LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
23AD81	Introduction to Artificial Intelligence	ASE, CE, ECE,EEE & ME
23AD82	Fundamentals of Data Science	ASE, CE, ECE,EEE & ME
23AD83	Introduction to Cloud Computing	ASE, CE, ECE,EEE & ME
23AD84	Data Analytics	ASE, CE, ECE,EEE & ME
23AE81	PRINCIPLES OF FLIGHT	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE82	SPACE SCIENCE	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE83	AIRCRAFT INSTRUMENTATION	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE84	AIR TRANSPORTATION SYSTEMS	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AM81	Python Programming for AI & ML	ASE, CE, ECE,EEE & ME
23AM82	AI in healthcare	ASE, CE, ECE,EEE & ME
23AM83	Fundamentals of Machine Learning	ASE, CE, ECE,EEE & ME
23AM84	Introduction to Deep learning	ASE, CE, ECE,EEE & ME
23CE81	Disaster Management	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE82	Climate change impact on Eco system	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE83	Environmental Sanitation	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE84	Introduction to Remote Sensing and GIS	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE85	Water Supply Systems	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE86	Sustainability in Engineering Practices	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CS81	Introduction to Java Programming	ASE, CE, ECE,EEE & ME
23CS82	Principles of Operating Systems	ASE, CE, ECE,EEE & ME
23CS83	Principles of Database Management Systems	ASE, CE, ECE,EEE & ME
23CS83	Principles of Database Management Systems	ASE, CE, ECE,EEE & ME
23CS84	IoT based smart Systems	ASE, CE, ECE,EEE & ME
23EC81	Linear and Digital IC Applications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC82	Principles of communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC83	Fundamentals of VLSI Design	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC84	Principles of Cellular & Mobile communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC85	Fundamentals of Satellite Communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Course Code	Course Name	Offered to the branches
23EE81	Basic Control System	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE82	Basic Electrical Measurements	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE83	Utilization of Electrical Energy	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE84	Electric Vehicles	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE85	Concepts of Energy Auditing & Management	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE86	Electrical Wiring Estimation and Costing	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23IT81	Computer System Architecture	ASE, CE, ECE,EEE & ME
23IT82	Introduction to Programming in Java	ASE, CE, ECE,EEE & ME
23IT83	Principles of Software Engineering	ASE, CE, ECE,EEE & ME
23ME81	Sustainable Energy Technologies	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME82	Introduction to Industrial Robotics	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME83	Applied Operations Research	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME84	Entrepreneurship	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME85	Additive Manufacturing	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME86	Vehicle Technology	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT

B.Tech-AI&DS 23AD81-INTRODUCTION TO ARTIFICIAL INTELLIGENCE

L	T	P	Cr.
3	0	0	3

Pre-requisite : Basic Engineering Mathematics Knowledge

Course Educational Objective : The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, reasoning, and learning. Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

Course Outcomes: At the end of this course, the student will be able to

CO1: Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
CO2: Apply the basic principles of AI in problem solving**. (Apply-L3).**
CO3: Illustrate the different searching algorithms to find and optimize the solution for the given problem**. (Apply-L3)**
CO4: Illustrate the different gaming algorithms and identify the importance of knowledge representation in Artificial Intelligence. **(Apply- L3)**
CO5: Describe the use of predicate logic to represent the knowledge in AI domain. **(Understand - L2)**

UNIT I

Introduction: What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II

Problem Solving: Problem-Solving Agents, Example Problems, searching for Solutions, search algorithms terminologies, properties of search algorithms, types of search algorithms. Informed and Uninformed Search Strategies, **Informed (Heuristic) Search Algorithms**: Best first search, A* Algorithm, AO* Algorithm and Local Search Algorithms. Searching with Non deterministic Actions.

UNIT III

Search Algorithms: **Uniformed / Blind Search Algorithms**: Breadth- first Search, Depth- first Search, Depth-limited Search, Iterative deepening depth-first search, Uniform cost search, Bidirectional Search.

UNIT IV

Adversarial Search/ Game Playing: Introduction, Minimax algorithm, Alpha-Beta pruning. **Knowledge-Based Agent**: Architecture, Knowledge base Levels, Types , Knowledge Representation mappings, forward and backward chaining/Reasoning techniques of inference engine , Approaches of knowledge representation, issues in knowledge representation.

UNIT V

Knowledge Representation Techniques: Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, What is Reasoning? Types of Reasoning and Reasoning Systems for Categories, The Internet Shopping World.

TEXTBOOKS:

1. StuartRussell,PeterNorvig,"ArtificialIntelligence:AModernApproach",3rdedition,Prentice Hall,2009.Canalsouse 2nd Ed.,PearsonEducationInternational,2003.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India,2011
3. Rich & Knight, Artificial Intelligence, second edition,Tata Mc GrawHill.

REFERENCE BOOKS:

1. Nils Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998.
2. David Poole, Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge Univ. Press, 2010.
3. Ronald Brachman, "Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.
4. Frank van Harmelen, Vladimir Lifschitz, Bruce Porter (Eds), "Handbookof Knowledge representation", Elsevier, 2008.
5. Ivan Bratko, "Prolog Programming for Artificial Intelligence", 4th Ed., Addison-Wesley, 2011.

B.Tech-AI & DS 23AD82 -FUNDAMENTALS OF DATA SCIENCE

L	T	P	Cr.
3	0	0	3

Prerequisite: Programming knowledge

Course Outcomes:

CO1: Identify basic building blocks of python to solve mathematical problems. (Understand)
CO2: Describe the key concepts in data science (Remember)
CO3: Enumerate the fundamentals of NumPy (Understand)
CO4: Demonstrate the fundamentals of Pandas (Understand)
CO5: Demonstrate data analysis, manipulation and visualization of data using Python libraries (Apply)

UNIT I

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements. Strings: Creating strings and basic operations on strings, string testing methods. Lists, Dictionaries, Tuples.

UNIT II

What is Data Science? Data Science life cycle, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.

UNIT III

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, creating ndarrays , Data Types for ndarrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

UNIT IV

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing & selection, and filtering.

UNIT V

Data Preprocessing: Data Loading, Storage, and File Formats - Reading and Writing data in textformat, binary data formats, interacting with html and web apis, interacting with databases; Data Wrangling: Clean, Transform, Merge, Reshape - Combining and Merging Data Sets, Reshapingand Pivoting, Data Transformation. String Manipulation; Data Aggregation.

TEXTBOOKS:

1. Wes McKinney, "Python for Data Analysis",O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
3. Python For Data Analysis (O Reilly, Wes Mckinney)

REFERENCE BOOKS:

1. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
3. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

B.Tech-AI&DS 23AD83- INTRODUCTION TO CLOUD COMPUTING

L	T	P	Cr.
3	0	0	3

Pre-requisite: Computer networks, and Operating Systems.

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to

CO1: Illustrate the key dimensions of the challenge of Cloud Computing (Understand – L2)

CO2: Classify the Levels of Virtualization and mechanism of tools. (Understand – L2)

CO3: Analyze Cloud infrastructure including Google Cloud and Amazon Cloud. (Analyze L4)

CO4: Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud. (Apply – L3)

CO5: Assess control storage systems and cloud security, the risks involved its impact and develop cloud application (Analyze – L4)

UNIT I:

Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, Performance, Security and Energy Efficiency.

UNIT II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:

Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS, and Microsoft Azure.

UNIT IV:

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource

Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V:

Storage Systems: Evolution of storage technology, storage models, file systems and databases, distributed file systems, general parallel file systems. Google file system.

TEXTBOOKS:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

REFERENCE BOOKS:

1. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
3. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

B.Tech-AI&DS 23AD84- DATA ANALYTICS

L	T	P	Cr.
3	0	0	3

Prerequisites: Database Management Systems, Knowledge of probability and statistics.

Course Educational Objectives:

- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of algorithms.
- To understand the various search methods and visualization techniques.

Course Outcomes: After completion of this course students will be able to

CO1: Understand the impact of data analytics for business decisions and strategy
CO2: Carry out data analysis/statistical analysis
CO3: To carry out standard data visualization and formal inference procedures
CO4: Design Data Architecture
CO5: Understand various Data Sources.

Syllabus:

UNIT – I: Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT – II: Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III :Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc. Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT – IV: Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and analyze for prediction

UNIT – V: Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

Textbooks:

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3 rd Edition, Morgan KaufmannPublishers.

Reference Books:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway LabsJeffrey D Ullman Stanford Univ.

B.Tech. **23AE81- PRINCIPLES OF FLIGHT**

L	T	P	Cr.
3	0	0	3

Course Educational Objectives: To learn basic aspects of aerodynamics, propulsive systems, function of flight vehicle structural components, performance of flight at unaccelerated and accelerated condition and concepts of stability requirements during flight.

Course Outcomes: At the end of the semester, the student will be able to
CO1: Classify the various forces and moments acting on an aircraft [Understand-L2]
CO2: Describe the working principles of various aircraft engines systems [Understand-L2]
CO3: Describe various structural elements of flight vehicle [Understand-L2]
CO4: Analyze the performance of flight during manoeuvring [Analyze-L4]
CO5: Apply the conditions of stability principles on aircraft [Apply-L3]

UNIT - I
AERODYNAMICS: Components of Airplane and Their Functions, Classifications, Airfoils - Airfoil Nomenclature, Classifications of NACA Airfoils, Wing Geometry, Aerodynamic Forces, Lift, Drag and Moment Coefficients, Centre of Pressure, Aerodynamics Centre, Pressure Distribution Over Aerofoil, Types of Drag.

UNIT - II
PROPULSION: Air-breathing Engines - Engine Theory, Classification of Air-breathing Engine Propulsion system – Propeller, Jet propulsion – The thrust equation, Turbojet engine, Turbofan engine, Ramjet engine, Rocket Engine.

UNIT-III
FLIGHT VEHICLE STRUCTURES: Fuselage-Monocoque, Semi-Monocoque Structures, Components of Wing, Bulkheads, Aircraft Materials-Metallic and Non-Metallic Materials, Composite Materials

UNIT - IV
AIRPLANE PERFORMANCE: Level Flight, Drag Polar, Thrust required for level and unaccelerated flight, Power required for level and unaccelerated flight, Rate of Climb, Absolute and Service Ceilings, Time to Climb, Range and Endurance – Jet Airplane. Take-off and Landing Performance, Turning flight

UNIT – V
STABILITY AND CONTROL: Definition of Airplane's axes, Concept of Stability and Control, Moments on the Airplane, Criteria for Static Longitudinal Stability – Quantitative Discussions, Static Longitudinal Control - Calculation of Elevator angle to trim, Directional Static Stability and control, Lateral Static Stability and control

REFERENCES:

1. John D Anderson Jr, and Mary L Bowden., "Introduction to Flight"., McGraw-Hill, 9th Edition, 2022
2. Robert C Nelson., "Flight Stability and Automatic Control"., TBS; Second 2nd Edition (2007)
3. Jan Roskam., "Airplane Flight Dynamics and Automatic Flight Controls"., Dar corporation. 2003
4. C. Kermode., "Mechanics of Flight"., Pearson Education Limited; 12th Edition, 2012

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B.Tech. **23AE82- SPACE SCIENCE**

L	T	P	Cr.
3	0	0	3

Course Educational Objectives: To learn basic aspects of solar system, space vehicles, perturbations, an interplanetary trajectory issues, ballistic missile trajectories and material used of spacecraft.

Course Outcomes: At the end of the semester, the student will be able
CO1: To understand the basic aspects of avaition [Understand-L2]
CO2: To understand the working of space vehicles [Understand-L2]
CO3: To understand the basic asepcts of space mechanics [Understand-L2]
CO4: To understand the basic aspects orbital mechanics [Understand-L2]

UNIT I
BASIC CONCEPTS: History of Aviation – Types of Flying Machines – Aircraft, Rotorcraft, and space craft -- History of Spaceflight -– The Solar System and the Copernican Model -- Physical Properties and Structure of the Atmosphere: Temperature, Pressure and Altitude Relationships.

UNIT II
SPACE VEHICLES: Major Components of Rocket, Spacecraft, and their Functions -- Atmospheric Dynamics and its Influence on Flying Machines: Lift, Drag and Moment -- Kepler's Laws -- Newton's Law of Motions Applied to Aeronautics.

UNIT III
BASIC ASPECTS OF SPACE MECHANICS: Reference frames and Coordinate systems – The celestial sphere, The ecliptic, Motion of vernal equinox: Time and Calendar – Sidereal time, Solar time, Standard time – Space Environment.

UNIT IV
ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES: Satellite orbits and its types -- Space mission – types – Launch vehicle selection – Trajectories of rockets and missiles – Introduction to Rocket propulsion – Solid propulsion rockets – Liquid propulsion rockets -- Staging in rockets.

UNIT V
ORBITAL MECHANICS: Two-body motion – Circular, Elliptic, Hyperbolic and Parabolic orbits – Basic Orbital Elements – Ground trace – Hohmann transfer – Bi-elliptic transfer

REFERENCES:
1. W.E. Wiesel, "Spaceflight Dynamics", McGraw-Hill, 1997
2. Cornelisse, Schoyer HFR, Wakker KF, "Rocket Propulsion and Space Flight Dynamics", Pitman publications, 1984
3. Sutton. G.P and Oscar Biblarz "Rocket Propulsion Elements", Wiley-Interscience,7th Edition., 2000.

B.Tech. **23AE83-AIRCRAFT INSTRUMENTATION**

L	T	P	Cr.
3	0	0	3

Course Educational Objectives: To learn the conventional and modern control systems and working principle of different types of hydraulic and pneumatic systems, engine systems, auxiliary systems.

Course Outcomes: At the end of the semester, the student will be able

CO1: To identify the various types of controls in the airplane design [Understand-L2]

CO2: To understand the performance of hydraulic and pneumatic systems in the aircraft operation [Understand-L2]

CO3: To understand the performance of various engine systems and auxiliary systems of an aircraft [Understand-L2]

CO4: To understand the general maintenance practices of aircraft operation [Understand-L2]

UNIT - I

AIRPLANE CONTROL SYSTEMS: Conventional Control Surfaces – Power Assisted and Fully Powered Flight Controls – Power Actuated Systems, Engine Control Systems (FADEC) – Modern control systems - Digital Fly by Wire Systems – Auto Pilot System, Active Control Technology.

UNIT - II

AIRCRAFT SYSTEMS: Hydraulic and Pneumatic Systems – Components – Advantages, Working Principles - Typical Air Pressure System – Brake System - Typical Pneumatic Power System - Components, Landing Gear Systems – Classifications.

UNIT - III

ENGINE SYSTEMS: Fuel Systems for Piston and Jet Engines, Components of Multi Engines. Lubricating Systems for Piston and Jet Engines - Starting and Ignition Systems, Typical Examples for Piston, and Jet Engines.

UNIT - IV

AUXILIARY SYSTEM: Basic Air Cycle Systems – Vapour Cycle Systems - Oxygen Systems, Fire Protection Systems, De-icing, and Anti-Icing System.

UNIT - V

GENERAL MAINTENANCE PRACTICES: Jacking, levelling, and mooring, refuelling, and defueling of aircraft, safety precautions. Hydraulic and fluid systems precautions against contamination. Identification color coding, symbols, and other markings to identify the fluid systems.

REFERENCES

1. McKinley. J. L, Bent. R.D, Aircraft Maintenance and Repair, McGraw-Hill, 1993.
2. General Hand Books of Airframe and Power Plant Mechanics, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi1995.
3. Mekinley. J. L, Bent. R. D, Aircraft Power Plants, McGraw-Hill, 1993.
4. Pallet. E. H. J, Aircraft Instruments & Principles, Pitman & Co, 1993.
5. Treager. S, Gas Turbine Engine Technology, Third Edition, McGraw-Hill Education.

B.Tech. **23AE84-AIR TRANSPORTATION SYSTEMS**

L	T	P	Cr.
3	0	0	3

Course Educational Objectives: To learn the fundamental of air transportation, airline economics and principles of airline scheduling

Course Outcomes: At the end of the semester, the student will be able to
CO1: Understand Aviation Industry and Its Regulatory Authorities [Understand-L2]
CO2: Understand the basic aspects of air traffic control system [Understand-L2]
CO3: Understand the basic aspects of airline economics [Understand-L2]
CO4: Understand the principles of airline scheduling [Understand-L2]

UNIT- I
AVIATION INDUSTRY & ITS REGULATORY AUTHORITIES: Introduction, history of aviation evolution, development, growth, challenges. Aerospace industry, air transportation industry economic impact- types and causes. The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA). Safety regulations- risk assessment- human factors and safety, security regulations, environmental regulations.

UNIT-II
AIRSPACE: Categories of airspace- separation minima, airspace sectors- capacity, demand and delay. Evolution of air traffic control system- procedural ATC system, procedural ATC with radar assistance, first generation 'automated' ATC system, current generation radar and computer-based ATC systems.

UNIT- III
AIRCRAFT: Costs- project cash-flow, aircraft price. Compatibility with the operational infrastructure. Direct and indirect operating costs. Balancing efficiency and effectiveness payload-range, fuel efficiency, technical contribution to performance, operating speed and altitude, aircraft field length performance. typical operating costs.

UNIT- IV
AIRPORTS: Setting up an airport- airport demand, airport siting, runway characteristics- length, declared distances, aerodrome areas, obstacle safeguarding. Runway capacity- evaluating runway capacity- sustainable runway capacity. Runway pavement length, Manoeuvring area airfield lighting, aprons, Passenger terminals-terminal sizing and configuration. Airport demand, capacity, and delay.

UNIT - V
AIRLINES: Setting up an airline- modern airline objectives. Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements. Indirect operating costs. Aircraft- buy or lease. Revenue generation, computerized reservation systems, yield management, Airline scheduling.

REFERENCES:

1. Hirst, M., The Air Transport System, Woodhead Publishing Ltd, Cambridge, England, 2008.
2. Wensven, J.G., Air Transportation: A Management Perspective, Eighth Edition, shgate, 2015.
3. Belobaba, P., Odoni, A. and Barnhart, C., Global Airline Industry, Second Edition, Wiley, 2015.
4. M. Bazargan, M., Airline Operations and Scheduling, Second Edition, Ashgate, 2010.
5. Nolan, M.S., Fundamentals of Air Traffic Control, 5th edn., Thomson Learning, 2011.

B.Tech-CSE(AI&ML)	23AM81-Python Programming for AI & ML	L	T	P	Cr.
		3	0	0	3

Pre-requisite:
Python Programming, familiarity with mathematics.

Course Objectives: The main objectives of the course is to make students

- Learn Python programming fundamentals and libraries.
- To learn the basics of AI and apply various search algorithms to solve problems effectively.
- To understand and apply data handling and preprocessing techniques using NumPy and Pandas for effective data analysis and machine learning.
- Understand data handling, visualization, and preprocessing in Python.
- To understand and apply basic ML algorithms using Python.

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

- **CO1**: Learn how to use Python to work with lists, sets, tuples, and dictionaries, and apply loops and conditions to solve basic problems. **(Understand-L2)**
- **CO2**: Apply the basics of Artificial Intelligence, AI agents, and apply different search algorithms like BFS, DFS, Uniform Cost Search, Greedy Search, and A* to solve problems. **(Apply-L3)**
- **CO3**: Apply Python libraries such as NumPy and Pandas for efficient data manipulation and preprocessing. **(Apply-L3)**
- **CO4**: Understand the Visualize and explore data using tools like Matplotlib and Seaborn for effective data analysis and interpretation. **(Apply-L3)**
- **CO5**: Apply the basics of Machine Learning, its types and uses, and understand how supervised, unsupervised, and reinforcement learning methods work. **(Apply-L3)**

UNIT – I: Python Basic Data Structures
Python programming introduction, Creating, Accessing and Manipulating Lists, Sets, Tuples and Dictionaries, Understanding the differences among them, Applications of the Data Structures. Using Branching and Control loops with Data structures.

UNIT – II: Python for AI Concepts
Introduction to Artificial Intelligence, AI agents, Problem Solving, Search Algorithms: Informed searching strategies: BFS (Breadth-First Search) and DFS (Depth-First Search), Uniformed cost search.
Uninformed searching strategies: Best first Search, Greedy best first search, A* algorithm.

UNIT – III: NumPy, Pandas & Data Preprocessing
Introduction to Numpy: Arrays, Indexing, Operations, Introduction to Pandas: DataFrames, Series, Data Cleaning: Handling Missing Values, Outliers, Feature Encoding: Label Encoding, One-Hot Encoding, Feature Scaling: MinMax, StandardScaler, Data Splitting: Train-Test Split.

UNIT-IV: Data Visualization and Exploratory Data Analysis (EDA)
Introduction to Matplotlib, Seaborn, Plotting Line, Bar, Histogram, Box, and Heatmaps, Pair plots, Correlation Matrix, Visualizing Categorical & Numerical Data, Understanding Data Distributions & Patterns.

UNIT-V: Introduction to Machine Learning

Introduction of Machine Learning, Types of ML, Applications of ML, Supervised Learning: Linear Regression, Logistic Regression, K-Nearest Neighbours, Support Vector Machine, Introduction to Unsupervised Learning and Reinforcement Learning.

Text books:

1. Kenneth Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2019 (Unit-I)
2. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig (for AI concepts) (Unit-II)
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024 Python Machine Learning – Sebastian Raschka (Unit-III to V)

Reference books:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Ed., O'Reilly Media.
2. Stefanie Molin, Hands-On Data Analysis with Pandas, Packt Publishing, 2021.
3. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach (4th Edition), Pearson, 2020.
4. "Machine Learning", TomM. Mitchell, McGraw-HillPublication, 2017
5. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Ed.), O'Reilly Media, 2022.

E-resources:

1. https://www.w3schools.com/python/
2. https://pandas.pydata.org/docs/
3. https://www.geeksforgeeks.org/artificial-intelligence/
4. https://seaborn.pydata.org/
5. https://developers.google.com/machine-learning/crash-course

B.Tech-CSE(AI&ML)

23AM82-AI in healthcare

L	T	P	Cr.
3	0	0	3

Pre-requisite: Basic concepts of Artificial Intelligence

Course Objectives:

- To understand the need and significance of AI for Healthcare.
- To study advanced AI algorithms for Healthcare.
- To learn Computational Intelligence techniques.
- To understand evaluation metrics and ethics in intelligence for Healthcare systems.
- To learn various NLP algorithms and their application in Healthcare.
- To investigate the current scope, implications of AI for developing futuristic Healthcare

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

CO1: Understand the role of AI for handling Healthcare data. **(Understand-L2)**

CO2: Apply advanced AI algorithms for Healthcare problems. **(Apply-L3)**

CO3: Learn and apply various Computational Intelligence techniques for Healthcare applications. **(Apply-L3)**

CO4: Use evaluation metrics for evaluating Healthcare systems. **(Apply-L3)**

CO5: Analyze the role of connected medicine, digital health, and therapeutics in enhancing patient care and engagement. **(Analyze-L4)**

UNIT – I:

Overview of AI, a multifaceted discipline, Applications of AI in Healthcare – Prediction, Diagnosis, Personalized Treatment, Behavior Modification, Drug Discovery, Follow-up Care, etc. Realizing the potential of AI in Healthcare, Healthcare Data – Use Cases.

UNIT – II:

Knowledge Discovery using AI, Multi-classifier Decision Fusion (AI perspective), and Abstract AI Methods. Evolutionary Algorithms, Illustrative Medical Applications: Multiagent Infectious Disease Propagation and Outbreak Prediction, Automated Amblyopia Screening System (AI-based). Computational Intelligence Techniques (AI-based), Dimensionality Reduction Algorithms (AI approaches).

UNIT – III:

Model development and workflow, evaluation metrics, Parameters and Hyperparameters, Hyperparameter tuning algorithms, multivariate testing, Ethics of Intelligence.

UNIT-IV:

NLP tasks in Medicine, Low-level NLP components, High-level NLP components, NLP Methods, Clinical NLP resources and Tools, NLP Applications in Healthcare. Model Interpretability using Explainable AI for NLP applications.

UNIT-V:

Evidence-based medicine, Personalized Medicine, Connected Medicine, Digital Health and Therapeutics, Conversational AI, Virtual and Augmented Reality, Blockchain for verifying supply chain, patient record

access, Robot-Assisted Surgery, Smart Hospitals, Case Studies on use of AI for Disease Risk Diagnosis from patient data, Augmented Reality applications for junior doctors.

Text books:

1. Arvin Agah, Medical Applications of Artificial Systems, CRC Press
2. A Guide to Artificial Intelligence in Healthcare by Dr. Bertalan Meskó May 2024

Reference books:

1. Erik R. Ranschaert, Sergey Morozov, Paul R. Algra, Artificial Intelligence in Medical Imaging – Opportunities, Applications and Risks, Springer
2. Sergio Consoli, Diego Reforgiato Recupero, Milan Petkovic, Data Science for Healthcare – Methodologies and Applications, Springer
3. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, Gia Nhu Nguyen, Emerging Technologies for Health and Medicine, Wiley

E-resources:

1. https://www.coursera.org/learn/data-mining
2. https://www.ibm.com/cloud/learn/knowledge-discovery

B.Tech-CSE(AI&ML)

23AM83-Fundamentals of Machine Learning

L	T	P	Cr.
3	0	0	3

Pre-requisite: Probability and Statistics, Data Warehousing and Data Mining

Course Objectives:

- Understand the fundamental concepts, models, and algorithms in Machine Learning.
- Learn to apply core ML techniques to solve real-world problems using modern software tools.
- Develop the ability to independently explore, implement, and evaluate machine learning models.
- Gain experience through research-oriented tasks and hands-on practice with recent ML frameworks.

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

- **CO1:** Identify the characteristics of machine learning. (**Understand- L2)**
- **CO2:** Understand the Model building and evaluation approaches **(Understand- L2)**
- **CO3:** Apply regression algorithms for real-world Problems. (**Apply- L3)**
- **CO4:** Handle classification problems via supervised learning algorithms. **(Apply- L3)**
- **CO5:** Learn advanced learning techniques to deal with complex data **(Apply- L3)**

UNIT – I: Introduction to Machine Learning and Preparing to Model

Introduction to Machine Learning - Introduction, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Preparing to Model- Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT – II: Modelling & Evaluation, Basics of Feature Engineering

Modelling & Evaluation- Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability.

Evaluating Performance of a Model. Basics of Feature Engineering- Introduction.

Feature Transformation – Feature Construction, Feature Extraction, Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Linear Discriminant Analysis (LDA), Feature Subset Selection.

UNIT – III: Regression

Introduction to regression analysis, Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the linear regression model, Polynomial Regression Model, Logistic Regression, Regularization, Regularized Linear Regression, Regularized Logistic Regression.

UNIT-IV: Supervised Learning: Classification

Classification- Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps. Common Classification Algorithms - k-Nearest Neighbour (kNN), Support vector

Machines (SVM), Random Forest model.

UNIT-V: Other Types of Learning

Ensemble Learning- Bagging, Boosting, Stacking and its impact on bias and variance, AdaBoost,Gradient Boosting Machines, XGBoost.

Reinforcement Learning - Introduction, Q Learning.

Text books:

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition,2015.
2. Tom M. Mitchell, "Machine Learning', MGH, 1997.

Reference books:

1. Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge.
2. Peter Harington, "Machine Learning in Action" , Cengage, 1st edition, 2012.
3. Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge university press,2012.
4. Jason Brownlee, "Machine Learning Mastery with Python Understand Your Data, Create
5. Accurate Models and Work Projects End-To-End", Edition: v1.4, 2011.

E-resources:

1. https://www.datacamp.com/blog/what-is-machine-learning
2. https://www.tutorialspoint.com/machine_learning/machine_learning_regression_analysis.htm

B.Tech-CSE(AI&ML) **23AM84 - Introduction to Deep learning**

L	T	P	Cr.
3	0	0	3

Pre-requisite: Probability and Statistics, Programming Knowledge

Course Objectives: The objective of the course is to provide basic knowledge of

- Computer operating system structure and functioning, understand how Operating Systems
- evolved with advent of computer architecture, and comprehend the different CPU scheduling
- algorithms, page replacement algorithms, disk scheduling and identify best one.

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

- **CO1:** Apply the fundamentals of linear algebra to machine learning algorithms. **(Apply-L3)**
- **CO2:** Understand the fundamental building blocks of deep learning **(Understand- L2)**
- **CO3:** Apply the concepts of Convolutional Neural Networks to computer vision applications. **(Apply- L3)**
- **CO4:** Apply the concepts of Recurrent Neural Networks to Natural Language Processing. **(Apply- L3)**
- **CO5:** Apply the regularization techniques to improve the model performance**. (Apply- L3)**

UNIT – I: Mathematical foundations of Deep Learning

Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear dependence and span, Norms, Special kinds of matrices and vectors, Trace operations, Eigen value decomposition

UNIT – II: Fundamentals of Deep Learning

Anatomy of Neural Networks: Layers, Models, Loss functions and optimizers, Training Deep Networks: Cost Functions, Optimizers, Types of Deep Neural Networks

UNIT – III: Convolutional Neural Networks

Motivation, Convolution Operation, Types of layers, Pooling, LENET5 Architecture

UNIT-IV: Recurrent Neural Networks

Architecture of traditional RNN, Types and applications of RNN, Variants of RNNs, Word Embedding using Word2vec

UNIT-V: Regularization and Auto encoders

Regularization for Deep Learning: L1 and L2, Dropout, Data Augmentation, Early Stopping, Case study on MNIST data Auto encoders: Architecture, Implementation, Denoising Auto encoders, Sparse Auto encoders, Use cases.

Text books:

1. Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn, Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

E-resources:

Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22cs22/previewB.Tech.(Artificial Intelligence and Data Science) Deep Learning:

B.Tech. (Sem.) **23CE81-DISASTER MANAGEMENT**

L	T	P	Cr.
3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre- disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

Course Outcomes:

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

a. Affirm the usefulness of integrating management principles in disaster mitigation work
b. Distinguish between the different approaches needed to manage pre- during and post-disaster periods
c. Explain the process of risk management
d. Relate to risk transfer

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in

agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers& Distributors Pvt.Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh-Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., NewDelhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

REFERENCE BOOKS:

1. 'Disaster Management' edited by H K Gupta (2003), Universitiespress.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universitiespress.R. Nishith, Singh AK,
3. "Disaster Management in India: Perspectives, Issues and strategies" New Royal BookCompany."

B.Tech. (Sem.)	23CE82-CLIMATE CHANGE IMPACT ON ECO-SYSTEM	L	T	P	Cr.
		3	0	0	3

UNIT I:

Climate System; Climate, weather and Climate Change; Overview of Earth's Atmosphere; Vertical Structure of Atmosphere; Radiation and Temperature; Laws of Radiation; Heat-Balance of Earth Atmosphere System; Random Temperature Variation; Modelling Vertical Variation in Air Temperature; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes.

UNIT II:

Hydrologic Cycle: Introduction; Global water balance; Cycling of water on land, a simple water balance model;

UNIT III:

Climate Variables affecting Precipitation: Precipitation and Weather, Humidity, Vapor Pressure, Forms of Precipitation, Types of Precipitation; Cloud; Atmospheric Stability; Monsoon; Wind Pattern in India; Global Wind Circulation; Evaporation and Transpiration, Processes of Vadose Zone, Surface Runoff, Stream flow

UNIT IV:

Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

UNIT V:

Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios

B.Tech. (Sem.)	23CE83-ENVIRONMENTAL SANITATION	L	T	P	Cr.
		3	0	0	3

Pre-requisites: NIL

Course Educational Objective: This course teaches the basic terminology of Environmental sanitation, different methods for control of Communicable and non-communicable diseases, the control techniques for rodent and vectors, sanitation measures that are required in few Institutions, sanitation management aspects due to rural and refuse wastes.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Explain the basic terminology of Environmental sanitation, different diseases, rural and refuse sanitation **(Understand-L2)**

CO2: Identify the impacts and ways to control Communicable and non-communicable diseases **(Understand-L2)**

CO3: Review and assess the control approaches for rodent and insect vectors **(Understand-L2)**

CO4: Classify the appropriate sanitation measures for several institutions **(Understand-L2).**

CO5: Select the appropriate measures to be taken for rural and refuse management **(Understand-L2).**

UNIT-I

Environmental Sanitation Basics

Introduction, History and evolution of sanitation practices, Role of Sanitary Engineer, Sanitation management aspects for liquid and solid wastes, Basic Definitions, Transmission of infectious agents, Types of diseases – Communicable, Non-communicable, Water borne diseases, Different modes of communicating diseases, Mortality rates.

UNIT-II

Control of Communicable and Non-Communicable Diseases

Communicable Diseases: Impacts, Control of Source (Agent Factors), Control of Mode of Transmission or Contributing Factor (Environmental Factors), Control of Susceptibles (Host Factors), Epidemic Control,

Non-Communicable Diseases: *Respiratory Diseases*: Types, Impacts, Control approaches, *Water- and Food borne Diseases*: Types, Impacts, Characteristics and Control of Water- and Food borne Diseases

UNIT-III

Insect Vector And Rodent Control

Mosquitoes as carriers of diseases – Mosquito control – Drainage, subsurface drainage – Man made mosquito breeding centres –outdoor control of mosquitoes – Housefly as disease carrier Fly control – Rodent control, Control Diseases transmitted from Animals.

UNIT-IV

Institutional Sanitation

Sanitation measures in Hotels/restaurants, Public bathing ghats, Schools, Hospitals, Swimming pools, Prisons.

UNIT-V

Rural And Refuse Sanitation

Rural sanitation: Aqua privy, Septic tank, Soak pit and sulabh mode of sanitation, Appropriate low cost rural sanitation techniques, Biogas generation from toilet.
Refuse Sanitation: Municipal garbage – sources, generation, collection, recovery and disposal options, Sanitation problems with regard to: Dumping and sanitary landfilling, mass firing of waste and incineration, Mosquito breeding, Leachate, Management issues.
Ecological Sanitation: Principle, Eco-sanitation as a sustainable approach
Occupational health hazards: Concept, Types, Safety aspects of sanitation workers

Text Books:
1. Joseph. A. Salvato, Nelson N. Nemerow, Frankiln J. Agardy, "Environmental Engineering", John Wiley & Sons, 5th Edition, 2003.
2. I.M. Prahlad Edited, "Environmental Sanitation - Reflections from Practice, A Module for Community Health Practitioners", Society For Community Health Awareness Research and Action, 2015.

References:
1. S.K. Garg, "Sewage Disposal and Air pollution engineering", Khanna Publishers, New Delhi, 2009.
2. K.V.S.G. Muralikrishna, "Environmental Sanitation", Reem Publications, Kakinada, 2003.

B.Tech. (Sem.)	23CE84-INTRODUCTION TO REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEMS	L	T	P	Cr.
		3	0	0	3

Course Objectives: The course is designed to understand the techniques of Remote Sensing and GIS Technology for civil engineering applications

Course Outcomes: On completion of the course, the student should be able to

CO1: Interpret the concepts of Photogrammetry and its applications **(Understand-L2)**

CO2: Select the type of remote sensing data for mapping earth surface features **(Understand-L2)**

CO3: Illustrate the Image enhancement techniques **(Understand-L2)**

CO4: Analysis the basic components of GIS **(Understand-L2)**

CO5: Apply remote sensing techniques for natural resources evaluation **(Understand-L2)**

UNIT I: PHOTOGRAMMETRY AND AERIAL PHOTOGRAPHY

Introduction – definition and terms in Photogrammetry -Types of aerial photographs - Geometry of aerial photograph- Introduction to aerial photography – basic information and specifications of aerial photographs - Planning and execution of photographic flights - Aerial cameras – types and their characteristics – Making measurements from aerial photographs, measurement of height from aerial photograph.

UNIT II: BASICS OF REMOTE SENSING

Overview of remote sensing- definition, concept, history & scope- Satellite characteristics, satellite for earth observation studies and planetary mission- Concept of sensor resolution, spatial, spectral, temporal and radiometric resolution- Electromagnetic radiation (EMR) and electromagnetic spectrum (EMS). Interactions of EMR with atmosphere, interaction of EMR with earth's surface features; vegetation, water and soil. Principles of visual image interpretation: elements of visual image interpretation.

UNIT III:DIGITAL IMAGE PROCESSING

Introduction to Digital image Processing and Digital image Processing systems -Digital data and storage formats (BSQ, BIL and BIP) - Pre-processing of satellite data (radiometric and geometric corrections) - Concept of image classification: supervised, unsupervised classification.

UNIT IV: GEOGRAPHICAL INFORMATION SYSTEMS

Introduction to GIS – definition, concept and history of developments in the field of information systems - Computer fundamentals for GIS - Hardware and software requirements for GIS-Data structure and formats - Spatial data models – raster and vector, Data base design-linkage between spatial and non spatial data

UNIT V:APPLICATION OF REMOTE SENSING

Application of remote sensing in disaster management (landslides, flood, draught, earthquake)- Applications of remote sensing in agriculture sciences (crop acreage estimation, cropping Patterns/monitoring) - Applications of remote sensing in natural resources management -

Applications of remote sensing in forestry and ecology- Application of remote sensing in land use/land cover.

Textbook:

1. Kang – Tsung Chang, "Introduction to geographic information system", Tata McGraw- Hill Education Private Limited, 2007.
2. Srivastava G.S – "An Introduction to Geoinformatics" McGraw Hill Education (India) Private Limited, 2014
3. Paine, D.P., 1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley
4. Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag
5. Remote Sensing Digital Image Analysis, John A. Richards: Springer-Verlag, 1993

Reference Books:

1. Rampal K.K. 1999: Hand book of Aerial Photography and Interpretation. Concept Publication
2. Lille sand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
3. Chang.T.K. 2002: Geographic Information Systems. Tata McGrawHill
4. Digital Image Processing, R.C. Gonzales, R. E. Woods: Addison Wesley, 1993
5. International Journal of Photogrammetry and Remote Sensing (ISPRS), Taylor and Francis UK

L	T	P	Cr.
3	0	0	3

B.Tech. (Sem.) **23CE85-WATER SUPPLY SYSTEMS**

Course Outcomes:

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

CO1: Outline of the various facets of water usage in daily life

CO2: Explain the origin of Natural waters and also to synthesize it for regular use

CO3: Discuss the utilization of non-potable water

CO4: Describe water supply system from a reservoir

CO5: Explain the characteristics of wastewater

UNIT-I

WATER AND LIFE:

Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

UNIT-II

SOURCES OF WATER:

Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

UNIT-III

DUAL SUPPLY OF WATER:

Potable and non-potable water – Protected water – Grey water – Black water – Water bornediseases – water related diseases – Sewage Irrigation.

UNIT-IV

DISTRIBUTION OF WATER:

Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution– Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

UNIT-V

INDUSTRIAL WATER:

Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

TEXT BOOKS:

1. K.N. Duggal, "Elements of Environmental Engineering", 7th Edition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1st Edition Mc Graw –Hill Publications, Civil Engineering Series, 1985.

REFERENCES:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rd Edition, Wiley, 2010.
3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

B.Tech. (Sem.)	23CE86-SUSTAINABILITY IN ENGINEERING PRACTICES	L	T	P	Cr.
		3	0	0	3

Course Outcomes: At the end of the course, the student will be able to

CO1: Explain sustainable development and different environmental agreements and protocols

CO2: Discuss real time activities causing environmental issues and different methods to use renewable energy resources

CO3: Explain local and global environmental issues

CO4: Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability

CO5: Discuss different renewable energy resources and explain methods to implement green technology

UNIT-I

Introduction to Sustainable Engineering- Sustainable development, concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering, threats for sustainability.

Environmental Ethics and Legislations – Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

UNIT-II

Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

UNIT-III

Tools for Sustainability - Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA), environmental auditing, bio mimicking, case studies.

UNIT-IV

Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment(GRIHA),leader ship in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.

Sustainable Industrialization and Urbanization – Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial

symbiosis, poverty reduction.

UNIT-V

Renewable energy resources- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydroplants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy**.**

Green technology and Green Business: Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

Text Book:

1. R.L. Ragand Lekshmi Dinachandran Remesh. *Introduction to Sustainable Engineering*. 2nd Edition, PHI Learning Pvt. Ltd., 2016.

References:

1. D.T.AllenandD.R.Shonnard.*SustainabilityEngineering:Concepts,DesignandCaseStudies*, 1st Edition, Prentice Hall, 2011.
2. A.S.Bradley,A.O.Adebayo,P.Maria.*Engineeringapplicationsinsustainabledesignand development*, 1st Edition, Cengage learning, 2016.

L	T	P	Cr.
3	0	0	3

B.Tech. **23CS81-INTRODUCTION TO JAVA PROGRAMMING**

Pre-requisite: Introduction to Programming

Course Educational Objective: Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Techniques in software development through JAVA.

Course Outcomes (COs): At the end of the course, the student will be able to:

- **CO1:** Understand Object Oriented Programming Concepts through constructs of JAVA. **(Understand - L2)**
- **CO2:** Apply the concepts of Inheritance and Polymorphism on real-world applications. **(Apply-L3)**
- **CO3:** Implement reusability using interface and packages. **(Understand - L2)**
- **CO4:** Construct robust applications using exception handling. **(Apply-L3)**
- **CO5:** Understand multi-threading concepts. **(Understand - L2)**

UNIT – I: Introduction to OOP & JAVA:

Java Basics: Java Buzzwords/Features OOP Concepts, Java History, Advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs.

Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi-dimensional), String, StringBuffer, StringTokenizer Classes.

UNIT – II: Extending Classes/ Reusability:

Inheritance: Introduction, Derived Classes, Advantages and Types of Inheritance, Implementation, Inheritance and Member Accessibility. Overriding, super keyword, Abstract Classes and Methods, final keyword, Final Classes and Final Methods, Dynamic Binding, Polymorphism.

UNIT – III: Interfaces & Packages:

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces.

Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default and private). Wrapper Classes (Like Integer, Float, Double).

UNIT – IV: Exception Handling:

Exception Handling: Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception.

UNIT – V: Multithreading:

Multithreading: Thread life cycle, creating threads, synchronizing and intercommunication of threads.

TEXT BOOKS

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

REFERENCES

1. The Java™ Programming Language: Ken Arnold, James Gosling, Pearson.
2. Introduction to Java Programming 7/e, Brief version, Y.Daniel Liang, Pearson
3. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI

L	T	P	Cr.
3	0	0	3

B.Tech. **23CS82-PRINCIPLES OF OPERATING SYSTEMS**

Pre-requisite: Knowledge of Computer fundamentals & Data structures

Course Educational Objective: The objective of the course is to provide basic knowledge of computer operating system structure and functioning, understand how Operating Systems evolved with advent of computer architecture, and comprehend the different CPU scheduling algorithms, page replacement algorithms, disk scheduling and identify best one.

Course Outcomes: At the end of this course, the student will be able to

CO1: Demonstrate the underlying principles and techniques of operating system **(Understand-L2)**

CO2: Interpret scheduling and communication methods of processes handled by operating systems **(Understand-L2)**.

CO3: Distinguish the process synchronization methods and deadlock handling approaches employed in operating systems **(Understand-L2)**.

CO4: Classify memory management techniques and virtual memory mechanisms **(Understand-L2)**.

CO5: Interpret the strategies of disk scheduling algorithms and file system architecture **(Understand-L2)**.

Unit-1:

Operating System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation, System Boot.

Unit-2:

Processes: Process concept, Inter-process Communication,

Process Scheduling: Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, PRIORITY, ROUNDROBIN)

Unit-3:

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Monitors.

Unit-4:

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance, Deadlock Detection, Recovery from deadlock.

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

Unit-5:

Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing

TEXTBOOKS:

1. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007.

REFERENCE BOOKS:

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, "Unix and shell Programming", Thomson, New Delhi, 1st Edition, 2003.
3. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html
4. https://swayam.gov.in/nd1_noc19_cs50/preview

L	T	P	Cr.
3	0	0	3

B.Tech. **23CS83-PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS**

Pre-requisite : Data Structures

Course Educational Objective: The Objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing, Indexing.

Course Outcomes: At the end of this course, the student will be able to

CO1: State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand -L2)**

CO2: Examine the relational model using Structured Query Language (SQL). **(Apply- L3)**

CO3: Employ principles of normalization for effective database design. **(Apply- L3)**

CO4: Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand- L2)**

CO5: Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand- L2)**

UNIT – I

Introduction: An overview of Database Management System, Database System Vs File System, Database System Concepts and Three Schema Architecture, Data Models, Database Schema and Instances, Data Independence, Database Languages, Database Structure.

Data Modelling using the Entity Relationship Model: ER model concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation.

UNIT – II

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data types and Literals, Insert, Update and Delete Operations, Tables, Views and Indexes, Nested Queries, Aggregate Functions, Joins, Unions, Intersection, Minus.

UNIT – III

Normalization: Functional Dependencies, Normal Forms - First, Second, Third Normal Forms, BCNF, Inclusion Dependences, Loss Less Join Decompositions, Multi Valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT – IV

Transaction Processing Concepts: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializability, Recoverability, Deadlock Handling.

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control.

UNIT – V

Crash Recovery: Log Based Recovery, Checkpoints.

Physical Database Design: Storage and file structure, indexed files, hashed files, B+ trees, files with dense index; files with variable length records.

TEXTBOOKS:

1. Henry F. Korth, Abraham Silberschatz, S.Sudarshan, "Database System Concepts", McGrawHill, 6th edition, 2009.
2. Shashank Tiwari, " ProfessionalNoSql", John Wiely& Sons, 2011.

REFERENCE BOOKS:

1. Raghu Ramakrishnan, JohanneseGehrke, —Database Management System‖, McGrawHill, 3rd edition, 2000.
2. Date C J, —An Introduction to Database System, Pearson Education, 8th edition, 2003.
3. RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", Addison Wesley, 6th edition, 2010.

L	T	P	Cr.
3	0	0	3

B.Tech. **23CS84-IOT BASED SMART SYSTEMS**

Pre-requisite : Data Structures

Course Objective: To provide a foundational understanding of Internet of Things (IoT) concepts, architecture, communication technologies, data handling, and cloud integration, enabling students from non-CSE disciplines to explore IoT-based smart systems relevant to their fields.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO1: Explain the basic concepts, applications, and communication principles of Internet of Things (IoT).(**Understand-L2)**

CO2: Describe the simplified architecture and communication technologies used in IoT-based systems. **(Understand-L2)**

CO3: Demonstrate an understanding of web and device connectivity methods used in IoT environments. **(Apply-L3)**

CO4 : Illustrate the process of data collection, organization, and its role in IoT-based smart solutions.**(Apply-L3)**

CO5: Summarize the role of cloud platforms and sensor technologies in building integrated smart systems. **(Understand-L2)**

UNIT I: Introduction to IoT: Overview of Internet of Things (IoT), Key Technologies and Applications of IoT, Machine-to-Machine (M2M) Communication Basics, Examples of Smart Systems in Daily Life, Basic Design Considerations for Connected Devices, Internet Connectivity and Common Protocols: HTTP, HTTPS

UNIT II: IoT Architecture and Communication Technologies: Simple Architecture of IoT Systems, Communication Layers and Components, Role of Gateways and Connectivity Options, Overview of Communication Technologies (Wi-Fi, Bluetooth, etc.), Ease of Designing and Cost-Effective Systems

UNIT III: Connectivity and Communication for IoT: Web-Based Communication for Smart Devices, Introduction to IoT Communication Protocols (Conceptual), Connecting Devices to the Web – Practical Insights, Overview of Data Transfer Methods in IoT

UNIT IV: Data Handling in IoT: Basics of Data Collection and Storage, Real-Life Applications: Smart Cities, Smart Agriculture, etc., Introduction to How IoT Systems Handle and Organize Data, Simple View of How IoT Supports Business or Government Processes

UNIT V: Cloud and IoT Integration: Using Cloud Platforms for IoT Data Storage, Simple Explanation of Cloud Services (e.g., Google Cloud, AWS, etc.), IoT Applications Using Cloud (e.g., Smart Monitoring Systems), Introduction to Sensors and Wireless Technologies (RFID, WSN), Everyday Examples of Sensors in Smart Systems

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley
2. Getting Started with the Internet of Things, Cuno Pfister , Oreilly

R23-OPEN ELECTIVE SYLLABUS – ECE

23EC81 – Linear and Digital IC Applications

B. Tech. (OE)

L	T	P	Cr.
3	0	0	3

Course Outcomes:

CO1: Analyze and design various configurations of operational amplifiers, and applications such as instrumentation amplifiers, voltage regulators, comparators, and waveform generators. (**Analyse-L4**)

CO2: Design and implement active filters and waveform generators using op-amps, IC-555, and IC-565, and evaluate their performance for signal processing applications. (**Analyse-L4**)

CO3: Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications. (**Apply-L3**)

CO4: Apply combinational logic ICs such as multiplexers, de-multiplexers, encoders, decoders, and arithmetic circuits to solve complex digital design problems. (**Apply-L3**)

CO5: Develop sequential circuits using flip-flops, counters, and shift registers, and analyze their use in digital memory systems, including ROM, RAM, and their variants. (**Analyse-L4**)

UNIT–I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-II

Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Bandpass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT-III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT-IV

Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXTBOOKS:

1. Ramakanth A. Gayakwad-Op-Amps & Linear ICs, PHI, 2003.
2. Floyd and Jain-Digital Fundamentals, 8th Ed., Pearson Education, 2005.

REFERENCEBOOKS:

1. D. Roy Chowdhury–Linear Integrated Circuits, New Age International (p) Ltd., 2nd Ed., 2003.
2. John. F. Wakerly–Digital Design Principles and Practices, 3rd Ed., Pearson,, 2009.
3. Salivahana-Linear Integrated Circuits and Applications, TMH, 2008.
4. William D. Stanley-Operational Amplifiers with Linear Integrated Circuits, 4th Ed., Pearson Education India, 2009

23EC82 – Principles of Communications

B. Tech. (OE)

L	T	P	Cr.
3	0	0	3

Pre-requisites: **Knowledge on Signals**

Course Educational Objective: This course covers fundamental principles of analog and digital modulation techniques. It introduces signal processing tools and digital conversion methods like sampling and quantization.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	**Describe** the principles of amplitude and angle modulation techniques including AM, DSB-SC, SSB, VSB, FM, and PM, along with their spectral properties and generation/detection methods
CO2	**Summarize** the role of Fourier analysis, autocorrelation, energy spectral density, and signal processing tools in the analysis of modulated signals
CO3	**Analyze** sampling, quantization, pulse modulation, and digital baseband modulation schemes such as PAM, DM, and DPCM, including reconstruction and noise effects
CO4	**Apply** probability, random variables, and random processes to evaluate noise and its impact on analog and digital communication systems.

UNITI: Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index

UNIT II : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver,Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT III : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT IV : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,**Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT V: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes,Gaussian Random Process, Noise.

TEXT BOOKS:

1. Simon Haykin, Communications Systems, John Wiley and Sons, Inc, 4th Edition, 2006.
2. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication," Cambridge university press, 2005.

References:

1. Simon Haykin, "Principles of Communication Systems", John Wiley, 2nd Edition.
2. George Kennedy and Bernard Davis "Electronics & Communication System", TMH 2004.

23EC83 – Fundamentals of VLSI Design

B. Tech. (OE)

L	T	P	Cr.
3	0	0	3

Pre-requisites: Analog and Digital Electronics.

Course Educational Objective: This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential sub system CMOS circuit designs used in VLSI Design.

Course Outcomes: At the end of the course, the student will be able to
CO1: **Remember** IC fabrication process and properties of MOSFET.
CO2: **Apply** the layout design rules for NMOS and CMOS circuits.
CO3: **Apply** the concepts of logic gates and combinational circuits used in ICs.
CO4: **Design** the sub system using combinational and sequential circuits.

UNIT – I: Introduction to MOS Technology
Introduction to Integrated Circuit (IC) Technology, The IC Era, Metal-Oxide-Semiconductor (MOS) and related VLSI Technology, Basic MOS Transistors, Enhancement mode Transistor action, Depletion mode Transistor action, NMOS Fabrication, CMOS Fabrication: The p-well process, The n-well process.

UNIT – II: Basic Electrical Properties of MOS Circuits
Drain to Source Current Ids versus Voltage Vds Relationships: The Non-saturated Region, The saturated Region, Aspects of MOS Transistor Threshold Voltage Vt, MOS Transistor Transconductance gm and Output conductance gds, MOS Transistor Figure of Merit ω0, The Pass Transistor, The NMOS Inverter, The CMOS Inverter.

UNIT – III: MOS Circuit Design Processes
MOS Layers, Stick Diagrams: NMOS Design style, CMOS Design style, Design Rules and Layout: Lambda-based Design Rules, Contact Cuts, Double Metal MOS Process Rules, CMOS Lambda-based Design Rules, General Observations on the Design Rules, Layout Diagrams.

UNIT – IV: Subsystem Design – I
Architectural Issues, Switch Logic: Pass Transistors and Transmission Gates, Gate Logic: The Inverter, Two-input NMOS and CMOS NAND Gates, Two-input NMOS and CMOS NOR Gates, Other forms of CMOS Logic, Structured Design Examples: Parity Generator, Bus Arbitration Logic for n-line Bus, Multiplexers, General Logic Function Block, Four-line Gray code to Binary code Converter, The Programmable Logic Array (PLA).

UNIT – V: Subsystem Design – II
Clocked Sequential Circuits: Two-phase clocking, Charge storage, Dynamic Register Element, Dynamic Shift Register, Other System Considerations: Bipolar Drivers for Bus Lines, Basic Arrangements for Bus lines, The pre-charged Bus Concept, Power Dissipation for CMOS Circuits, Current Limitations for VDD and GND (VSS) Rails, Further Aspects of VDD and VSS Rail Distribution, General Considerations: Some problems, Illustration of Design Processes: The General Arrangement of a 4-bit Arithmetic Processor, The Design of a 4-bit Shifter.

TEXT BOOK

1. Douglas A. Pucknell, Kamran Eshraghian, “Basic VLSI Design” PHI Publishers, 3rd Edition.

REFERENCE

1. Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.
2. Neil. H. E. Weste and Kamaran Eshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rdEdition.
3. John P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley Publishers.

B. Tech. (OE)

23EC84 – Principles of Cellular & Mobile Communications

L	T	P	Cr.
3	0	0	3

Pre-requisites: Basics of Analog & Digital Communication

Course Educational Objective: This course gives knowledge on cellular mobile communications, cellular technology fundamentals, radio propagation models, modulation and multiple access techniques, mobile wireless systems & standards for cellular systems.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	**Describe** the basic concepts of cellular mobile communication systems and wireless communication standards. **(Understand-L2).**
CO2	**Summarize** the evolution of cellular technologies from 1G to 5G, sources and impacts of interference in cellular systems. **(Understand-L2)**.
CO3	**Analyze** the multiple access techniques and system architectures employed in 2G, 3G, 4G, and 5G networks. (**Apply-L3**).
CO4	**Characterize** the principles of advanced cellular technologies such as LTE, OFDMA, mmwave, and MIMO **(Understand-L2)**

UNIT–I:

Introduction to Mobile Communication: Fundamentals of wireless & cellular communications: Evolution of cellular systems, requirements, goals, and vision of the next generation wireless communication systems, examples of wireless communication systems.

UNIT–II:

Cellular Concepts and Interference: Frequency reuse, frequency management, channel assignment, handoff mechanism, Interference, types of interferences in cellular system, C/I ratio, Interference reduction methods and system capacity improvement: cell splitting, cell sectoring.

UNIT–III:

2G and 3G Cellular Technologies: Multiple access techniques: FDMA, TDMA, CDMA, 2G digital cellular Technologies: GSM, GSM services, GSM architecture, comparison of Analog and digital cellular systems, 3G cellular Technologies: CMDA2000, WCDMA.

UNIT–IV:

4G Cellular Technology: Need and Opportunities for 4G, features provided by 4G, LTE: LTE architecture, mobility Management, Evolution of VoLTE, OFDMA: OFDM, OFDMA in 4G, advantages of OFDMA.

5G Cellular Technology: Need of 5G technology, 5G mobile network architecture, Features of 5G technology. Small cells: Past, present, and future trends of cellular networks coverage and capacity of small Cell networks.

UNIT–V:

Advanced Cellular Technologies: Challenges in migration from 4G to 5G, Set of 5G requirements, mm-wave: Applications, radio wave propagation, Massive MIMO: Point-to-point MIMO, Virtual MIMO (relaying), challenges, beam forming.

TEXT BOOKS:

1. Theodore S. Rappaport, "wireless communications Principles and Practices", PHI, 2005.
2. R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies. John Willey & Sons, West Sussex, 2017.

REFERENCE BOOKS:

1. Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology.
2. Lee W.C.Y, "Mobile communication Engineering Theory and Applications", 2/e McGraw-Hill, New York, 2003

23EC85 – Fundamentals of Satellite Communications

B. Tech. (OE)

L	T	P	Cr.
3	0	0	3

Pre-Requisites: Dynamics, Kinematics, Thermodynamics.

Course Educational Objective: This course provides the knowledge on laws associated with the motion of a satellite, launching a satellite into orbit with launch vehicles, subsystems, structures, spacecraft control and applications.

Course Outcomes (COs): At the end of the course, student will be able to

CO1	**Describe** the operational frequency bands, Space craft control mechanisms**,** sensors and navigational aids used in satellite systems **(Understand-L2)**
CO2	**Summarize** the functions of satellite space segment, earth segment, Multiple access techniques and satellite services. **(Understand-L2)**
CO3	**Illustrate** the operational principles of satellite power system and space craft Control mechanism. **(Understand-L2)**
CO4	**Interpret** the fundamental concepts of orbital mechanics & satellite communication and its application**(Understand-L2)**

UNIT I

Introduction to Satellite Systems: Need of space communication, General structure of satellite communication system, Types of spacecraft orbits, Satellite subsystems and their functions – structure, thermal mechanisms, power, propulsion, guidance and control, bus electronics. Communication bands- characteristics and applications.

UNIT - II

Orbital Mechanics and satellite launching: Fundamentals of orbital dynamics – Kepler's laws, Orbital parameters, Orbital perturbations, need for station keeping. Orbital effect, Launch vehicles: Expendable Launch Vehicles and Reusable Launch Vehicles.

UNIT – III

Power System and Bus Electronics: Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency; Space battery systems-battery types, characteristics and efficiency parameters; power electronics. Telemetry, Tracking, command and monitoring, control functions.

UNIT – IV

Spacecraft Control: Control requirements: attitude control and station keeping functions, type of control maneuvers, Stabilization schemes: spin stabilization, gravity gradient, 3 axis stabilization, control systems: mass expulsion systems, Momentum exchange Systems; Gyro and magnetic torque-sensors, star and sun sensor, earth sensor, magnetometers and inertial sensors.

UNIT – V

Satellite Services &Applications: Global Positioning System architecture and location principle, Direct to Home, Home receiver, Satellite Mobile Services, VSAT, MSAT, RADARSAT, IRNSS constellation, Satellite structures and materials.

TEXT BOOKS

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003.
2. Dennis Roddy, "Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

REFERENCE BOOKS

1. M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.
2. D.C Agarwal, "Satellite communications", Khanna Publications, 5th Edition, 2006.

OE(23EE81)	Basic Control System	L	T	P	Cr.
		3	0	0	3

Pre Requisite: None

Course Educational Objective: The objective of this course is to introduce to the students the principles and applications of control systems in everyday life. It deals with the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems the different aspects of stability analysis of systems in frequency domain and time domain.

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

CO1. Develop mathematical model of linear time invariant systems. **(Apply-L3)**
CO2. Understand various controllers and compensators **(Understand-L2)**
CO3. Analyze linear time invariant systems in Time domain **(Apply-L3)**
CO4. Analyze time invariant systems in Frequency domain **(Apply-L3)**
CO5. Apply state space analysis concepts for deriving state models and understand the concept of controllability and observability **(Apply-L3)**

UNIT – I: INTRODUCTION CONTROL SYSTEM

Concepts of Control Systems- Classification of control systems, Open Loop and closed loop control systems - Different examples of control systems.

Control System Components: Electric Actuators, Servomotors, DC Tachogenerator, Potentiometer, Synchros, Stepper Motor

UNIT – II: TRANSFER FUNCTION, BLOCK DIAGRAM REDUCTION AND SIGNAL FLOW GRAP

Transfer Function, Poles and Zeros Transfer Function, Mechanical Translational and Rotational systems, Block diagram representation of systems-Block diagram algebra, Signal flow graph - Reduction using Mason's gain formula.

UNIT – III: TIME RESPONSE ANALYSIS

Standard test signals, Time response of second order systems, Time domain specifications, Steady state errors and error constants. The concept of stability – R-H stability criterion, The root locus concept - construction of root loci (Real Poles and Zeros only).

UNIT – IV: FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications, Polar Plot, Bode Plot, Stability Analysis from Bode Plots, Introduction to PI, PD and PID controllers, Lag, Lead, Lag-Lead compensators

UNIT – V: STATE SPACE ANALYSIS

Concepts of state, state variables and state space model, State Space Representation Using Physical Variables, solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. B. C. Kuo , "Automatic Control Systems" , John wiley and sons ,9th edition, 2014
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, 6th edition , 2017

REFERENCE:

1. Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition,1998.
2. Norman S. Nise, "Control Systems Engineering" , John Wiley, New Delhi, 6th edition, 2012
3. Richard C Dorf and Robert H Bishop, "Modern control systems" , Prentice Hall Pearson education, Inc.) New Delhi, 12th edition, 2003.

OE (23EE82) **Basic Electrical Measurements**

L	T	P	Cr.
3	0	0	3

Prerequisite: None

Course Educational Objective: This course enables the students to understand the construction and working principle of different types of meters. It also provides knowledge of calculation of parameters of electrical network**.**

Course Outcomes: At the end of the course student will able to:

CO1: Compare the performance of PMMC, Moving iron and dynamometer types of measuring instruments and energy meters. **(Understand-L2)**

CO2: Determine the circuit parameters using appropriate method of measurement. **(Apply-L3)**

CO3: Understand working principle of special purpose instruments **(Understand-L2)**

CO4: Understand principles of magnetic measurements **(Understand-L2)**

UNIT-1: MEASURING INSTRUMENTS

Classification-deflecting, control and damping torques-Ammeters and Voltmeters-PMMC, Moving iron type instruments-expression for deflecting and controlling torque-errors and compensation, extension of range using shunts and series resistance, electrostatic voltmeters electrometer type and attracted disc type.

UNIT-II: MEASUREMENT OF RESISTANCE, INDUCTANCE, CAPACITANCE
Method of measuring low, medium, high resistance- Wheatstone bridge, Kelvin double bridge, loss of charge method, Method of measuring Inductance- Mawell Inductance-Capacitance Bridge, Carey-Foster slide Wire Bridge. Method of measuring Capacitance and loss angle, Weins'bridge, Schering bridge

UNIT-III: MEASUREMENT OF POWER & ENERGY

Measurement of Power-Single phase dynamometer Wattmeter-LPF, UPF, errors and compensation, measurement of active and reactive power. Measurement of Energy-single phase Energy meter- driving and braking torques, errors and compensation.

UNIT-IV: SPECIAL PURPOSE MEASURING INSTRUMENTS

Instrument transformers: construction, connection of CT and PT in the circuit, Power factor meter, Frequency meter: Resonance type and Weston type Potentiometers: Principle and operation of DC Potentiometer, standardization, measurement of resistance, current and voltage.

UNIT-V: MAGNETIC MEASUREMENTS

Ballistic galvanometer, equation of motion, flux meter- constructional details, comparison with Ballistic galvanometer, Determination of B-H loop-method of reversals, magnetic testing under a.c conditions.

TEXT BOOKS

1. A. K. Sawhaney, DhanpatRai& Sons "A Course in Electrical and Electronic measurements & Instrumentation" , Education & Technical publishers New Delhi , 4th Edition 2015.

2. U.A.Bakshi,&A.V.Bakshi "Electrical measurement" Technical publications Pune, 2nd Edition 2010.

REFERENCE:

1. Nakra&Chaudhari "Instrumentation: Measurement and Analysis" TMH, New Delhi, 4 th edition, 2006.

2. D.V.S. Moorthy, "Transducers and Instrumentation", PHI Ltd New Delhi 2nd edition 2011.

OE (23EE83)	Utilization of Electrical Energy	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Basic Electrical Engineering

Course Educational Objective: This course enables the student to acquire knowledge on methods of Electric Heating and welding, different lighting schemes. It also introduces the concepts of Electric Drives for Industrial and traction system, and also different tariff methods.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO1: Understand mechanism of electric heating and electric welding. **(Understand-L2)**

CO2: Analyze performance of various lighting schemes. **(Understand-L2)**

CO3: Analyze the performance of electric drive systems. **(Understand-L2)**

CO4: Understand the different schemes of traction and its main components **(Understand-L2)**

CO5: Understand various tariff methods and power factor improvement techniques. **(Understand-L2)**

UNIT-1: ELECTRIC HEATING AND WELDING

Electric Heating: Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces. Electric Welding: Electric welding–Resistance and arc welding–Electric welding equipment– Comparison between AC and DC Welding.

UNIT-II: ILLUMINATION ENGINEERING

Introduction, Nature of light &Laws of illumination, Lighting schemes, sources of light, Fluorescent Lamp, CFL and LED, Sodium Vapour Lamp, Neon lamps, mercury vapour lamps, Comparison between tungsten & fluorescent tubes, Requirements of good lighting & Street lighting

UNIT-III: ELECTRIC DRIVES

Introduction, Factors affecting selection of motor, Types of loads, Steady state characteristics of drives, Transient characteristics, Size of motor, load equalization, Industrial applications

UNIT-IV: ELECTRIC TRACTION

Introduction, requirements of an ideal traction system, System of electric traction and track electrification–the traction motor– train movement, Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves

UNIT-V: TARIFF AND POWER FACTOR IMPROVEMENT

Tariff: Desirable characteristics, types - Flat rate, block-rate, KVA maximum demand and Time of Day tariff. Power factor: Disadvantages of low power factor, advantages of improved

p.f.,without using p.f. improvement devices, power factor improvement using; static capacitor, most economical power factor, location of power factor improvement devices from consumer.

TEXT BOOKS:

1. C.L.Wadhwa "Generation,Distribution and Utilization of Electrical energy, New Age International Publishers,3rd Edition,2015.

2. N.V.Suryanarayana "Utilization of electric power including electric drives and electric traction, New age international publishers New Delhi,2nd edition 2014.

REFERENCE:

1. V K Mehta & Rohit Mehta, "Principles of Power System", Revised Edition, S.Chand Publications, 2022.

2. A.Chakrabarthi, M.L.Soni, P.V.Gupta and U.S.Bhatnagar, "A Textbook on Power system Engineering", Dhanpat Rai Publishing Company (P) Ltd., 2008.

OE (23EE84)	Electric Vehicles	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Basic Electrical Engineering

Course Educational Objective: This course enables the students to acquire knowledge on basic concepts related to mechanics, kinetics and dynamics of electric vehicles, technical characteristics and properties of batteries. It also introduces the concepts of different configurations of drive trains.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Illustrate propulsion system for an electric vehicle. **(Understand-L2)**

CO2: Understand characteristics and properties of batteries. **(Understand-L2)**

CO3: Analyze ratings and requirements of electrical machines. **(Understand-L2)**

CO4: Analyze mechanism of electrical vehicle drive train. **(Understand-L2)**

CO5: Understand configuration of hybrid electric vehicles. **(Understand-L2)**

UNIT I: ELECTRIC VEHICLES

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II; BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III: DC & AC ELECTRICAL MACHINES

Motor and Engine rating, Requirements, DC machines, Three phase A.C machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV: ELECTRIC VEHICLE DRIVE TRAIN

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V: HYBRID ELECTRIC VEHICLES

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

TEXT BOOKS:

1. IqbalHussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.

2. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.

REFERENCE:

1. MehrdadEhsani, YiminGao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.

2. SandeepDhameja, “Electric Vehicle Battery Systems”, Newnes, 2000

OE (23EE85) **Concepts of Energy Auditing & Management**

L	T	P	Cr.
3	0	0	3

Pre-requisite: Basics of Conservation of Electrical Energy

Course Educational Objectives: This course enables the students to understand basic concepts of Energy Audit & various Energy conservation schemes. It also covers energy management program, Energy Efficient Motors and lighting control efficiencies.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the different parameters for energy auditing (**Understand-L2)**

CO2: Interpret the controlling of energy management and energy efficiency **(Understand-L2)**

CO3: Analyze the Reactive power management strategies. **(Understand-L2)**

CO4: Analyze energy conservation measures for economic aspects. **(Apply-L3)**

UNIT–I:Basic Principles of Energy Audit

Energy audit- definitions - concept - types of **Energy** audit - energy index - cost index - pie charts - Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry, thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017)

UNIT–II: **Energy Management**

Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language - Questionnaire – check list for top management.

UNIT–III: Energy Efficient Motors and Lighting

Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.

UNIT–IV: Power Factor Improvement and Energy Instruments

Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on power factor - power factor motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

UNIT–V: Economic Aspects and their Computation

Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

Text Books:

1. Energy management by W.R.Murphy & G.Mckay Butter worth - Heinemann publications - 1982.

2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

Reference Books:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

Online Learning Resources:

1. https://nptel.ac.in/courses/108106022
2. https://archive.nptel.ac.in/courses/108/106/108106022

OE (23EE86)	Electrical Wiring Estimation and Costing	L	T	P	Cr.
		3	0	0	3

Pre-requisite: Electrical Circuits, Basics of Power Systems and Electrical Machines.

Course Educational Objectives: This course enables the students to learn the electrical symbols, simple electrical circuits and design of electrical installation for different types of buildings and small industries. It also covers the basic components of electrical substations and motor control circuits.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the various electrical apparatus and their interconnections. **(Understand-L2)**

CO2: Examine various components of electrical installations. **(Understand-L2)**

CO3: Estimate the cost for installation of wiring for different types of building and small industries. **(Understand-L2)**

CO4: Understand the components of electrical substations. **(Understand-L2)**

CO5: Understand the control circuits for starting of three phase induction motor and synchronous motor. **(Understand-L2)**

UNIT – I: Electrical Symbols and Simple Electrical Circuits

Identification of electrical symbols -Electrical wiring Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.

UNIT – II: Design Considerations of Electrical Installations

Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

UNIT – III: Electrical Installation for Different Types of Buildings and Small Industries

Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.

UNIT – IV: Substations

Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case study.

UNIT – V: Motor control circuits

Introduction to AC motors - starting of three phase squirrel cage induction motors -starting of wound rotor motors -starting of synchronous motors -contractor control circuit components -basic control circuits -motor protection – Schematic and wiring diagrams for motor control circuits.

Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta – Kataria SK & Sons - 2013.

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/nou25_ec07/preview

B.Tech.(IT) **23IT82-INTRODUCTION TO PROGRAMMING IN JAVA (OPEN ELECTIVE)**

L	T	P	Cr.
3	0	0	3

Pre-requisite: Programming for Problem Solving Using C

Course Educational Objective:

Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Technique in software development through JAVA.

Course Outcomes (CO): At the end of this course, the student will be able to:

CO1: Understand Object Oriented Programming Concepts through constructs of JAVA. **(Understand - L2)**
CO2: Apply the concepts of Inheritance and Polymorphism on real-world applications. **(Apply –L3)**
CO3: Apply reusability using interface and packages. **(Apply- L3)**
CO4: Construct robust applications using exception handling & multithreading **(Apply- L3)**
CO5: Understand and Implement Event Handling & Swings. **(Understand - L2)**

UNIT – I: Introduction to OOP & JAVA:

Java Basics: Java Buzzwords/Features OOP Concepts, Java History, Advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs.
Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi-dimensional), String, StringBuffer, StringTokenizer Classes.

UNIT – II: Extending Classes/ Reusability:

Inheritance: Introduction, Derived Classes, Advantages and Types of Inheritance, Implementation, Inheritance and Member Accessibility. Overriding, super keyword, Abstract Classes and Methods, final keyword, Final Classes and Final Methods, Dynamic Binding, Polymorphism

UNIT – III: Interfaces & Packages:

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces.
Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default and private). Wrapper Classes (Integer, Float, Double)

UNIT – IV: Exception Handling & Multithreading:

Exception Handling: Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception, assertions.
Multithreading: Thread life cycle, creating threads, synchronizing and intercommunication of threads.

UNIT – V: Event Handling & Swings:

Event Handling- Introduction, limitations of AWT, The Delegation event model- Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.
Exploring Swing Controls- JLabel and Image Icon, JText Field, JButton, JCheck Box, JRadio Button, JList, JCombo Box

TEXT BOOKS:

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education

REFERENCE BOOKS:

1. The Java™ Programming Language: Ken Arnold, James Gosling, Pearson.
2. Introduction to Java Programming 7/e, Brief version, Y. Daniel Liang, Pearson
3. Java for Programmers, P.J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI

B.Tech.(IT)

23IT83- PRINCIPLES OF SOFTWARE ENGINEERING (OPEN ELECTIVE)

L	T	P	Cr.
3	0	0	3

Prerequisite: Object Oriented Programming

Course Objectives:

- Understand the fundamental principles and concepts of software engineering.
- Comprehend and differentiate various software process models.
- Apply principles and guidelines for designing and evaluating user-friendly interfaces.
- Apply various software testing strategies and techniques for ensuring software quality.
- Develop proactive strategies for identifying, assessing, and mitigating risks in software engineering projects.

Course Outcomes: At the end of the Course, student will be able to:

CO1: The fundamental concepts of software engineering, including the nature of software, software myths, and the software process. **Understand** (**Level 2**)

CO2: Analyze and specify software requirements using appropriate methods and). **Apply (Level 3)**

CO3: Apply software design principles to develop modular, maintainable, and scalable software systems. **Apply (Level 3)**

CO4: Implement effective testing strategies to ensure the reliability and quality of software applications. **Apply (Level 3)**

CO5: Apply knowledge of project management practices, including risk management, planning, and maintenance in software development. **Apply (Level 3).**

UNIT I:

INTRODUCTION TO SOFTWARE ENGINEERING: The Nature of Software, Software Engineering, Software Myths and the Software Process.

PROCESS MODELS: Generic process model, Waterfall, Incremental Process Model, Spiral model and Evolutionary models.

UNIT II:

UNDERSTANDING REQUIREMENTS: Requirements Engineering, Identifying Stakeholders, Eliciting Requirements, Building the requirements Model, Validating Requirements.

UNIT III:

USER-INTERFACE DESIGN: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT IV:

SOFTWARE TESTING STRATEGIES:

A Strategic Approach to Software Testing, White- Box Testing, Basis Path Testing, Black-Box Testing, System Testing.

UNIT V:

RISK MANAGEMENT:

Reactive versus Proactive Risk Strategies, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan.

TEXT BOOKS:

1. Roger S. Pressman, *Software Engineering a Practitioner's Approach*, 7th Edition, TMH, 2010.
2. Somerville, *Software Engineering*, 9th Edition, Pearson Education, 2011.

REFERENCES:

1. K.K.Agarwal &Yogesh Singh,*Software Engineering*, 3rd Edition, New Age International Publishers, 2008.
2. PankajJalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, 2011.

E-REFERENCES:

1. https://nptel.ac.in/courses/Software Engineering
2. https://www.coursera.org/courses?query=software engineering
3. https://www.udemy.com/courses/development/software-engineering.

B.Tech. **23CS83-PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS (OPEN ELECTIVE)**

L	T	P	Cr.
3	0	0	3

Pre-requisite: Data Structures

Course Educational Objective: The Objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing and Indexing.

Course Outcomes: At the end of this course, the student will be able to

CO1: State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand -L2)**

CO2: Examine the relational model using Structured Query Language (SQL). **(Apply- L3)**

CO3: Employ principles of normalization for effective database design. **(Apply- L3)**

CO4: Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand- L2)**

CO5: Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand- L2)**

UNIT – I

Introduction: An overview of Database Management System, Database System Vs File System, Database System Concepts and Three Schema Architecture, Data Models, Database Schema and Instances, Data Independence, Database Languages, Database Structure.

Data Modelling using the Entity Relationship Model: ER model concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation.

UNIT – II

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data types and Literals, Insert, Update and Delete Operations, Tables, Views and Indexes, Nested Queries, Aggregate Functions, Joins, Unions, Intersection, Minus.

UNIT – III

Normalization: Functional Dependencies, Normal Forms - First, Second, Third Normal Forms, BCNF, Inclusion Dependences, Loss Less Join Decompositions, Multi Valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT – IV

Transaction Processing Concepts: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializability, Recoverability, Deadlock Handling.

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control.

UNIT – V

Crash Recovery: Log Based Recovery, Checkpoints.

Physical Database Design: Storage and file structure, indexed files, hashed files, B+ trees, files with dense index; files with variable length records.

TEXTBOOKS:

1. Henry F. Korth, Abraham Silberschatz, S.Sudarshan, "Database System Concepts", McGraw Hill, 6th Edition, 2009.
2. "Professional NoSQL" Shashank Tiwari, John Wiely& Sons, 2011.

REFERENCE BOOKS:

1. Raghu Ramakrishnan, JohanneseGehrke, —Database Management System‖, McGrawHill, 3rd edition, 2000.
2. Date C J, —An Introduction to Database System, Pearson Education, 8th edition, 2003.
3. RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", Addison Wesley, 6th edition, 2010.

23ME81- SUSTAINABLE ENERGY TECHNOLOGIES

L	T	P	C
3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVE:

To provide the insights on different sustainable energy sources, potential, salient features and utilization of solar, wind, geothermal, ocean thermal energy, bio energy and fuel cell systems.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: Demonstrate the importance, the impact of solar radiation. **(Understanding-L2)**

CO2: Understand the principles of solar PV modules and storage in PV systems. **(Understanding-L2)**

CO3: Discuss solar energy storage systems and their applications. **(Understanding-L2)**

CO4: Describe power extraction from wind and bio-mass. **(Understanding-L2)**

CO5: Illustrate the working of geothermal, ocean energy and fuel cells. **(Understanding-L2)**

UNIT – 1

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – 2

SOLAR PV MODULES AND PV SYSTEMS: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems. Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System.

UNIT – 3

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – 4

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz's criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, Gasifiers, applications.

UNIT – 5

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Geothermal power generation, Relative Merits and Demerits.

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges and applications.

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

TEXT BOOKS:

1. Renewable Energy Technologies -Ramesh & Kumar /Narosa
2. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
3. Non-conventional Energy Source- G.D Roy/Standard Publishers.

REFERENCES:

1. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Non-conventional Energy Source- G S Sawhney- PHI, New Delhi, 2012

23ME82- INTRODUCTION TO INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVE:

This course introduces students to the fundamental components and applications of industrial robotic systems. It covers various types of actuators, robot kinematics, and control programming principles. Additionally, students will explore the role of image processing and machine vision in enhancing robotic functionality.

COURSE OUTCOMES: At the end of the course, the student will be able to

- **CO1:** Comprehend the anatomy of a robot and identify the components, configurations, and industrial applications of robotic systems. **(Understanding – L2)**
- **CO2:** Describe the types, characteristics, and selection criteria of actuators and sensors used in robotic systems. **(Understanding – L2)**
- **CO3:** Apply D-H parameters to solve forward and inverse kinematics of robotic manipulators. **(Apply – L3)**
- **CO4:** Demonstrate the principles of trajectory planning, learn robot programming, and utilize programming languages for robot control. **(Applying – L3)**
- **CO5:** Describe the principles and applications of image processing and machine vision in robotics. **(Understanding – L2)**

UNIT I: INTRODUCTION TO ROBOTICS AND ROBOT ANATOMY

INTRODUCTION: Overview of Robotics in the context of Automation, CAD/CAM, and Industry 4.0 – Evolution of Robotics – Present and emerging applications in smart manufacturing, healthcare, logistics, and AI-driven systems – Classification of robots based on coordinate and control systems.

ROBOT ANATOMY & STRUCTURE: Components of a robotic system – Robot structure, degrees of freedom, workspace – Robot drive systems and kinematic chains – Block diagram and signal flow representation – Types of arms and their configuration – End-effectors: types, design challenges, and selection criteria.

UNIT II: ACTUATION AND SENSOR SYSTEMS FOR ROBOTICS

ACTUATORS: Working principles and control of pneumatic, hydraulic, and electrical actuators – Stepper and servo motors – Comparison of actuation methods with respect to cost, performance, and integration with embedded systems.

SENSORS AND FEEDBACK COMPONENTS: Role of sensors in robotic perception and control – Position sensors (potentiometers, encoders, resolvers), velocity sensors – Feedback mechanisms in robotic systems – Integration with microcontrollers and data acquisition systems.

UNIT III: ROBOT KINEMATICS AND TRANSFORMATIONS

MOTION ANALYSIS: Coordinate transformations – Homogeneous transformations for rotation and translation in 2D/3D space – Transformation matrices.

MANIPULATOR KINEMATICS: Denavit–Hartenberg (D-H) parameters – Forward and inverse kinematics for articulated manipulators – Joint space vs task space – Solving kinematics using programming approaches (Python/Matlab/ROS).

UNIT IV: PATH PLANNING AND ROBOT PROGRAMMING

TRAJECTORY PLANNING: Basics of trajectory generation – Obstacle avoidance strategies – Motion interpolation (joint, linear, and circular paths) – Skew motion and joint-integrated motion.

PROGRAMMING AND SIMULATION: Introduction to robot programming languages (e.g., Python, RAPID, URScript) – Overview of simulation platforms such as RoboDK, ROS, and Gazebo – Basics of software stacks for robot control and path execution.

UNIT V: MACHINE VISION AND IMAGE PROCESSING FOR ROBOTICS

MACHINE VISION SYSTEMS: Concepts of sensing and digitization – Vision system architecture – Image preprocessing, feature extraction, and object recognition.

ROBOTIC APPLICATIONS: Applications of machine vision in navigation, inspection, pick-and-place, quality control, and autonomous systems – Introduction to Open CV and AI models in vision tasks – Training vision systems using supervised and unsupervised learning techniques.

TEXT BOOKS

1. Saeed B.Niku, Introduction to robotics- analysis, systems &application, Second Edition, Willy India Private Limited, New Delhi,2011.
2. R.K.Mittal and IJ Nagrath, Robotics and Control, Tata McGraw–Hill Publishing company Limited, New Delhi, 2003.

REFERENCES

1. Mikell P.Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey,Ashish Dutta, Industrial Robotics, Second Edition McGraw- Hill Education (India) PrivateLimited,2012
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private Limited, New Delhi,4thEdition 2002
3. John.JCriag, Introduction to Robotics-Mechanics and Control, Third Edition, Pearson Education,Inc., 2008.

L	T	P	C
3	0	0	3

23ME83- APPLIED OPERATIONS RESEARCH

PRE-REQUISITES: Engineering Mechanics, Kinematics of Machines

COURSE OBJECTIVES:

This course introduces students to various models and techniques used in Operations Research for effective decision-making. It covers linear programming, transportation and sequencing problems, replacement analysis, game theory, queuing models, and project management techniques like PERT and CPM. Students will also gain knowledge in dynamic programming and simulation to solve complex industrial and managerial problems.

COURSE OUTCOMES: At the end of the course, the student will be able to

- **CO1:** Formulate and solve linear programming problems using graphical and simplex methods for optimal decision-making. **(Applying – L3)**
- **CO2:** Apply appropriate methods to solve transportation, assignment, sequencing, and travelling salesman problems in production and logistics scenarios. **(Applying – L3)**
- **CO3:** Develop replacement models and queuing systems to support maintenance and service operations. **(Applying – L3)**
- **CO4:** Demonstrate and design strategies using game theory and apply inventory models to optimize resource allocation. **(Applying – L3)**
- **CO5:** Apply dynamic programming techniques to solve optimization problems and simulate real-world systems for decision support. **(Applying – L3)**

UNIT – I: INTRODUCTION TO OPERATIONS RESEARCH

INTRODUCTION - definition– characteristics and phases – types of operation research models – applications.

LINEAR PROGRAMMING: Problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II: TRANSPORTATION PROBLEM, SEQUENCING

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- travelling salesman problem.

SEQUENCING: Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III: REPLACEMENT THEORY, GAME THEORY

REPLACEMENT THEORY: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

GAME THEORY: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

UNIT – IV: QUEQUING SYSTEMS, PROJECT MANAGEMENT

WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel.

PROJECT MANAGEMENT: Basics for construction of network diagram, Program Evaluation and Review Technique (PERT), Critical Path Method (CPM) – PERT Vs. CPM, determination of floats-Project crashing and its procedure.

UNIT – V: DYNAMIC PROGRAMMING, SIMULATION

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming-shortest path problem – linear programming problem.

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages

TEXTBOOKS

1. Taha, H. A. (2022). Operations Research: An Introduction (11th ed.). Pearson.
2. Sharma, S. D. (2012). Operations Research: Theory, Methods & Applications. Kedar Nath Ram Nath & Co.

REFERENCE BOOKS

1. Hillier, F. S., & Lieberman, G. J. (2014). Introduction to Operations Research (10th ed.). McGraw-Hill.
2. Natarajan, A. M., Balasubramani, P., & Tamilarasi, A. (2005). Operations Research. Pearson Education.
3. Saseini, M., Yaspan, A., & Friedman, L. (Year n/a). Operations Research: Methods and Problems. Wiley.
4. Panneerselvam, R. (2006). Operations Research. PHI Learning.
5. Wagner, H. M. (1969). Principles of Operations Research. PHI Learning.
6. Sharma, J. K. (1997). Operations Research: Theory & Applications. Macmillan India.
7. Sharma, J. K. (2010). Mathematical Model in Operations Research. Tata McGraw-Hill.
8. Pai (2012). Operations Research. Oxford University Press.
9. Kalavathy, S. (2015). Operations Research. Vikas Publishing House.
10. Cheema, D. S. (2016). Operations Research. University Science Press.
11. Ravindran, A., Phillips, D. T., & Solberg, J. (2nd ed., 2007). Operations Research: Principles and Practice. Wiley.

L	T	P	C
3	0	0	3

23ME84- ENTREPRENEURSHIP

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVE:

The objective is to develop and strengthen entrepreneurial qualities and motivation among students, while also imparting fundamental entrepreneurial skills and knowledge necessary to run a business efficiently and effectively.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: Understand the fundamentals of entrepreneurship and identify the traits and competencies required for becoming a successful entrepreneur. **(Understanding-L2)**

CO2: Analyze the influence of family, society, and support institutions on entrepreneurial development and identify the role of training programs in fostering entrepreneurship. **(Analyzing-L4)**

CO3: Interpret central and state industrial policies and assess their impact on establishing and running a business, including aspects of international business. **(Applying-L3)**

CO4: Prepare a comprehensive business plan, including product selection, capital planning, ownership structure, and feasibility analysis to match entrepreneurial goals. **(Applying-L3)**

CO5: Apply strategies for launching and managing small businesses, including finance and HR mobilization, marketing, product launching, and evaluating business performance. **(Applying-L3)**

UNIT-I: ENTREPRENEURAL COMPETENCE

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

UNIT-II: ENTREPRENEURAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services.

UNIT-III: INDUSTRIAL POLACIES

Central and State Government Industrial Policies and Regulations - International Business.

UNIT-IV: BUSINESS PLAN PREPARATION

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT- V: LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

TEXT BOOKS

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.

REFERENCES

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.
4. Arya Kumar. Entrepreneurship. Pearson. 2012 5. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

23ME85- ADDITIVE MANUFACTURING

L	T	P	C
3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVE:

The course aims to provide a comprehensive understanding of the principles of prototyping, including the classification of Rapid Prototyping (RP) processes and the functioning of liquid-based RP systems. It further focuses on the understanding and application of solid-based and powder-based RP systems, along with various rapid tooling techniques. Additionally, the course emphasizes the knowledge of different data formats and explores the diverse applications of Additive Manufacturing (AM) processes across multiple fields.

COURSE OUTCOMES: At the end of the course, the student will be able to

- **CO1:** Understand the principles of prototyping, classification of RP processes and liquid-based RP systems. **(Understanding-L2)**
- **CO2:** Understand and apply different types of solid-based RP systems. **(Understanding-L2)**
- **CO3:** Apply powder-based RP systems. **(Applying-L3)**
- **CO4:** Analyze and apply various rapid tooling techniques. **(Applying-L3)**
- **CO5:** Understand different types of data formats and explore the applications of AM processes in various fields. **(Understanding-L2)**

UNIT – 1

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – 2

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modelling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – 3

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – 4

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools,

Ceramic tools, investment casting, spin casting, die casting, sand casting process. Direct rapid tooling: Direct AIM, LOM Tools, and Direct Metal Tooling using 3DP.

UNIT – 5

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, and Newly Proposed Formats.

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, RP medical and bioengineering applications: customized implants and prosthesis, forensic sciences.

TEXT BOOKS:

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications

REFERENCES:

1. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
2. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
4. Rapid Prototyping / Chua and Liou

23ME86- VEHICLE TECHNOLOGY

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PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVE:

The course aims to provide in-depth knowledge of advanced engine technologies, with a focus on various advanced combustion methods and their benefits. It covers the significance and techniques of utilizing low carbon fuels, along with a comprehensive understanding of hybrid and electric vehicle configurations. The course also explores the application of fuel cell technology in the automotive sector, emphasizing sustainable and efficient transportation solutions.

COURSE OUTCOMES: At the end of the course, the student will be able to

- **CO1:** Describe the latest trends in engine technology. **(Understanding-L2)**
- **CO2:** Discuss the need of advanced combustion technologies and its impact on reducing carbon foot-print on the environment. **(Understanding-L2)**
- **CO3:** Analyzing the basic characteristics of low carbon fuels, its impact over conventional fuels and in achieving sustainable development goals. **(Analyzing-L4)**
- **CO4:** Demonstrate the working and energy flow in various hybrid and electric configurations. **(Understanding-L2)**
- **CO5:** Analyzing the need for fuel cell technology in automotive applications. **(Analyzing-L4)**

UNIT – I: ADVANCED ENGINE TECHNOLOGY

Gasoline Direct Injection, Common Rail Direct Injection, Variable Compression Ratio Turbocharged Engines, Electric Turbochargers, VVT, Intelligent Cylinder De-activation, After Treatment Technologies, Electric EGR, Current EMS architecture.

UNIT – II: COMBUSTION TECHNOLOGY

Spark Ignition combustion, Compression Ignition Combustion, Conventional Dual Fuel Combustion, Low Temperature Combustion Concepts– Controlled Auto Ignition, Homogeneous Charge Compression Ignition, Premixed Charge Compression Ignition, Partially Premixed Compression Ignition, Reactivity Controlled Compression Ignition, Gasoline Direct Injection Compression Ignition.

UNIT – III: LOW CARBON FUEL TECHNOLOGY

Alcohol Fuels, Ammonia Fuel and Combustion, Methane Technology, Dimethyl Ether, Hydrogen Fuel Technology, Challenges, and way forward

UNIT – IV: HYBRID AND ELECTRIC VEHICLE (BATTERY POWERED)

Conventional Hybrids (Conventional ICE + Battery), Modern Hybrids (RCCI/GDCI Engine + Battery), Pure Electric Vehicle Technology – Challenges and Way forward

UNIT – V: FUEL CELL TECHNOLOGY

Fuel cells for automotive applications - Technology advances in fuel cell vehicle systems - Onboard hydrogen storage - Liquid hydrogen and compressed hydrogen - Metal hydrides, Fuel cell control system - Alkaline fuel cell - Road map to market.

TEXT BOOKS:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Rakesh Kumar Maurya, Characteristics and Control of Low Temperature Combustion Engines. ISBN 978-3-319-68507-6 , SPRINGER

REFERENCES:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons, 1998
4. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
5. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

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