful completion of this course, the student will be able to:

1. Recall concepts of responsible AI, governance, and AI risk categories.
2. Explain technical and ethical risks in AI systems including accuracy, robustness, fairness, and privacy.
3. Apply SAFE-AI framework principles to assess AI models for safety and responsibility.
4. Analyze AI models for technical and ethical risks using appropriate evaluation metrics.
5. Evaluate AI systems based on explainability, fairness, sustainability, and robustness measures.
6. Design safe and responsible AI solutions using governance processes and SAFE-AI framework.

|               |                                                                                                                                                                                                                                                                      |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (7SAMDM4) Safe and Responsible Artificial Intelligence Systems</b>                                                                                                                                                                                       | <b>L</b>  |
| <b>Unit-1</b> | Introduction Responsible AI, AI Governance: The Regulation and Policies, Technical Risks Introduction: Accuracy, Robustness, Explainability, Ethical Risks Introduction: Fairness and Human Rights, Privacy, Sustainability, The SAFE-AI Framework                   | <b>07</b> |
| <b>Unit-2</b> | Technical Risks Technical Risks: Accuracy: Risk Management Framework, prediction, classification, multidimensional predictions, textual predictions accuracy, mitigation, Robustness: Model Robustness, comparison, Explainability: Model Explainability, mitigation | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                                                                        |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | Ethical Risks Introduction: Fairness and Human Rights: Model Fairness, mitigation, Sustainability: Environmental sustainability, social and governance sustainability, Model sustainability, mitigation, Privacy: introduction, mitigation                                                                                                             | <b>07</b> |
| <b>Unit-4</b> | Human Centered AI Evaluating AI, Accessing AI, Improving AI, Scoring AI, Mitigation, The SAFE-AI Framework, The Governance Processes: Risk of AI Models, Governance Process                                                                                                                                                                            | <b>07</b> |
| <b>Unit-5</b> | Technical and Ethical Risks evaluation Technical Risks: Accuracy: RGA: A unified Measure of Accuracy, Benchmarks, Scoring Rubric, Robustness: measuring robustness, Explainability: explainability measurement, Ethical Risks: Fairness: measuring fairness for individuals and organizations, Privacy: scoring rubric, Sustainability: scoring rubric | <b>07</b> |
| <b>Unit-6</b> | Case Studies and Implementation Logistic Regression Models, Tree Models, Neural Networks, Model Comparison, SAFE-HAI Assessment, Accuracy, Explainability, Robustness, Fairness, Applications of AI models                                                                                                                                             | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                           | <b>42</b> |

**Text Book:**

1. A. I. Human, Toju Duke and Paolo Giudici, “Responsible AI in Practice”, (2025).

**Reference Books:**

1. Stuart J. Russell and Peter Norvig,” Artificial Intelligence: A Modern Approach “(4th Edition), Pearson (2021) ISBN:978-0-13-461099-3
2. Sray Agarwal and Shashin Mishra,” Responsible AI “, Springer International Publishing (2021) ISBN:978-3-030-60555-9
3. Virginia Dignum,” Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way “, Springer (2019) ISBN:978-3-030-30371-6
4. P. Kumaraguru, B. Ravindran and A. Rajkumar,” Responsible & Safe AI “, NPTEL (2025).
5. Qinghua Lu, Liming Zhu, Jon Whittle and Xiwei Xu,” Responsible AI: Best Practices for Creating Trustworthy AI Systems “, Addison-Wesley Professional (2023) ISBN:978-0-13-792072-3.

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 7SAMDM8     | Ethics in Data Science | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic knowledge of Data Science, Machine Learning, Database Systems, Statistics, and Artificial Intelligence fundamentals.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Ethics in Data Science by being able to do each of the following:

1. Understand ethical principles, privacy concerns, and fairness issues in data science.
2. Analyze ethical challenges arising during data collection, preprocessing, modeling, and evaluation.
3. Apply ethical frameworks and responsible practices in the development and deployment of data-driven systems.

**Course Outcomes:** After successful completion of this course, the student will be able to:

1. Recall the fundamental concepts of ethics, privacy, fairness, and accountability in data science.
2. Explain ethical issues related to data gathering, preprocessing, and model development.
3. Apply privacy-preserving and fairness-aware techniques in data science workflows.
4. Analyze bias, discrimination, and ethical risks in data-driven systems and applications.
5. Evaluate the ethical implications of data science models, results, and deployment strategies.
6. Design responsible and ethical data science solutions that promote transparency, fairness, and social good.

|        | Subject: (7SAMDM8) Ethics in Data Science                                                                                                                                                                            | L |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit-1 | Introduction to Data Science Ethics The Rise of Data Science (Ethics), Why Care?, Right and Wrong, Data Science, Data Science Ethics Equilibrium, The FAT Flow Framework for Data Science Ethics                     | 7 |
| Unit-2 | Ethical Data Gathering Privacy as a Human Right, Regulations, Privacy Mechanisms, Cautionary Tales: Backdoors and Messaging Encryption, Bias, Cautionary Tales: Bumps, Gorillas, and Resumes, Human Experimentation, | 7 |



|                |                                                                                                                                                                                                                                                       |           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b>  | Ethical Data Preprocessing Defining and Measuring Privacy, Cautionary Tales: Re-identification, Defining and Selecting Variables, Cautionary Tale: Pregnancy and Face Recognition, Fair Relabelling, Cautionary Tale: Biased Language                 | <b>7</b>  |
| <b>Unit -4</b> | Ethical Modelling Privacy-Preserving Data Mining, Discrimination-Aware Modelling, Predicting Recidivism and Redlining, Comprehensible Models and Explainable AI, Explaining Webpage Classifications, Including Ethical Preferences: Self-Driving Cars | <b>7</b>  |
| <b>Unit-5</b>  | Ethical Evaluation Ethical Measurement, Ethical Interpretation of the Results, Ethical Reporting, Cautionary Tale of Diederik Stapel                                                                                                                  | <b>7</b>  |
| <b>Unit-6</b>  | Ethical Deployment Access to the System, Different Treatments for Different Predictions, Censoring Search and Face Recognition, Honesty and DeepFake, Governance, Unintended Consequences                                                             | <b>7</b>  |
|                | <b>Total</b>                                                                                                                                                                                                                                          | <b>42</b> |

**Text Book:**

1. David Martens,” Data Science Ethics: Concepts, Techniques and Cautionary Tales “, Oxford University Press (2022) ISBN:978-0-19-284726-3.

**Reference Books:**

1. Mike Loukides, Hilary Mason and DJ Patil,” Ethics and Data Science “, O’Reilly Media (2018) ISBN:978-1-4920-4554-0
2. Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins,” Engineering Ethics: Concepts and Cases “, Cengage Learning (2009) ISBN:978-0-495-50182-3
3. M. Govindarajan and S. Natarajan,” Engineering Ethics “, Prentice Hall of India, New Delhi (2004) ISBN:978-81-203-2616-8

**B.Tech. Seventh Semester (Civil Engineering)**

| Course Code | Course Title                  | L | T | P | C |
|-------------|-------------------------------|---|---|---|---|
| 7SCMDM4     | Basics of Structural Analysis | 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

Students will be taught -

1. Concepts related to Forces and its effects, resolution and composition of coplanar forces.
2. Analysis of simple structures like beams and frames.
3. Concept of Centre of Gravity and Moment of Inertia
4. Analysis of beam for Shear force and bending moments.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Compose and resolve the forces, analyse the equilibrium force systems.
2. Analyse the statically determinate structures like beams and frames.
3. Analyse the statically determinate trusses
4. Calculation of Center of Gravity and Moment of Inertia
5. Study of stress, strain, elastic constant and their relationship.
6. Calculation of shear force and bending moments.

|        | Subject: Basics of Structural Analysis                                                                                                                                                                                                                                                                                              | L |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit-1 | <b>Equilibrium and Resultant-</b> Concept of force, force systems, moment, couple, resolution and compositions of coplanar forces. Free-body diagrams, equations of equilibrium-Lami's theorem, problems on equilibrium of co-planar forces acting on a rigid body and system of rigid bodies.                                      | 7 |
| Unit-2 | <b>Analysis of Determinate structure (Beams and Frames):</b> Determinate and Indeterminate structure, introduction to the types of beams and frames. Analysis of beams and frames using principles of statics (Determinate only).                                                                                                   | 7 |
| Unit-3 | <b>Analysis of Determinate structure (Trusses) -</b> Determinate and Indeterminate structure, introduction to the types of trusses. Analysis of trusses using principles of statics (Determinate only).                                                                                                                             | 7 |
| Unit-4 | <b>Centre of Gravity and Moment of Inertia -</b> Centroid, First Moment of Area, Centroid of composite sections, Second Moment of Area, Radius of Gyration, product of inertia, perpendicular and parallel axis theorem, polar moment of inertia, radius of gyration, Definition of principal axes and principal moment of inertia. | 7 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Stresses and strains</b> - Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only. | 7         |
| <b>Unit-6</b> | <b>Axial force, shear force &amp; bending moment diagrams</b> - Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear force, bending moment and loading intensity.                                                                                                                        | 7         |
| <b>Total</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>42</b> |

**Text Books:**

1. Bhavikatti, S. S. and Rajashekarappa, K. G., Engineering Mechanics, New Age International Publishers, New Delhi.
2. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.

**Reference Books:**

1. Singer, F. L., Engineering Mechanics, Harper Collins Pub., Singapore
2. Timoshenko, S. P. and Young, D. H., Engineering Mechanics, McGraw-Hill International C., Auckland.
3. Beer, F. P. and Johnston, E. R., Vector Mechanics for Engineers, McGraw-Hill International C., Auckland.
4. S. Timoshenko and O. H. Young, Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
5. Beer and Johnston, Mechanics of materials, Mc-Graw Hill
6. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd

| Course Code | Course Title                       | L | T | P | C |
|-------------|------------------------------------|---|---|---|---|
| 7SCMDM8     | Basics of Geotechnical Engineering | 3 | 0 | 0 | 3 |

### Course Learning Objectives:

Students will be taught -

1. The various types of soil and their classification.
2. The index properties and engineering properties of soil.
3. The mechanics of compaction and factors affecting the compaction.
4. The concept of permeability and factors affecting it.

### Course Outcomes:

At the end of the course, students will be able to -

1. Determine the Index properties and Atterberg limits for soil classification.
2. Understand the mechanics of compaction and quality control in the field.
3. Explain the permeability of soil and methods of dewatering.
4. Calculate the seepage discharge.
5. Calculate the shear strength of soil.
6. Understand the concept of consolidation and stress distribution in soil mass.

|        | Subject: Basics of Geotechnical Engineering                                                                                                                                                                                                                                                                                                                                           | L |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Unit-1 | <b>Soil Fundamentals and Its Properties:</b> History of development of soil mechanics, formation of soil, its significance to the field problems. Soil properties and its classification, Definition of soil, soil as a three-phase system, weight volume relationship, Index properties of coarse and fine-grained soil, BIS classification of fine-grained and coarse-grained soil. | 7 |
| Unit-2 | <b>Compaction of Soil:</b> Compaction of soil, mechanics of compaction, factors affecting compaction, standard and modified Proctor test, their field determination, zero air void line, concept of wet of optimum and dry of optimum, different structures of soil, field compaction and their control, CBR test and CBR values for soaked and unsoaked conditions.                  | 7 |
| Unit-3 | <b>Permeability of Soil:</b> Permeability of soil, Darcy's law and its validity, discharge and seepage velocity, factors affecting permeability, determination of coefficient of permeability in laboratory and field, permeability for stratified soil deposits, drainage and dewatering of soil and its various methods.                                                            | 7 |

|               |                                                                                                                                                                                                                                                                                                               |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>Seepage Analysis:</b> Laplace equation and its application for the computation of discharge seepage, seepage pressure, quick sand condition, concept of flow net, characteristics and uses of flow net, preliminary problem of discharge, estimation of discharge through homogenous earthen embankment.   | 7         |
| <b>Unit-5</b> | <b>Shear Strength of Soil:</b> A physical concept of shear strength, introduction of Mohr's stress diagram, unconfined compression test, laboratory measurement of shear strength for different drainage conditions by direct shear test, triaxial test, merits and demerits of various shear strength tests. | 7         |
| <b>Unit-6</b> | <b>Stresses in Soil Mass and Consolidation Theory:</b> State of stress at a point, stress distribution in soil mass, Boussinesq's theory and its applications for point load. Concept of consolidation using spring analogy, Terzaghi's theory of one-dimensional consolidation.                              | 7         |
| <b>Total</b>  |                                                                                                                                                                                                                                                                                                               | <b>42</b> |

#### **Text Book:**

1. Craig R. F.: Soil Mechanics
2. Lambe T. W. and Whitman R. V.: Soil Mechanics, John Wiley and Sons, 1969
3. Terzaghi K. and Peck R. B.: Soil Mechanics in Engg. Practice, John Wiley & Sons, 1967
4. Gulhati S. K.: Engg. Properties of Soils, Tata McGraw Hill, New Delhi, 1978
5. Singh A.: Soil Engg. In Theory and Practice, Asia Publishing House, Mumbai.

#### **Reference Book:**

1. Venkataramiah C.: Soil Mechanics and Foundation Engineering
2. B. M. Das, Advanced Soil Mechanics
3. S. K. Garg: Soil Mechanics and Foundation Engineering
4. Arora K. R.: Soil Mechanics and Foundation Engineering
5. Murthy V. N.: Geotechnical Engineering, Principles and Practices of Soil Mechanics and Foundation Engineering.

**B.Tech. Seventh Semester (Computer Science and Engineering)**

| Course code | Course Title                           | L  | T  | P  | C  |
|-------------|----------------------------------------|----|----|----|----|
| 7SKMDM4     | Basics of Enterprise Resource Planning | 03 | 00 | 00 | 03 |

**Course Learning Objectives:**

1. To understand the concepts, business processes, and functional areas of Enterprise Resource Planning (ERP) systems.
2. To analyze the role of ERP systems in integrating organizational functions such as sales, production, supply chain, and human resources.
3. To evaluate ERP applications and implementations across various business sectors through real-world case studies.

**Course Outcomes** After Successful completion of this course, the student will be able to:

1. Explain ERP concepts, business processes, and functional area information systems.
2. Describe the evolution, architecture, and key features of ERP systems.
3. Illustrate ERP-based sales, distribution, and customer relationship management processes.
4. Analyze ERP applications in production planning and supply chain management.
5. Explain the role of ERP systems in human resource management.
6. Evaluate ERP applications and case studies across various business sectors.

|               |                                                                                                                                                                                                                                                                                 |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Course:</b> Basics of Enterprise Resource Planning                                                                                                                                                                                                                           | L         |
| <b>Unit 1</b> | <b>Introduction to ERP:</b> Functional Areas and Business Processes, Functional Area Information Systems, Business Process Integration, Enterprise Systems Overview, Benefits and Challenges of ERP Systems.                                                                    | <b>07</b> |
| <b>Unit 2</b> | <b>Development of Enterprise Resource Planning Systems :</b> Evolution of Information Systems, Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP II), ERP Software Emergence, SAP ERP and SAP S/4HANA Overview, ERP for Midsized and Small Enterprises | 07        |
| <b>Unit 3</b> | <b>Marketing Information Systems and Sales Order Process :</b> Overview of Fitter Snacker, Sales and Distribution in ERP, Sales Order Process, Customer Master Data, Order Processing, Customer Relationship Management (CRM), Integration of Sales and Marketing Functions.    | <b>07</b> |
| <b>Unit 4</b> | <b>Production and Supply Chain Management Information Systems:</b> Production Overview, Production Planning Process, Demand Management, Material Management, Inventory Management, Supply Chain Management (SCM), ERP Integration with Suppliers.                               | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                                                                                |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit 5</b> | <b>Human Resource Processes with ERP:</b> Human Resource Processes, Employee Data Management, Payroll Processing, Recruitment and Training, Performance Management, Advanced ERP Human Resource Features, Additional Human Resource Management Functions.                                                                                                      | <b>07</b> |
| <b>Unit 6</b> | <b>Applications of ERP and Case Studies :</b> ERP Applications in Manufacturing Industries, ERP Applications in Service and Healthcare Sectors, ERP Applications in Retail, Banking, and E-Commerce, ERP in Supply Chain and Logistics Management, Case Studies on Successful ERP Implementations, Challenges, Benefits, and Lessons Learned from ERP Projects | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                   | <b>42</b> |

**Text Book:**

1. Ellen F. Monk, Bret J. Wagner, “Concepts in Enterprise Resource Planning” ,4th Edition, Cengage Learning

**Reference Books:**

1. Enterprise Resource Planning, McGraw Hill Education.
2. Enterprise Resource Planning: Concepts and Practice, PHI Learning.
3. ERP Demystified, Tata McGraw-Hill.
4. Enterprise Resource Planning Systems, Cambridge University Press.
5. Modern ERP: Select, Implement and Use Today's Advanced Business Systems, Lulu Press.

| Course code | Course Title                           | L  | T  | P  | C  |
|-------------|----------------------------------------|----|----|----|----|
| 7SKMDM8     | Software Testing and Quality Assurance | 03 | 00 | 00 | 03 |

### Course Learning Objectives:

1. To understand the fundamental concepts, techniques, and processes involved in software testing and quality assurance.
2. To apply software testing methods, test design techniques, and defect management practices for ensuring software quality.
3. To evaluate software quality, reliability, standards, and testing practices through quality assurance frameworks and real-world case studies.

**Course Outcomes** After Successful completion of this course, the student will be able to:

1. Understand the fundamentals of software testing, quality, and testing processes.
2. Explain testing theories and unit testing techniques.
3. Apply white-box testing techniques for software testing.
4. Analyze integration and system testing methods for software quality assessment.
5. Design test cases and test plans using appropriate testing techniques.
6. Evaluate software quality, reliability, and process improvement models.

|               | Course: Software Testing and Quality Assurance                                                                                                                                                                                                                                                        | L  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-1</b> | Introduction to Software Testing : Software Testing Process ,Objectives of Software Testing, Testing Techniques, Software Testing Life Cycle (STLC) ,Concept of Testing ,Types of Errors ,Stubs and Drivers ,Verification and Validation ,Different Types of Verification and Validation Mechanisms . | 07 |
| <b>Unit-2</b> | Concepts of Software Review: Code Inspection, Code Walkthrough,Software Testing Methods and Strategies: Software Testing Methods ,Testing Fundamentals ,Test Case Design ,White Box Testing and its Types ,Black Box Testing and its Types, Grey Box Testing.                                         | 07 |
| <b>Unit-3</b> | Software Testing Strategies ,Strategic Approach to Software Testing:Unit Testing ,Integration Testing ,Validation Testing ,System Testing ,Software Testing Metrics:Concept and Development of Testing Metrics, Different Types of Metrics Complexity,Test Cases, Test Design.                        | 07 |
| <b>Unit-4</b> | Defect Management,Defect Management Process, Defect Reporting, Metrics Related to Defects ,Using Defects for Process Improvement, Software Reliability, Formal Technical Reviews,Informal Technical Reviews.                                                                                          | 07 |



|               |                                                                                                                                                                                                                                                                                                                |    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-5</b> | Software Quality Control & Assurance, SQA Activities, Quality Management, Software Quality Factors, Quality Model ,Quality Metrics,Quality Improvement , Quality Standard, Quality Cost, Quality Cost Measures,ISO 9001,Six Sigma.                                                                             | 07 |
| <b>Unit-6</b> | Case Studies in Software Testing and Quality Assurance: Defect Management in an ERP System, E-Commerce Application Testing, Banking System Verification and Validation, Healthcare Management Software Quality Assurance, Agile Software Testing in a Startup Environment, Testing of AI-Based Chatbot System. | 07 |
| <b>Total</b>  |                                                                                                                                                                                                                                                                                                                | 42 |

**Text Book:**

1. Software Testing and Quality Assurance: Theory and Practice – *Kshirasagar Naik and Priyadarshi Tripathy*.

**Reference Books:**

1. *Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw-Hill Education, April 2009.*
2. *K. K. Aggarwal & Yogesh Singh, Software Engineering, 2nd Edition, New Age International Publishers, New Delhi, 2005*

### **B.Tech. Seven Semester (Electronics & Telecommunication Engineering)**

| <b>Course Code</b> | <b>Course Title</b>       | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|---------------------------|----------|----------|----------|----------|
| 7SEMDM4            | Electronic Circuit design | 03       | 00       | 00       | 03       |

#### **Pre-requisites:**

1. (5SEMDM2) Electronic Devices & Circuits
2. (6SEMDM3) Analog & Digital communication

#### **Course Learning Objectives:**

1. To understand the design procedures of voltage regulators, Amplifiers, signal generators, timers, temperature controller and PLLs using analog and digital integrated circuits.
2. To analyze the functionality and performance of analog and digital electronic circuits for timing, control, and logic applications.
3. To apply electronic circuit design principles to develop simple application-oriented systems for sensing, control, timing, power regulation, and digital interfacing.

#### **Course Outcomes:**

After completion of this course the student shall be able to:

- CO1: Explain the operating principles, characteristics, and applications of voltage regulators, operational amplifiers used in electronic circuit design.
- CO2: Design of various applications of timer IC555.
- CO3: Analyze the sensor interface circuits using standard analog ICs.
- CO4: Design of comparator and PLLs using IC565.
- CO5: Design combinational and sequential digital circuits using logic gates.
- CO6: Design application-oriented electronic systems such as regulated power supplies, appliance timers, alarm circuits, battery chargers, LED temperature indicators, and sensor-based control circuits.

| <b>Unit</b>   | <b>Content</b>                                                                                                                                                                                                                         | <b>No. of Lectures Required</b> |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Unit-1</b> | Design of Voltage regulator using IC78XX and 79XX series, LM317 and LM723.                                                                                                                                                             | <b>07</b>                       |
| <b>Unit-2</b> | IC 555 Timer fundamentals, Design of Astable and Monostable circuits using IC 555, PWM generation using IC 555, waveform generator using IC8038.                                                                                       | <b>07</b>                       |
| <b>Unit-3</b> | Design of Temperature controller / indicator using thermocouple, resistance thermal detector using thermo sensors LM35, PLL using IC 565.                                                                                              | <b>07</b>                       |
| <b>Unit-4</b> | Design of inverting and non-inverting amplifiers, Design of summing and differential amplifier using IC 741, Design of Comparator, zero-crossing detector, Schmitt Trigger using IC 741.                                               | <b>07</b>                       |
| <b>Unit-5</b> | <b>Digital Circuit Design:</b> Design using logic gates, Combinational circuit design, Multiplexer and decoder applications, Flip-flop based circuits, Counter design, Shift register applications, Introduction to CMOS logic design. | <b>07</b>                       |
| <b>Unit-6</b> | <b>Application-Oriented Electronic Circuit Design:</b> Regulated power supply circuits, LED temperature indicator, Appliance timer, Siren/Alarm circuit, Sensor interface circuits, Battery Charger Circuit.                           | <b>07</b>                       |
|               | <b>Total</b>                                                                                                                                                                                                                           | <b>42</b>                       |

#### **Textbooks:**

1. Ramakant A. Gayakwad, "Operational Amplifiers and Linear Integrated Circuits", Pearson Education, 4th Edition, 2022.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design" Pearson, 6th Edition, 2018.

#### **Reference Books:**

1. Sergio Franco, "Design with Linear Integrated Circuits & Op-amps", McGraw-Hill Education, 4th Edition, 2014.
2. Paul Horowitz-W. Hill, "The art of Electronics", Cambridge publication, 3rd Edition, 2014.

| Course Code | Course Title                            | L  | T  | P  | C  |
|-------------|-----------------------------------------|----|----|----|----|
| 7SEMDM8     | Satellite and Optic Fiber Communication | 03 | 00 | 00 | 03 |

**Pre-requisites:**

1. (4SEMDM5) Basic Electronic Communication System
2. (5SEMDM6) Introduction to Wireless Communication

**Course Learning Objectives:**

1. To make Understand the fundamentals of satellite communication systems.
2. To Analyze satellite subsystems, link design, and communication techniques.
3. To Explain the principles of optical fiber communication.
4. To Study optical sources, detectors, fiber characteristics, and modern optical networks.

**Course Outcomes:**

After completion of this course the student shall be able to :

**CO1:** Explain the fundamentals of satellite communication systems, , satellite frequency bands, and various satellite orbits.

**CO2:** Analyze Orbital mechanics and describe satellite subsystems, earth station components, and transponders.

**CO3:** Evaluate basic satellite link budget calculations and describe the applications of satellite communication in navigation,

**CO4:** Explain the principles of optical fiber communication, light propagation and different types of optical fibers.

**CO5:** Describe the transmission characteristics of optical fiber.

**CO6:** Elaborate the performance of various optical sources and detectors.

| Unit         | Content                                                                                                                                                                                                                                                                                       | L         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit-1       | <b>Fundamentals of Satellite Communication:</b> Architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, Frequency spectrum and satellite frequency bands, Types of satellite orbits: GEO, MEO, LEO.                             | 07        |
| Unit-2       | <b>Orbital Mechanics and Satellite Systems:</b><br>Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, concepts of Solar day and Sidereal day.<br><b>Satellite subsystems:</b> Payload, TT&C, Power, Thermal Control, AOCS. | 07        |
| Unit-3       | <b>Link Analysis and Applications:</b><br><b>Link Analysis :</b> Uplink and downlink ,Link budget analysis , C/N ratio.<br>GPS: Radio and Satellite navigation, Position, Location in GPS, GPS receiver operation, Differential GPS.                                                          | 07        |
| Unit-4       | <b>Fundamentals of Optical Fiber Communication:</b><br>Optical communication system, Optical fiber structure, Light propagation and Total Internal Reflection , Acceptance angle and Numerical Aperture, Types of optical fibers: Step-index, Graded-index, Single-mode, Multimode Fibers     | 07        |
| Unit-5       | <b>Transmission Characteristics of optical fiber:</b><br>Attenuation, Material absorption losses, Linear and Non linear scattering losses, Fiber bend losses, Dispersion.                                                                                                                     | 07        |
| Unit-6       | <b>Optical Sources and Optical Detectors :</b><br><b>Optical sources:</b> Basic Concept, Optical emission from semiconductors, Light Emitting Diode and LASER diode.<br><b>Optical detectors:</b> Principle of Photodiode, P-i-N Photodetector and Avalanche Photodetector.                   | 07        |
| <b>Total</b> |                                                                                                                                                                                                                                                                                               | <b>42</b> |

#### Textbooks:

1. Pratt Timothy and Bostian W. Charles, “Satellite Communication”, Willey Int. Pub., New York, 3<sup>rd</sup> edition, 2021.
2. G. Keiser, “Optical Fiber Communication”, McGraw Hill International, 5<sup>th</sup> edition, 2016.

#### Reference Books:

1. Dennis Roddy, “Satellite Communication”, McGraw Hill Int, New York, 4<sup>th</sup> edition, 2006.
2. Robert M Gagliardi, “Satellite Communication”, CBS Publication, 2<sup>nd</sup> Edition, 1991.
3. Seniors J. M., “Optical Fiber Communication and Applications”, Pearson Education, 3<sup>rd</sup> edition, 2010.

**B.Tech. Seven Semester (Information Technology Engineering)**

| Course Code | Course Title                   | L  | T  | P  | C  |
|-------------|--------------------------------|----|----|----|----|
| 7SNMDM4     | Management Information Systems | 03 | 00 | 00 | 03 |

**Course Prerequisite:** - NIL

**Course Objectives:**

1. To understand the concept, scope, and components of Management Information Systems (MIS) and their role in organizations.
2. To learn the classification, structure, and types of information systems (TPS, MIS, DSS, EIS) and how they support business processes.
3. To explore enterprise systems (ERP, CRM, SCM), e-business, and business intelligence tools to assess their impact on organizational efficiency.
4. To gain knowledge of system planning, acquisition, implementation strategies, and SDLC models to design and manage effective information systems.
5. To understand cybercrime, cyber law, information security management, and emerging technologies like blockchain in the context of MIS.
6. To investigate contemporary issues such as cloud computing, mobile computing, data analytics, and strategic information systems for managerial decision-making.

**Course Outcomes:**

On completion of the course, the students will be able to:

1. Define MIS, explain its scope, and describe its role in supporting organizational decision-making.
2. Classify and differentiate between various types of information systems and evaluate their applications in business contexts.
3. Demonstrate the ability to apply enterprise systems (ERP, CRM, SCM) and e-business solutions to real-world organizational problems.
4. Design and propose system development strategies using SDLC models and CASE tools for effective MIS implementation.
5. Analyse and apply cyber threats, information security controls, and understand legal and ethical implications of information systems.

6. Evaluate emerging MIS trends (cloud, mobile, analytics) and propose strategic uses of information systems for competitive advantage.

|               | <b>Subject: Management Information Systems</b>                                                                                                                                                                                                                                                                                                 | <b>L<br/>(Hrs)</b> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <b>Unit-1</b> | <b>Introduction to MIS &amp; Foundations</b><br>Concept, definition and scope of MIS, Nature and components of MIS, Structure and classification of information systems, Information systems and organizations, Importance of MIS in managerial decision-making, Management challenges of IT, Ethical and social issues in information systems | <b>07</b>          |
| <b>Unit-2</b> | <b>Business Applications of Information Systems</b><br>Types of information systems (TPS, MIS, DSS, EIS etc.), Systems for collaboration and social business, E-business and e-commerce systems, Enterprise Systems: ERP, CRM, SCM, Business Intelligence and Knowledge Management Systems                                                     | <b>07</b>          |
| <b>Unit-3</b> | <b>Management of Information Systems</b><br>Information system planning, System acquisition and selection, System implementation strategies, System development approaches, SDLC models (waterfall, prototype, iterative), Computer-assisted software engineering tools                                                                        | <b>07</b>          |
| <b>Unit-4</b> | <b>System Analysis &amp; Design in MIS</b><br>System analysis process and requirements gathering, Methodologies for MIS design, Structured analysis tools and techniques, Alternative system building approaches, Organizational change and IS development, Business process re-engineering                                                    | <b>07</b>          |
| <b>Unit-5</b> | <b>Information Security &amp; Cyber Issues</b><br>Introduction to cyber space and cyber law, Cybercrime: types, origins and classifications, Cybercriminals: global and Indian perspectives<br>Information security management, Internet security defenses and controls, System audit and control, Emerging issues (blockchain basics)         | <b>07</b>          |
| <b>Unit-6</b> | <b>Emerging Trends &amp; Contemporary Issues in MIS</b><br>Trends in MIS: mobile computing, cloud computing, Data warehouses, data mining and analytics, Knowledge work systems and expert systems, Strategic information systems, Ethical and social issues revisited in digital environment, Case studies and managerial applications        | <b>07</b>          |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                   | <b>42</b>          |

**Text Book:**

1. D P Goyal, *Management Information Systems–Managerial Perspective*, Macmillan, 3rd Edition, 2010

**Reference Books:**

1. Management Information Systems: Managing the Digital Firm (17th Edition) , Kenneth C. Laudon & Jane P. Laudon.
2. Management Information Systems, James A. O'Brien & George M. Marakas
3. Apache OFBiz for Ecommerce and ERP – <https://ofbiz.apache.org/>



| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 7SNMDM8     | Block-chain Technology | 03 | 00 | 00 | 03 |

**Course Pre-requisites:** Introduction to cyber security, Fundamentals of Cryptography

**Course Learning Objectives:**

1. To Understand the origin, evolution, and key features of blockchain technology, including cryptographic concepts
2. To Analyze the structure and operations of blockchain architecture, including block components, architecture layers, and various consensus algorithms.
3. To Understand the principles and working of cryptocurrencies
4. To Study the concept of smart contracts.
5. To Describe the Ethereum blockchain platform.
6. Analyze various blockchain platforms and tools including Corda, Quorum, Multichain, and BaaS.

**Course Outcomes:**

On completion of the course, the students will be able to:

1. Explain the evolution, features, and cryptographic basics of blockchain technology.
2. Analyze the architecture and operation of blockchain systems
3. Demonstrate an understanding of cryptocurrencies
4. Design and deploy basic smart contracts using blockchain development tools.
5. Describe the architecture, components, and working of the Ethereum blockchain platform.
6. compare and evaluate major blockchain platforms for suitable application use.

|               | Subject: Blockchain                                                                                                                                                                           | L (Hrs)   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Introduction To Blockchain:</b><br>History of Blockchain, Features of Blockchain, Cryptographic Primitive: Hashing, Digital Signatures, Types of Blockchains: Public, Private, Consortium. | <b>07</b> |
| <b>Unit-2</b> | <b>Blockchain Architecture and Consensus:</b><br>Block structure and Blockchain operation, Blockchain architecture layers, Consensus Algorithms: Proof of Work, Proof of Stake,               | <b>07</b> |

|               |                                                                                                                                                                                        |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | Delegated Proof of Stake.                                                                                                                                                              |           |
| <b>Unit-3</b> | <b>Bitcoin:</b><br>Introduction to Cryptocurrency, Working of Bitcoin, Mining and consensus in Bitcoin, Bitcoin Wallets                                                                | <b>07</b> |
| <b>Unit-4</b> | <b>Smart Contracts and Development Tools:</b><br>Introduction to Smart Contracts, Solidity Programming Basics, Smart Contract Lifecycle, Tools for Smart Contract Development.         | <b>07</b> |
| <b>Unit-5</b> | <b>Ethereum Blockchain Platform:</b><br>Introduction to Ethereum, Ethereum Architecture, Ethereum Virtual Machine (EVM), Ethereum Applications.                                        | <b>07</b> |
| <b>Unit-6</b> | <b>Blockchain Platforms and Tools:</b><br>Overview of Corda, Quorum, Multichain, Blockchain-as-a-Service (BaaS), Development Tools and SDKs, Comparison of Major Blockchain Platforms. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                           | <b>42</b> |

#### **Text Book:**

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.

#### **Reference Books:**

1. ArshdeepBahga, Vijay Madisetti, “Blockchain Applications: A Hands on Approach”, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O’Reilly, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” Create Space Independent Publishing, 2016.
4. Joel Sklar: Text Book of Web Design, CENGAGE Learning.

### **B.Tech. Seventh Semester Industrial IoT**

| Course Code | Course Title                  | L  | T  | P  | C  |
|-------------|-------------------------------|----|----|----|----|
| 7STMDM4     | Industrial Internet of Things | 03 | 00 | 00 | 03 |

**Course Pre-requisite:** 4STMDM1 Fundamentals of IoT

#### **Course Objectives:**

1. To introduce the basic concepts of Industrial Internet of Things (IIoT), cyber security, deployments and management methodologies for industrial (IoT).
2. To understand Localization and Tracking in IIoT Networks and fundamentals of industry 4.0.
3. To develop knowledge of next generation sensors, Product Life cycle Management and big data analysis along with IoT Applications in industrial sectors.

#### **Course Outcomes:**

1. Demonstrate knowledge about fundamental concepts of IIoT and Cyber Security in Industry 4.0.
2. Elaborate knowledge of IIoT system deployment, monitoring, control and management.
3. Comprehend different localization and tracking techniques in IIoT Network
4. Explain basic factors and emerging issues of industry 4.0
5. Discuss industrial Sensors, Product Life cycle Management and basics of big data and data analysis
6. Summarize functioning of various industries using IoT and applications of UAV in industries

|               | Course Name: Industrial Internet of Things                                                                                                                                                                                                                                               | Hrs. |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Unit-1</b> | <b>Introduction to Industrial IoT:</b><br>Introduction to Industrial Internet system, Definition, IoT v IIoT, Industrial process, Key enablers of IIOT, basics of Cyber Security in Industry 4.0                                                                                         | 7    |
| <b>Unit-2</b> | <b>Industrial IoT Methodology:</b><br>Operating systems used in IIoT deployments, Networking and wireless communication protocols used in IIoT deployments. Three Tier Industrial IoT System Architecture, Overview of Smart Remote Monitoring Unit, components, control and management. | 7    |
| <b>Unit-3</b> | <b>Localization and Tracking in IIoT Networks</b><br>Introduction to device localization and tracking; different types of localization techniques, Radio-Frequency Identification (RFID) and fingerprinting, Device diversity/heterogeneity issue in IIoT networks.                      | 7    |

|               |                                                                                                                                                                                                  |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>Introduction to 4.0 Industry:</b><br>Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected business perspective                | 6         |
| <b>Unit-5</b> | <b>Industry 4.0 and introduction to big data analysis:</b><br>Next Generation Sensors, Collaborative Platform and Product Life cycle Management, introduction to Big Data and Advanced Analysis. | 6         |
| <b>Unit-6</b> | <b>Industrial IoT Applications:</b><br>Overview of Factories and Assembly Line, Food Industry, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries.                    | 7         |
|               | <b>Total</b>                                                                                                                                                                                     | <b>40</b> |

**Text Book:**

1. Industrial Internet of Things: Technologies, Design and Applications – Sudan Jha, Usman Tariq, Gyanendra Prasad Joshi, Vijender Kumar Solanki, CRC Press, 2022.

**Reference Books:**

1. “Industry 4.0: The Industrial Internet of Things”, Alasdair Gilchrist, Apress, 2016
2. “Introduction to Industrial Internet of Things and Industry 4.0”, Sudip Misra, Chandana Roy, Anadarup Mukherjee, CRC Press, 2021
3. “Hands on Industrial Internet of Things”, Giacomo Veneri, Antonio Capasso, Packt Press, 2018.

### B.Tech. Seventh Semester (Mechanical Engineering)

| Course Code | Course Title          | L  | T  | P  | C |
|-------------|-----------------------|----|----|----|---|
| 7SMMDM4     | Industrial Automation | 03 | 00 | 00 | 3 |

#### Course Prerequisites:

1. Knowledge of production processes and manufacturing techniques
2. Knowledge of Engineering graphics

#### Course Learning Objectives:

CLO1. To study the concepts of Automation in industries.

CLO2. To learn the importance of product design suitable for automation.

CLO3. To study the functioning of computer aided manufacturing and CIM.

#### Course Outcomes:

Students will be able to –

1. Understand the concepts of automation and its importance in industries.
2. Understand the basics of CNC technology and apply the programming knowledge.
3. Understand the concept of programming logic controller.
4. Understand and apply the knowledge of robotics in industries.
5. Understand the knowledge of FMS and ASRS and also demonstrate the design and application of AGV.
6. Understand the concept of CIM and CAQC.

|               | <b>Subject:</b> Industrial Automation                                                                                                                                                                                                                                                                                                                                            | <b>L</b> |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Unit-1</b> | <b>Introduction:</b> Automation & its types, Automation for mass manufacturing and assembly, Reasons for automating, Automation strategies, Types of automated assembly systems, part feeding devices, Automated flow lines, Control function, General terminology and analysis of automated flow line, Partial automation, Line balancing.                                      | 7        |
| <b>Unit-2</b> | <b>Numerical Control/Computer Numerical Control (NC/CNC):-</b> Basic concept, N.C. controls- point to point , straight cut and continuous path control, machine control units, open and closed loop system, NC machine components, CNC & DNCs, Manual part programming formats, Various Programming codes, Manual part programming for drilling, Milling and turning operations, | 7        |

|               |                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | programming language- APT.                                                                                                                                                                                                                                                                                                                                                                         |    |
| <b>Unit-3</b> | <b>Programmable Logic Control (PLC):</b> Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Process Safety Automation: Levels of process safety through use of PLCs, Introduction to DCS.                                                                                                                              | 7  |
| <b>Unit-4</b> | <b>Robotics:-</b> Evolution of industrial robots, Robots anatomy, Arm geometry, drive system and end efforts, sensors, Evolution of geometrical configurations for robots, Programming techniques of Robots, Application of Robots in manufacturing- part handling, part processing and part building, Technical Specifications of a Robot.                                                        | 7  |
| <b>Unit-5</b> | <b>Computer Aided Process Planning (CAPP) &amp; Flexible Manufacturing System (FMS):</b> Introduction to CAPP, Retrieval type process planning system, Generative process planning systems, Benefits of CAPP. Introduction of FMS, FMS Components, FMS Application & Benefits, Automated Guided Vehicle System (AGVS), AGVS Application, Vehicle Guidance technology, Vehicle Management & Safety. | 7  |
| <b>Unit-6</b> | <b>Computer Integrated Manufacturing (CIM):</b> Introduction, Sequence of functions in CIM, elements of CIM system, CIM Wheel, Structure of CIM database system, Guidelines for CIM development, Benefits of CIM, Introduction to automated inspection, Advantages over traditional method. On-line & offline inspection, CMM construction, types & working.                                       | 7  |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                       | 42 |

#### **Textbooks:**

1. Production system, Automation and CIM; Mikell P. Groover, Pearson Publications.
2. CNC Machines; M.Adithan & B.S.Pabla; New Age International.
3. Programmable Logic Controllers: Principles and Applications; John W. Webb and Ronald A. Reis, 5th Edition, Prentice Hall Inc., New Jersey, 2003

#### **Reference Books:**

1. Robotics; Yarem Koren, Mcgraw Hill.
2. CAD/CAM/CIM ; Radhakrishnan & Subramaniam; New age International.
3. Computer aided Manufacturing; P.N.Rao, N.K.Tiwari and & T.K.Kundra; Tata Mcgraw Hill

| Course Code    | Course Title                                 | L  | T  | P  | C |
|----------------|----------------------------------------------|----|----|----|---|
| <b>7SMMDM8</b> | <b>Robotics &amp; Industrial Application</b> | 03 | 00 | 00 | 3 |

### Course Prerequisites:

1. Basics concepts of Engineering mathematics.
2. Basics concepts of computer programming.

### Course Learning Objectives:

- CLO1. To learn the fundamentals of robotics, it's various configurations & end-effectors.  
CLO2. To learn the various drives & sensors used in industrial robots.  
CLO3. To learn the Robot Kinematics, Programming & Economic evaluation.

### Course Outcomes:

Students will be able to –

1. Understand the fundamentals of robotics, robot anatomy, configurations, and specifications.
2. Understand categories and different types of end-effectors and design considerations for end effectors.
3. Demonstrate the working principles of pneumatic, hydraulic, and electric drives in robotic systems.
4. Evaluate the functionalities of contact and non-contact sensors like vision sensors, proximity sensors, and wrist force sensors.
5. Understand the concept of Robot Kinematics & Programming.
6. Apply the knowledge to identify the robot configuration suitable for a specific application.

|               |                                                                                                                                                                                                                                                                                                                                                                        |          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|               | <b>Subject:</b> Robotics & Industrial Application                                                                                                                                                                                                                                                                                                                      | <b>L</b> |
| <b>Unit-1</b> | <b>Fundamentals of Robotics-</b> Introduction, Automation & Robotics-robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot specifications.                                                                                       | 7        |
| <b>Unit-2</b> | <b>Robots end-effectors</b> -classification of end-effectors, mechanical grippers, hooking or Lifting grippers, grippers for molten metal, plastics, vacuum cups, magnetic grippers Electrostatic grippers, multiple grippers, internal & external grippers, drive systems for grippers, active & passive grippers. Design consideration in gripper, gripper analysis. | 7        |
| <b>Unit-3</b> | <b>Robot drives &amp; control-</b> Pneumatic power drives, hydraulic systems,                                                                                                                                                                                                                                                                                          | 7        |

|               |                                                                                                                                                                                                                                                                                                                                 |    |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | electric drives, robot controllers-servo and non servo systems, motion control of robots, point to point and continuous path control.                                                                                                                                                                                           |    |
| <b>Unit-4</b> | <b>Robot Sensors-</b> Features, Contact type sensors:- wrist force sensor, binary & analog touch sensor, Artificial skins, force, torque, encoders, position, velocity sensors,<br><b>Non contact type sensors-</b> vision sensor, proximity, range sensors, safety measures in robot.                                          | 7  |
| <b>Unit-5</b> | <b>Robot Kinematics &amp; Programming –</b><br><b>Robot Kinematics-</b> Forward & reverse kinematics, forward and reverse transformation of two DOF & three DOF 2-D manipulator, homogeneous transformations.<br><b>Robot Programming-</b> Teaching of robots, robot programming methods. Robot programming in formal language. | 7  |
| <b>Unit-6</b> | <b>Industrial Applications of robots-</b> Part Handling: Pick & Place, Palletizing, Loading and Unloading, material Handling<br><b>Part processing:</b> Machining, Welding, Painting, heat Treatment<br><b>Part Building:</b> Assembly, Part Integration<br><b>Part Inspection:</b> Gauging, Inspection for Quality attributes  | 7  |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                    | 42 |

#### **Text Books:**

1. Industrial Robotics by M. P. Groover, McGraw Hill.
2. Robotics for Engineering, Korean Yoram, McGraw Hill.

#### **Reference Books:**

1. Robotics Technology & Flexible Automation by S. R. Deb, Tata McGraw Hill
2. Robots & Manufacturing automation by Asfahal, C. Ray, John Wiley
3. Robotic Engineering by Richard D. Klafter, PHI.