JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech., ADVANCED MANUFACTURING SYSTEMS
EFFECTIVE FROM ACADEMIC YEAR 2025- 26 ADMITTED BATCH
R25 COURSE STRUCTURE AND SYLLABUS

I Year, I Semester

Course Code	Course Title	L	T	P	Credits
Professional Core-I	Automation in Manufacturing	3	0	0	3
Professional Core-II	Theory of Metal Cutting	3	0	0	3
Professional Elective - I	1. Design for Manufacturing and Assembly 2. Advanced Manufacturing Processes 3. Product Data Management	3	0	0	3
Professional Elective - II	1. Optimization Techniques and Applications 2. Precision Engineering 3. Additive Manufacturing	3	0	0	3
	Research Methodology and IPR	2	0	0	2
Lab - I	Automation Lab	0	0	4	2
Lab - II	Advanced Manufacturing Processes and Metal Cutting Lab	0	0	4	2
Audit - I	Audit Course- I	2	0	0	0
	Total	**16**	**0**	**8**	**18**

I Year, II Semester

Course Code	Course Title	L	T	P	Credits
Professional Core - III	Computer Integrated Manufacturing	3	0	0	3
Professional Core - IV	Manufacturing Systems: Simulation Modelling and Analysis	3	0	0	3
Professional Elective - III	1. Materials Technology 2. Quality Engineering in Manufacturing 3. Advanced Tool Design	3	0	0	3
Professional Elective - IV	1. Artificial Intelligence in manufacturing 2. Concurrent Engineering 3. Industrial Robotics	3	0	0	3
	Mini Project with Seminar	0	0	4	2
Lab - III	Computer Integrated Manufacturing Lab	0	0	4	2
Lab - IV	Simulation of Manufacturing Systems Lab	0	0	4	2
Audit - II	Audit Course - II	2	0	0	0
	Total	**14**	**0**	**12**	**18**

II Year, I Semester

Course Code	Course Title	L	T	P	Credits
Professional Elective - V	1. Production and Operations Management 2. MEMS 3. Flexible Manufacturing Systems	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review - II	0	0	18	6
	Total	**6**	**0**	**18**	**12**

II YEAR, II Semester

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review - III	0	0	18	6
Dissertation	Dissertation Viva-Voce	0	0	42	14
	Total	**0**	**0**	**60**	**20**

***For Dissertation Work Review - I, Please refer R25 Academic Regulations.**

Audit Course I:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education

Audit Course II:

1. Constitution of India
2. Pedagogy Studies
3. Stress Management by Yoga
4. Personality Development through Life Enlightenment Skills

Open Electives:

1. Business Analytics
2. Waste to Energy
3. Principles of Automation
4. Artificial Neural Networks

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
AUTOMATION IN MANUFACTURING
(Professional Core - I)

L	T	P	C
3	0	0	3

Prerequisites: Production Technology, Machine Tools, Operations Research

Course Objectives:

1. To introduce the basics of automation and its classification in manufacturing systems.
2. To understand control systems, types of automation, and their hardware components.
3. To analyze automated material handling, storage, and inspection systems.
4. To study transfer mechanisms and principles of system integration.
5. To evaluate economic aspects and strategies of implementing manufacturing automation.

Course Outcomes: Upon completion of this course the student will be able to:

1. Classify different types of automation and describe their roles in modern manufacturing.
2. Analyze discrete and continuous control systems used in automation.
3. Design material handling systems and storage solutions for automated facilities.
4. Understand inspection systems, transfer mechanisms, and integration methods.
5. Apply cost analysis and automation strategies in real-world manufacturing contexts.

UNIT-I: Introduction to Automation

Automation in Production Systems, Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing Operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation.

UNIT-II: Material Handling

Introduction, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and Other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic Data Capture, Overview of Automatic Identification Methods, Bar Code Technology and Other ADC Technologies.

UNIT -III: Manual Assembly Lines

Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, Largest Candidate Rule, Kilbridge and Wester Method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in Assembly Line Design.

UNIT-IV: Transfer lines

Fundamentals of Automated Production Lines, Storage Buffers, Applications of Automated Production Lines. Analysis of Transfer Lines with No Internal Storage, Analysis of Transfer Lines with Storage Buffers.

UNIT-V: Automated Assembly Systems

Fundamentals of Automated Assembly Systems, Design for Automated Assembly and Quantitative Analysis of Assembly Systems, Parts Delivery System at Workstations, Multi Station Assembly Machines and Single Station Assembly Machines, Partial Automation.

TEXTBOOKS:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Education, 4th Edition, 2015.
2. CAD/CAM: Principles, Practice and Manufacturing Management, Chris Mc Mohan, Jimmie Browne, Pearson Edu. (LPE), 2nd Edition, 2000.

REFERENCE BOOKS:

1. Automation, Buckingham W, Haper and Row Publishers, New York, 3rd Edition, 1961.
2. Automation for Productivity, Hugh D. Luke, A Becker and Hayes publication, New York, 1st Edition, 1972.
3. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education, 5th Edition, 2023.
4. Computer Control of Manufacturing Systems, Yoram Koren, McGraw-Hill, 1st Edition, 1983.
5. Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design, Yusuf Altintas, Cambridge University Press, 2nd Edition, 2012.
6. Industrial Automation: Hands On, Frank Lamb, McGraw-Hill Education, 1st Edition, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
THEORY OF METAL CUTTING
(Professional Core - II)

L	T	P	C
3	0	0	3

Pre- requisites: Engineering graphics, Mechanics of solids

Course Objectives:

1. To study the mechanics of metal cutting and chip formation processes.
2. To analyze the forces involved in various cutting operations.
3. To understand tool materials, tool life, and wear mechanisms.
4. To study heat generation and temperature control in metal cutting.
5. To evaluate cutting fluids and machining economics.

Course Outcomes: At the end of this course Students can

1. Understand the mechanics of chip formation in metal cutting.
2. Analyze cutting forces, power consumption, and cutting tool geometry.
3. Evaluate tool materials, tool wear mechanisms, and tool life equations.
4. Analyze heat generation and temperature distribution in machining operations.
5. Apply principles of metal cutting to optimize cutting conditions and tool selection.

UNIT – I: Metal Cutting Mechanics and Force Analysis

Geometry of Metal Cutting Process, Chip formation, Chip thickness ratio, Radius of Chip Curvature, Cutting Speed, Feed and Depth of Cut, Types of Chips and Chip Breakers.

Orthogonal and Oblique Cutting Processes: Definition, Forces and Energy Calculations, Power consumed, MRR, Effect of Cutting Variables on Forces, Force Measurement using Dynamometers.

UNIT – II: Single Point Cutting Tool

Various Systems of Specifications, Single Point Cutting Tool Geometry and their Inter-Relation. Theories of formation of Built up edge and their Effect, Design of Single Point contact Tools Throw away inserts.

UNIT – III: Multipoint Cutting Tools and Grinding Analysis

Multipoint Cutting Tool: Drill geometry, design of drills, Rake and Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speed and feed machining time design from cutters.

Grinding: Specifications of Grinding Wheel, Mechanics of Grinding, Effect of Grinding Conditions on Wheel wear and grinding ratio. Depth of Cut, Speed, Machining time, Temperature power.

UNIT – IV: Tool Life and Tool Wear

Theories of Tool Wear, Adhesion, Abrasive and Diffusion Wear Mechanisms, Forms of Wear, Tool life criteria and Machinability Index.

Types of Sliding Contact, Real area of Contact, Laws of Friction and Nature of Frictional Force in Metal Cutting. Effect of Tool Angle, Economics, Cost Analysis, Mean Co-Effect of Friction.

UNIT – V: Metal Cutting and Tool Materials

Cutting Temperature: Sources of Heat in Metal Cutting, Influence of Metal Conditions, Temperature Distribution, Zones, Experimental Techniques, Analytical Approach. Use of Tool Work, Thermocouple for Determination of Temperature. Temperature Distribution in Metal Cutting.

Cutting fluids: Functions of Cutting Fluids, Types of Cutting Fluids, Properties, Selection of Cutting Fluids.

Cutting tool materials: Historical Developments, Essential Properties of Cutting Tool Materials, Types, Composition and Application of Various Cutting Tool Materials, Selection of Cutting Tool Materials.

TEXTBOOKS:

1. Metal Cutting Principles, MC Shaw, Oxford and IBH Publications, New Delhi, 3rd Edition, 1957.
2. Fundamentals of Machining, Boothryd, Edward Amold publishers Ltd, 2nd Edition, 1989.

REFERENCE BOOKS:

1. Tool Design, David S. Ostwald, Tata McGraw Hill, 5th Edition, 2000.
2. Fundamentals of Tool Design, F.W. Wilson, ASTME PHI, 6th Edition, 2010.
3. Technology of machine tools, Steve F. Krar, Arthur R. Gill and Peter Smid, McGraw Hill Education (India) Pt. Ltd., 7th Edition, 2013.
4. Metal Cutting Principles, Milton C. Shaw, Oxford University Press, 2nd Edition, 2005.
5. Introduction to Machining Science, G. Kuppuswamy, Alpha Science International Ltd, 2nd Edition, 2005.
6. Machining and Machine Tools, A.B. Chattopadhyay, Wiley India, 1st Edition, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
DESIGN FOR MANUFACTURING AND ASSEMBLY
(Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisites: Manufacturing Processes, Engineering Materials

Course Objectives:

1. Introduce the principles and constraints of manufacturability that influence product design.
2. Familiarize students with Design for Manufacturability (DFM) methodology and its application across various manufacturing processes.
3. Enable students to identify infeasible or impractical designs early in the product development cycle.
4. Guide students to select appropriate materials and processes based on functionality and manufacturability.
5. Equip students with tools to improve assembly efficiency through manual and automated design considerations.

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

1. Understand and evaluate quality and cost aspects of product design for manufacture and assembly.
2. Apply Boothroyd's systematic DFA/DFM methods to optimize design and improve manufacturability.
3. Integrate DFM principles in casting, machining, forming, welding, and plastic component design.
4. Analyze and identify key design variables to align product development with customer and process specifications.
5. Apply automation and manual assembly techniques to enhance production efficiency and reliability.

UNIT - I: Design and Material Selection

Introduction, Design Philosophy, Steps in Design Process, General Design Rules for Manufacturability, Basic Principles of Designing for Economical Production, Creativity in Design. Selection of Materials for Design, Developments in Material Technology, Criteria for Material Selection, Material Selection Interrelationship with Process Selection, Process Selection Charts.

UNIT - II: Machining and Casting Design

Machining Process: Overview of Various Machining Processes, General Design Rules for Machining, Dimensional Tolerance and Surface Roughness, Design for Machining Ease, Redesigning of Components for Machining Ease with Suitable Examples, General Design Recommendations for Machined Parts. Metal Casting: Appraisal of Various Casting Processes, Selection of Casting Process, General Design Considerations for Casting, Casting Tolerances, Use of Solidification Simulation in Casting Design, Product Design Rules for Sand Casting.

UNIT - III: Forming, Joining and Plastics

Metal Joining: Appraisal of Various Welding Processes, Factors in Design of Weldments, General Design Guidelines, Pre- and Post-Treatment of Welds, Effects of Thermal Stresses in Weld Joints, Design of Brazed Joints.

Forging: Design Factors for Forging, Closed Die Forging Design, Parting Lines of Dies, Drop Forging Die Design, General Design Recommendations.

Extrusion and Sheet Metal Work: Design Guidelines for Extruded Sections, Design Principles for Punching, Blanking, Bending, Deep Drawing, Keeler-Goodman Forming Line Diagram, Component Design for Blanking.

Plastics: Viscoelastic and Creep Behavior in Plastics, Design Guidelines for Plastic Components, Design Considerations for Injection Moulding.

UNIT-IV: Automated Assembly Design

Assembly Advantages: Development of the Assembly Process, Choice of Assembly Method, Assembly Advantages, Social Effects of Automation.

Automatic Assembly Transfer Systems: Continuous Transfer, Intermittent Transfer, Indexing Mechanisms, and Operator-Paced Free-Transfer Machine.

UNIT-V: Design of Manual Assembly

Design for Assembly: Fits in the Design Process, General Design Guidelines for Manual Assembly, Development of the Systematic DFA Methodology, Assembly Efficiency, Classification System for Manual Handling, Classification System for Manual Insertion and Fastening, Effect of Part Symmetry on Handling Time, Effect of Part Thickness and Size on Handling Time, Effect of Weight on Handling Time, Parts Requiring Two Hands for Manipulation, Effects of Combinations of Factors, Effect of Symmetry, Effect of Chamfer Design on Insertion Operations, Estimation of Insertion Time.

TEXT BOOKS:

1. Assembly Automation and Product Design, Geoffrey Boothroyd, Marcel Dekker Inc., New York, 1st Edition, 1992.
2. Engineering Design: A Materials and Processing Approach, George E. Dieter, McGraw-Hill International, 2nd Edition, 2000.
3. Handbook of Product Design, Geoffrey Boothroyd, Marcel Dekker Inc., New York, 1st Edition, 1990.

REFERENCES:

1. Product Design for Manufacturing and Assembly, Geoffrey Boothroyd, Peter Dewhurst, Winston Anthony Knight, CRC Press, 3rd Edition, 2010.
2. Design for Manufacturability Handbook, James G. Bralla, McGraw-Hill, 2nd Edition, 1999.
3. Materials and Design: The Art and Science of Material Selection in Product Design, Michael F. Ashby and Kara Johnson, Butterworth-Heinemann, 3rd Edition, 2013.
4. Manufacturing Processes for Design Professionals, Rob Thompson, Thames and Hudson, 1st Edition, 2007.
5. Design and Manufacturing of Plastics Products, Nabil Bashir, Wiley-Scrivener, 1st Edition, 2020.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

ADVANCED MANUFACTURING PROCESSES

(Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisites: Production Technology, Machine Tools, Metal Cutting, Material Science.

Course Objectives:

1. Introducing xstudents to various unconventional and advanced manufacturing processes.
2. To explain the working principles and applications of non-traditional machining methods.
3. To provide an understanding of surface treatment techniques and their industrial significance.
4. To familiarize students with modern processing methods for ceramics and composite materials.
5. To expose students to emerging trends in e-manufacturing, nanotechnology, micro-machining, and high-speed machining.

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

1. Explain various surface treatment processes.
2. Explain various non-traditional machining processes.
3. Estimate performance characteristics of various machining processes.
4. Understand ceramics and composites processing techniques.
5. Apply concepts of e-manufacturing, nanotechnology, micromachining, and high-speed machining in advanced manufacturing.

UNIT-I: Surface Treatment

Scope, Cleaners, Methods of Cleaning, Surface Coating Types and Ceramic and Organic Methods of Coating, Economics of Coating. Electro Forming, Chemical Vapour Deposition, Thermal Spraying, Ion Implantation, Diffusion Coating, Diamond Coating and Cladding.

UNIT-II: Non-Traditional Machining

Introduction, Need, AJM, Parametric Analysis, Process Capabilities, USM Mechanics of Cutting, Models, Parametric Analysis, WJM Principle, Equipment, Process Characteristics, Performance, EDM Principles, Equipment, Generators, Analysis Of R-C Circuits, MRR, Surface Finish, WEDM.

UNIT-III: Modern Machining Processes

Laser Beam Machining: Principle of Working, Equipment, Material Removal Rate, Process Parameters, Performance Characterization, Applications.

Plasma Arc Machining: Principle of Working, Equipment, Material Removal Rate, Process Parameters, Performance Characterization, Applications.

Electron Beam Machining: Principle of Working, Equipment, Material Removal Rate, Process

Parameters, Performance Characterization, Applications.
Electro Chemical Machining: Principle of Working, Equipment, Material Removal Rate, Process Parameters, Performance Characterization, Applications.

UNIT-IV: Processing of Ceramics

Applications, Characteristics, Classification. Processing of Particulate Ceramics, Powder Preparations, Consolidation, Drying, Sintering, Hot Compaction, Area of Application, Finishing of Ceramics.
Processing of Composites: Composite Layers, Particulate and Fiber Reinforced Composites, Elastomers, Reinforced Plastics, MMC, CMC, Polymer Matrix Composites.

UNIT-V: Fabrication of Microelectronic devices

Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. e-Manufacturing, nanotechnology, micromachining and High-speed Machining, basic principles, working, applications, advantages.

TEXTBOOKS:

1. Manufacturing Engineering and Technology, Serope Kalpakjian , Steven R. Schmid, Pearson Publications, 7th Edition, 1995.
2. Foundation of MEMS, Chang Liu, Pearson Education, 2nd Edition, 2011.

REFERENCE BOOKS:

1. Process and Materials of Manufacturing, R. A. Lindburg Prentice Hall India Learning Private Limited, 4th Edition 1990.
2. Introduction to Manufacturing Processes, John A Schey, Mc Graw Hill Book company, 2nd Edition, 1987.
3. Micro Machining of Engineering Materials, J. Mc Geough, CRC Press, 1st Edition, 2001.
4. Non-Traditional Manufacturing Processes, Gary F Benedict, CRC Press, 1st Edition, 1987.
5. Advanced Methods of Machining by J. A Mc Geough, Chapman and Hall; 1988th Edition, 1988
6. Advanced Machining Processes, V. K. Jain, Allied Publishers, 1st Edition, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

PRODUCT DATA MANAGEMENT

(Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisites: Management Science

Course Objectives:

1. To build competence with tools and methods for product design and development.
2. To instill confidence in creating and managing new product development projects.
3. To promote awareness of cross-functional roles in product development (marketing, finance, design, production).
4. To enhance the ability to coordinate multidisciplinary tasks towards a common goal.
5. To reinforce knowledge through practice and reflection in real-world, action-oriented settings.
6. To strengthen team collaboration skills.

Course Outcomes: After doing this course, the student will be able to

1. Understand industrial product development, customer needs, and design aspects of new products.
2. Involve customers in product development and effectively manage their requirements.
3. Apply design of experiments and technical analysis in product development.
4. Understand and apply concepts of product architecture.
5. Investigate customer needs and conduct problem surveys.
6. Apply design for manufacturability concepts and develop prototypes.

UNIT- I: Introduction

Need For IPPD, Strategic Importance of Product Development, Integration of Customer, Designer, Material Supplier and Process Planner, Competitor and Costumer, Behavior Analysis. Understanding Customer, Promoting Customer Understanding, Involve Customer in Development, Managing Requirements, Organization, Process Management and Improvement, Plan and Establish Product Specification.

UNIT – II: Concept Generation and Selection

Task, Structured Approaches, Clarification Search, Externally and Internally Explore Systematically, Reflect on the Solutions and Process, Concept Selection, Methodology, Benefits. Product Architecture: Implications, Product Change, Variety, Component Standardization, Product Performance, Manufacturability.

UNIT - III: Product Development Management

Establishing the Architecture, Creation, Clustering, Geometric Layout Development, Fundamental and Incidental Interactions, Related System Level Design Issues, Secondary Systems, Architecture of the Chunks, Creating Detailed Interface Specifications.

Industrial Design: Integrate Process Design, Managing Costs. Robust Design Integrating: CAE, CAD, CAM Tools, Simulating Product Performance and Manufacturing Processing

Electronically, Need for Industrial Design, Impact Design Process.

UNIT – IV: Industrial Design Process and Evaluation

Investigation Of Customer Needs, Conceptualization, Refinement, Management of the Industrial Design Process, Technology Driven Products, User Driven Products Assessing the Quality of Industrial Design.

UNIT – V: Design for Manufacturing and Product Development

Definition, Estimation of Manufacturing Cost, Reducing the Component Costs and Assembly Costs, Minimize System Complexity. Prototype Basics, Principles of Prototyping, Planning for Prototypes, Economics Analysis, Understanding and Representing Tasks, Baseline Project Planning, Accelerating the Project Execution.

TEXT BOOKS:

1. Product Design and Development, Kari T. Ulrich and Steven D. Eppinger, McGrawill Education, 6th Edition, 2016.
2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, 1st Edition, 1992.

REFERENCE BOOKS:

1. Tool Design–Integrated Methods for Successful Product Engineering, Staurt Pugh, Addison-Wesley Publishing Company, 1st Edition, 1991.
2. Production and Operations Management, William J. Stevenson, McGraw Hill, 13th Edition, 2022.
3. Tool Design: Integrated Methods for Successful Product Engineering, Stuart Pugh, Addison-Wesley Publishing Company, 2nd Edition, 2022.
4. Production and Operations Management, William J. Stevenson, McGraw-Hill Education, 14th Edition, 2024.
5. Product Lifecycle Management: Driving the Next Generation of Lean Thinking, Michael Grieves, McGraw-Hill Education, 2nd Edition, 2021.
6. Engineering Design Process, Yousef Haik and Tamer M. Shahin, Cengage Learning, 4th Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

OPTIMIZATION TECHNIQUES AND APPLICATIONS

(Professional Elective - II)

L	T	P	C
3	0	0	3

Pre-requisites: Operations Research

Course Objectives:

1. To introduce the fundamentals of optimization and its role in engineering and decision-making.
2. To develop the ability to formulate optimization problems for real-world applications.
3. To familiarize students with classical, numerical, and modern optimization techniques.
4. To enable analysis and comparison of various optimization algorithms for efficiency and accuracy.
5. To apply optimization methods to solve practical problems in manufacturing, design, and management.

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

1. Apply suitable optimization techniques to solve single-variable and multivariable problems.
2. Perform sensitivity analysis for parameter changes in Linear Programming Problems.
3. Solve integer and stochastic programming problems using appropriate algorithms.
4. Formulate and solve Goal Programming models for multi-objective optimization.
5. Apply metaheuristic methods such as Genetic Algorithm, Simulated Annealing, and Particle Swarm Optimization to real-world problems.

UNIT-I: Linear Programming

Formulation, Simplex Method and Artificial Variable Optimization Techniques: Big M and Two-Phase Methods. Sensitivity Analysis: Changes in the Objective Coefficients, Constants and Coefficients of the Constraints. Addition of Variables, Constraints. Simulation, Introduction, Types, Steps, Applications. Inventory and Queuing, Advantages and Disadvantages.

UNIT-II: Integer and Stochastic Programming Techniques

Integer Programming: Introduction, Formulation, Geometry Cutting Plane Algorithm, Zero or One Algorithm, Branch and Bound Method.

Stochastic Programming: Basic Concepts of Probability Theory, Random Variables, Distributions - Mean, Variance, Correlation, Co Variance, Joint Probability Distribution. Stochastic Linear Programming: Chance Constrained Algorithm.

UNIT-III: Single Variable Non-Linear Unconstrained Optimization

Elimination Methods: Uni-Model Function, Its Importance. Fibonacci Method and Golden Section Method. Interpolation Methods: Quadratic and Cubic Interpolation Methods.

UNIT-IV: Multi variable non-linear unconstrained optimization

Direct Search Methods, Univariant Method, Pattern Search Methods, Powell's, Hook Jeeves, Rosenbrock Search Methods. Gradient Methods: Gradient Of Function and its Importance, Steepest

Descent Method, Conjugate Direction Methods: Fletcher- Reeves Method Variable Metric Method.

UNIT-V: Geometric Programming and Modern Optimization Methods

Geometric Programming: Posynomials, Arithmetic, Geometric Inequality, Unconstrained G.P, Constrained G.P (≤ Type Only).

Non-Traditional Optimization Algorithms: Genetics Algorithm, Working Principles, Similarities and Differences Between Genetic Algorithm and Traditional Methods. Simulated Annealing, Working Principle, Simple Problems. Introduction to Particle Swarm Optimization. (PSO).

TEXTBOOKS:

1. Engineering Optimization: Theory and Practice, S. S. Rao, New Age International Pvt. Ltd Publishers, 3rd Edition, 2013.
2. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Operations Research: Theory and Applications, S. D. Sharma, Kedar Nath Ram Nath Publisher, 4th Edition, 2022.
2. Operations Research: An Introduction, H. A. Taha, Pearson Publisher, 10th Edition, 2019.
3. Optimization in operations research, R. L Rardin, Pearson Imprint, 3rd Edition, 2016.
4. Optimization Techniques, Chakraverty and P.R. Chandraputla, Pearson Asia, 1st Edition, 2011.
5. Optimization: Theory and Practice, Mohan C. Joshi and Kannan M. Moudgalya, Narosa Publishing House, 1st Edition, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

PRECISION ENGINEERING

(Professional Elective - II)

L	T	P	C
3	0	0	3

Pre-requisites: Machine Tools, Metrology

Course Objectives:

1. To introduce the fundamental principles and scope of precision engineering in modern manufacturing.
2. To impart knowledge on the design and development of precision components and systems.
3. To familiarize students with ultra-precision machining processes and micro/nano manufacturing technologies.
4. To develop understanding of precision measurement, metrology standards, and error analysis.
5. To enable students to apply precision engineering concepts for improving product quality, reliability, and performance.

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

1. Apply fits and tolerances for parts and assemblies according to ISO standards.
2. Apply selective assembly concept for quality and economic production.
3. Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
4. Evaluate the part and machine tool accuracy.
5. Analyze the causes for dimensional and geometrical errors prior to and during machining and suggest remedies.

UNIT- I: Machine Tool Accuracy and GD&T Principles

Concepts of Accuracy: Introduction, Concept of Accuracy of Machine Tools, Spindle and Displacement Accuracies, Accuracy of Numerical Control Systems, Errors Due to Numerical Interpolation, Displacement Measurement System and Velocity Lags.

Geometric Dimensioning and Tolerance**:** Tolerance Zone Conversions, Surfaces, Features, Features of Size, Datum Features, Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datum, Datum Feature of Representation, Form Controls, Orientation Controls, Logical Approach to Tolerance.

UNIT-II: Datum Systems

Design of Freedom, Grouped Datum Systems, Different Types, Two and Three Mutually Perpendicular Grouped Datum Planes, Grouped Datum System with Spigot and Recess, Pin and Hole, Grouped Datum System with Spigot and Recess Pair and Tongue, Slot Pair, Computation of Transnational and Rotational Accuracy, Geometric Analysis and Application.

UNIT-III: Tolerance Analysis and Charting Techniques

Tolerance Analysis: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost Aspects, Feature Tolerances, Geometric Tolerances.

Tolerance Charting Techniques: Operation Sequence for Typical Shaft type of Components, Preparation of Process Drawings for different Operations, Tolerance Worksheets and Central

Analysis, Examples. Design Features to Facilitate Machining, Datum Features, Functional and Manufacturing. Components Design, Machining Considerations, Redesign for Manufactured Parts Examples.

UNIT–IV: Surface Finish and Tolerance Relationships

Review of Relationship between Attainable Tolerance Grades and Different Machining Process. Cumulative Effect of Tolerances Sure Fit Law, Normal Law and Truncated Normal Law.

UNIT-V: Measuring Systems Processing

In Process or In-Situ Measurement of Position of Processing Point, Post Process and on Machine Measurement of Dimensional Features and Surface Mechanical and Optical Measuring Systems.

TEXTBOOKS:

1. Precision Engineering in Manufacturing, Murthy R. L., New Age International,1st Edition, 1996.
2. Geometric Dimensioning and Tolerancing: Applications and Techniques for Use in Design, Manufacturing, and Inspection, James D. Meadows, Marcel Dekker Inc, 1st Edition, 1995.

REFERENCE BOOK:

1. Engineering Design: A Systematic Approach, Dr-Ing. Robert Matousek, Matousek, Blackie and Son Ltd, 1st Edition, 1957.
2. Precision Engineering, V. C. Venkatesh and Sudin Izman, McGraw-Hill Education, 1st Edition, 2007.
3. Fundamentals of Precision Engineering, Richard Leach, CRC Press, 1st Edition, 2014.
4. Precision Engineering and Nanotechnology, Liangchi Zhang, Springer, 1st Edition, 2012.
5. Precision Manufacturing, David Dornfeld, Springer, 1st Edition, 2007.
6. Handbook of Precision Engineering, Pat McKeown, Butterworth-Heinemann, 1st Edition, 1991.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
ADDITIVE MANUFACTURING
(Professional Elective - II)

L	T	P	C
3	0	0	3

Prerequisites: Basics of Manufacturing, Basic knowledge in Calculus, Physics, Thermodynamics, and Chemistry

Course Objectives:

1. To introduce the fundamentals of additive manufacturing technologies and processes.
2. To explain the principles of various AM techniques like SLS, SLA, FDM, and 3DP.
3. To study materials used in additive manufacturing and their properties.
4. To explore applications of additive manufacturing in prototyping and production.
5. To provide insights into design guidelines, limitations, and future trends in AM.

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

1. Understand the basic principles and classifications of additive manufacturing processes.
2. Select appropriate AM processes and materials for different applications.
3. Analyze design considerations specific to additive manufacturing.
4. Evaluate the performance and limitations of various AM techniques.
5. Apply additive manufacturing knowledge in product development and industrial applications.

UNIT–I: Introduction to AM

Prototyping Fundamentals: Need For Time Compression in Product Development, Need for Additive Manufacturing, Historical Development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly Used Terms, Classification of AM Process, Fundamental Automated Processes: Distinction Between AM and CNC, Other Related Technologies.

UNIT–II: Liquid and Solid-Based AM Systems

Liquid-Based AM 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. Poly Jet: Process, Principle, Working Principle, Applications, Advantages and Disadvantages, Case Studies. Micro Fabrication.

Solid-Based AM Systems: Laminated Object Manufacturing (LOM): Models and Specifications, Process, Working Principle, Applications, Advantages and Disadvantages, Case Studies. Fused Deposition Modeling (FDM): Models and Specifications, Process, Working Principle, Applications, Advantages and Disadvantages, Case Studies. Multi-Jet Modelling (MJM): Models and Specifications, Process, Working Principle, Applications, Advantages and Disadvantages, Case Studies.

UNIT–III: **Powder-Based AM and Rapid Tooling**

Powder Based AM 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.
Laser Engineered Net Shaping (LENS): Models and Specifications, Process, Working Principle, Applications, Advantages and Disadvantages, Case Studies. Electron Beam Melting (EBM): Models and Specifications, Process, Working Principle, Applications, Advantages and Disadvantages, Case Studies
Rapid Tooling: Introduction To Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool Process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling Using 3DP.

UNIT–IV: AM Data Formats and Software
AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL File Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Subdivision Techniques.
AM Software's: Need For AM Software, Features of Various AM Software's Like Magics, Mimics, Solid View, View Expert, 3D View, Velocity 2, Rhino, STL View 3 Data Expert And 3 D Doctor, Surgi Guide, 3-Matic, Simplant, Mesh Lab.

UNIT–V: Industrial and Medical AM Applications
Applications of AM, Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS Application, Arts and Architecture.
RP Medical and Bioengineering Applications: Planning and Simulation of Complex Surgery, Customized Implants and Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Web Based Rapid Prototyping Systems

TEXTBOOK:
1. Rapid Prototyping: Principles and Applications, Chee Kai Chua, Kah Fai Leong and Chu Sing Lim, World Scientific Publishing Co, Third Edition, 2010.
2. Additive Manufacturing: Materials, Processes, Quantifications and Applications, Kun Zhou, CRC Press, 1st Edition, 2021.

REFERENCE BOOKS:
1. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, D. T. Pham and S. S. Dimov, Springer, 1st Edition 2001.
2. Wohlers Report 2000: Rapid Prototyping and Tooling State of the Industry, Terry T. Wohlers, Wohlers Associates, Fort Collins, CO, Annual Report, 2000.
3. Rapid Prototyping and Engineering Applications, Frank W. Liou, CRC Press, 2nd Edition, 2019.
4. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2nd Edition, 2015.
5. Additive Manufacturing: Design, Methods, and Processes, Andreas Gebhardt, Hanser Publishers, 2nd Edition, 2016.
6. Fundamentals of Additive Manufacturing for the Practitioner, Sheku Kamara, Javarro Russell, Klaus-Dieter Thoben, Wiley, 1st Edition, 2021.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Prerequisite: Fundamentals of Statistics, Technical Writing Skills

Course Objectives:

1. To understand research fundamentals, methodologies, and the significance of research ethics.
2. To enable students to formulate research problems and conduct literature surveys effectively.
3. To introduce the principles of data collection, analysis, and interpretation in research.
4. To explain intellectual property rights, patents, copyrights, and trademarks.
5. To highlight the importance of IPR in protecting innovative ideas and research outcomes.

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

1. Understand the research process, methodologies, and ethics involved in scholarly work.
2. Formulate and define research problems with appropriate objectives.
3. Apply suitable data collection and analysis techniques for research projects.
4. Understand the various forms of intellectual property rights and legal aspects related to patents and copyrights.
5. Apply the knowledge of IPR to safeguard their innovations and research findings.

UNIT-I: Research Problem and Investigation Approaches

Meaning of Research Problem, Sources of Research Problem and Criteria Characteristics of a Good Research Problem, Errors in Selecting a Research Problem, Scope and Objectives of Research Problem. Approaches of Investigation of Solutions for Research Problem, Data Collection, Analysis, Interpretation, Necessary Instrumentations.

UNIT-II: Literature Review and Ethics

Effective Literature Studies Approaches, Analysis, Plagiarism, Research Ethics.

UNIT-III: Technical Writing and Proposals.

Effective Technical Writing, How to Write Report, Paper Developing a Research Proposal, Format of Research Proposal, a Presentation and Assessment by A Review Committee.

UNIT-IV: Intellectual Property and Patenting

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process Of Patenting and Development: Technological Research, Innovation, Patenting, Development. International Scenario: International Cooperation on Intellectual Property. Procedure for Grants of Patents, Patenting Under PCT.

UNIT-V: Patent Rights and Emerging IPR

Patent Rights: Scope of Patent Rights, Licensing and Transfer of Technology, Patent Information and Databases, Geographical Indications. New Developments in IPR: Administration of Patent System. IPR of Biological Systems, Computer Software Etc., Traditional Knowledge Case Studies, IPR and IITs.

TEXTBOOKS:

1. Research methodology: an introduction for science and engineering students, Stuart Melville and Wayne Goddard, Juta and Co. Ltd, 1ST Edition, 1996.
2. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, SAGE, 2nd Edition, 2010.

REFERENCE BOOKS:

1. Resisting Intellectual Property, Debora J. Halbert, Routledge, Taylor and Francis, 1st Edition, 2005.
2. Industrial Design, W. H. (William Henry) Mayall, Iliffe Books (London), also McGraw-Hill editions, 1st Edition, 1974.
3. Intellectual Property in the New Technological Age, Robert P. Merges, Peter S. Menell and Mark A. Lemley, Aspen Casebook Series, Latest Edition, 2016.
4. Intellectual Property Rights under WTO, T. Ramappa, Wheeler Publishing, 1st Edition, 2000.
5. Research Methodology and IPR, P. N. Ganesan, Scitech Publications, 1st Edition, 2019.
6. Intellectual Property Rights: Unleashing the Knowledge Economy, Prabuddha Ganguli, Tata McGraw-Hill, 1st Edition, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

AUTOMATION LAB

L	T	P	C
0	0	4	2

Prerequisites: Industrial Automation and Control Systems

Course Objectives:

1. To provide hands-on experience in programming and operating automation systems
2. To familiarize students with PLC programming, industrial sensors, and actuators.
3. To train students in developing and implementing control logic for industrial applications.
4. To introduce SCADA and HMI systems in automation control.
5. To enable troubleshooting and maintenance of automated systems.

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

1. Operate and program PLCs for various industrial automation applications
2. Interface sensors and actuators with automation controllers.
3. Design and implement automation logic for manufacturing processes.
4. Understand SCADA systems for monitoring and control applications.
5. Troubleshoot automation systems and optimize control strategies.

List of Experiments:

1. Draw the circuit diagram to operate a single acting pneumatic cylinder using 3, 2 push button direction control valve.
2. Draw the circuit diagram to operate double acting pneumatic cylinder using 5, 2 direction control valve using push button momentary switch, push button latch.
3. Draw the circuit diagram to operate single acting pneumatic cylinder using 5, 2 air spring valve and PLC.
4. Draw the circuit diagram to operate a double acting pneumatic cylinder using 5, 2 air spring valve and PLC.
5. Draw the circuit diagram to operate a double acting hydraulic cylinder using 4, 2 direction control valve (solenoid control) using push button switch, latch switch.
6. Draw the circuit diagram to operate double acting hydraulic cylinder using 4, 2 directions.
7. Draw the circuit diagram to operate double acting hydraulic cylinder using 4, 2 direction control valve (solenoid control) using PLC.
8. Draw the circuit diagram to operate double acting hydraulic cylinder using 4, 3 direction control valve (solenoid control) using PLC.
9. Direct Kinematic Analysis of a Robot.
10. Inverse Kinematic Analysis of a Robot.
11. Trajectory planning of a Robot joint in Space scheme.
12. Palletizing Operation using Robot Programming.
13. Robotic programming using SCARA.

Note: Conduct any 10 out of 13 exercises from the list.

Lab Manuals:

1. Automation and Robotics Laboratory Manual, S. R. Deb & S. Deb, Tata McGraw Hill Education, 1st Edition, 2019.
2. Programmable Logic Controllers and Automation Laboratory Manual, Frank D. Petruzella, McGraw Hill Education, 4th Edition, 2017.
3. Industrial Automation Laboratory Manual, K. S. Srinivasan, Wiley India, 1st Edition, 2018.
4. Mechatronics and Industrial Automation Lab Manual, W. Bolton, Pearson Education, 6th Edition, 2020.
5. PLC and SCADA Laboratory Manual, Rajesh Kumar & R. K. Rajput, S. Chand Publishing, 1st Edition, 2016.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

ADVANCED MANUFACTURING PROCESSES and METAL CUTTING LAB

L	T	P	C
0	0	4	2

Prerequisites: Advanced Manufacturing Processes, Theory of Metal Cutting

Course Objectives:

1. To provide hands-on experience in advanced manufacturing and metal cutting operations.
2. To demonstrate non-traditional machining processes and cutting force analysis.
3. To enable students to understand the influence of process parameters on machining performance.
4. To expose students to measurement techniques for cutting forces, tool wear, and surface finish.
5. To correlate theoretical knowledge with experimental outcomes in manufacturing.

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

1. Operate advanced manufacturing machines and metal cutting equipment.
2. Measure and analyze cutting forces, tool wear, and surface finish.
3. Evaluate the performance of different advanced manufacturing processes.
4. Understand the effect of process parameters on product quality and machining efficiency.
5. Apply theoretical concepts in solving practical manufacturing problems and optimize machining operations.

List of Experiments:

1 Study of the morphology of chips produced from different materials and machining processes.
2 Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions.
3 Study of cutting ratio, chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4 Evaluations of tool face temperature with thermocouple method.
5 Roughness of machined surface. Influence of tool geometry and feed rate.
6 Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
7. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
8 Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
9 Determination of cutting forces in turning
10 Inspection of parts using tool makers microscope, roughness and form tester
11 EDM: MRR and TWR and Surface Finish
12 Experimental Study on ECM
13 3D Printing

Note: Conduct any10 out of 13 exercises from the list.

Lab Manuals:

1. Advanced Manufacturing Processes Laboratory Manual, V. K. Jain, Narosa Publishing House, 2nd Edition, 2020.
2. Lab Manual on Advanced Manufacturing Processes, P. M. Pandey, I K International Publishing House, 1st Edition, 2018.
3. Advanced Machining Processes Laboratory Manual, Hassan El-Hofy, McGraw Hill Education, 1st Edition, 2019.
4. Metal Cutting and Machine Tools Laboratory Manual, G. K. Lal & A. K. Choudhury, Narosa Publishing House, Revised Edition, 2017.
5. Laboratory Manual of Manufacturing Processes and Metal Cutting, R. K. Rajput, S. Chand Publishing, 1st Edition, 2016.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
COMPUTER INTERGRATED MANUFACTURING
(Professional Core - III)

L	T	P	C
3	0	0	3

Prerequisites: Manufacturing Processes, Production Technology and CAD/CAM

Course Objectives: To make the students

1. To understand the role of computers in manufacturing.
2. To provide an in-depth understanding of manufacturing and database systems.
3. To provide an understanding of the needs of the market and design the product.
4. To design and develop material handling, storage and retrieval systems for specific cases of manufacturing.
5. To develop CIM systems for current manufacturing scenario by using computer and networking tools.

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

1. Select the necessary computing tools for the development of products.
2. Use appropriate database systems for manufacturing a product and store the same for future use.
3. Apply the latest technology of manufacturing systems and software for the development of a product.
4. Use modern manufacturing techniques and tools including principles of networking.
5. Apply the concepts of lean manufacturing and agile manufacturing.

UNIT – I: Concepts of CIM

The meaning of Manufacturing, Types of Manufacturing; CIM Definition, Elements of CIM, CIM wheel, Concept or Technology, Evolution of CIM, Benefits of CIM, Needs of CIM, Hardware and software, Fundamentals of Communication, Communications Matrix, Product Development Cycle. Concurrent Engineering: Definition, Sequential Engineering versus Concurrent Engineering, Benefits of Concurrent Engineering, Characteristics of Concurrent Engineering, Framework for Integration of Life Cycle Phases in CE, Concurrent Engineering Techniques, Integrated Product Development (IPD), Product Life Cycle Management (PLM), Collaborative Product Development.

UNIT – II: Database Systems and PDM

Introduction to Manufacturing Data, Types, Sources, Database Terminology, Database Requirements, Database Models, Database Management System, DBMS Architecture, Query Language, Structural Query Language (SQL), Basic structure, Data Definition Language (Create, Alter, Drop, Truncate, View), Data Manipulation Language (Store, Retrieve, Update, Delete).
Illustration of Creating and Manipulating a Manufacturing Database, SQL as a Knowledge Base Query Language, Features of Commercial DBMS, Oracle, MySQL, SQL Access, Sybase, DB2, Product Data Management (PDM), Advantages of PDM.

UNIT – III: Product and Manufacturing Systems

Product Design: Needs of the market, Design and Engineering, The design Process, Design for Manufacturability (DFM): Component Design, Design for Assembly.

Computer-Aided Process Planning: Basic Steps in developing a process plan, Variant and Generative Process Planning, Feature Recognition in Computer-Aided Process Planning. Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP –II).

Cellular Manufacturing: Design of Cellular Manufacturing Systems, Cell Formation Approaches: Machine Component Group Analysis, Similarity Coefficients- Based Approaches, Evaluation of Cell Design.

Shop-floor Control: Data Logging and Acquisition, Automated Data Collection, Programmable Logic Controllers, Sensor Technology. Flexible Manufacturing Systems: Physical Components of an FMS, Types of Flexibility. Layout Considerations: Linear Single Machine Layout, Circular Machine Layout, Cluster Machine Layout, Loop Layout, Operational Problems of FMS. FMS benefits.

UNIT – IV: Networking and CIM Models

Principles of Networking, Network Terminology, Types of Networks: LAN, MAN, WAN. Selection of Network Technology: Communication medium, Network Topology, Medium access control Methods, Signaling methods. Network Architectures and Protocols: OSI Model, MAP and TOP, TCP, IP, Network Interconnection and Devices, Network Performance. Framework for Enterprise, wide Integration.

CIM Models: ESPRIT-CIM OSA Model, NIST-AMRF Model, Siemens Model of CIM, Digital Equipment Corporation Model, IBM Concept of CIM.

UNIT – V: Lean Manufacturing:

Definition, Principles of Lean Manufacturing, Characteristics of Lean Manufacturing, Value of Product, Continuous Improvement, Focus on Waste, Relationship of Waste to Profit, Four Functions of Lean Production, Performance Measures, The Supply Chain, Benefits of Lean Manufacturing. Introduction to Agile and Web Based Manufacturing systems.

TEXT BOOKS:

1. Principles of Computer Integrated Manufacturing, S.Kant Vajpayee, Prentice Hall India, 1st Edition, 1998.
2. Systems Approach to Computer Integrated Design and Manufacturing, Nanua Singh, John Wiley and Sons, Inc, 1st edition, 1995.

REFERENCE BOOKS:

1. CAD, CAM, CIM, P. Radhakrishnan, S. Subramanyam and V. Raju, New Age International Pvt Ltd, 4th Edition, 2016.
2. Computer Integrated Manufacturing, A. Alavudeen and N. Venkateshwaran, Prentice Hall India Learning Pvt Ltd, 1st Edition, 2010.
3. Manufacturing Planning and Control for Supply Chain Management, F. Robert Jacobs and William Lee Berry, McGraw-Hill Education, 7th Edition, 2023.
4. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education, 5th Edition, 2023.
5. Manufacturing Systems Engineering, Stanley B. Gershwin, Prentice Hall, 2nd Edition, 2022.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
MANUFACTURING SYSTEMS: SIMULATION MODELLING AND ANALYSIS
(Professional Core - IV)

L	T	P	C
3	0	0	3

Prerequisites: Operations Research, Optimization Techniques, Probability Statistics

Course Objectives:

1. Learn ways of analyzing the systems.
2. Classification of systems-based nature of dynamics and knowledge of elements.
3. To develop simulation model for dynamic discrete – event stochastic system.
4. To run the model and collect the data.
5. To analyze the output data of simulation for specified for performance measures based on type of simulation and method of output data analysis.

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

1. Define the state of system W.R.T specified performance measures.
2. Develop simulation model for the said system
3. Generate random variations and learn various simulation languages.
4. Analyze through simulation the model and present the results to specified confidence level.
5. Apply simulation for flow shop systems and job shop systems.

UNIT - I: System Modeling and Statistical Analysis

System Analysis, Ways to Analyze the System, Model, Types of Models, Simulation, Definition, Types of Simulation Models, Steps Involved in Simulation, Advantages and Disadvantages. Parameter Estimation, Estimator, Properties Estimate, Point Estimate, Confidence Interval Estimates, Independent, Dependent, Hypothesis, Types of Hypothesis, Steps, Types 1 and 2 Errors, Framing, Strong Law of Large Numbers.

UNIT - II: Model Validation and Stochastic Inputs

Building of Simulation Model, Validation, Verification, Credibility their Timing, Principles of Valid Simulation Modeling, Techniques for Verification, Statistical Procedures for Developing Credible Model. Modeling of Stochastic Input Elements, Importance, Various Procedures, Theoretical Distribution, Continuous, Discrete their Suitability in Modeling.

UNIT - III: Random Variate Generation and Simulation Languages

Generation Of Random Variates, Factors for Selection, Methods, Inverse Transform, Composition, Convolution, Acceptance, Rejection, Generation of Random Variable, Exponential, Uniform Weibull, Normal Bernoullie, Binomial Uniform Poison. Simulation Languages, Comparison of Simulation Languages with General Purpose Languages, Simulation Languages vs Simulators, Software Features, Statistical Capabilities, GPSS, SIMAN, SIMSCRIPT, Simulation of M-M-1 Queue, Comparison of Simulation Languages.

UNIT - IV: Output Data Analysis and Steady-State Simulation

Output Data Analysis, Types of Simulation with Respect to Output Data Analysis, Warm Up Period, Welch Algorithm, Approaches for Steady State Analysis, Replication, Batch Means Methods, Comparisons.

UNIT –V: Simulation Applications in Manufacturing

Applications of Simulation, Flow Shop System, Job Shop System M/M/1 Queues with Infinite and Finite Capacities, Simple Fixed Period Inventory System, New Boy Paper Problem.

TEXT BOOKS:

1. Simulation Modelling and Analysis by Law, A.M. and Kelton, McGraw Hill, 2nd Edition, 1991.
2. Discrete-Event System Simulation, Jerry Banks and John S. Carson II, Prentice-Hall, 1st Edition, 1984.

REFERENCE BOOKS:

1. Simulation of Manufacturing Systems, Allan Carrie, John Wiley and Sons, Chichester and New York, 1st Edition, 1988.
2. A Course in Simulation, Sheldon M. Ross, Macmillan Publishing Company, 1st Edition, 1990.
3. Simulation Modeling and SIMNET, H. A. Taha, Prentice Hall, 1st Edition, 1988.
4. Modeling and Simulation of Discrete Event Systems, Byoung Kyu Choi and DongHun Kang, Wiley, 2nd Edition, 2023.
5. Introduction to Simulation Using Simulink, Michael A. Dwyer, Springer, 1st Edition, 2023.
6. Simulation with AnyLogic, Andrei Borshchev, Springer, 2nd Edition, 2021.
7. Manufacturing Systems Modeling and Analysis, Guy L. Curry and Richard M. Feldman, Pearson Education, 2nd Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
MATERIALS TECHNOLOGY
(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: Engineering Materials, Mechanical Behavior of Materials

Course Objectives:

1. To study the structure, properties, and performance of engineering materials.
2. To understand the influence of microstructure on material properties.
3. To explore advanced materials, including composites, ceramics, and polymers.
4. To analyze material selection criteria for manufacturing applications.
5. To introduce recent developments in materials technology and their industrial applications.

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

1. Understand the structure-property relationships of engineering materials.
2. Select suitable materials for specific engineering applications.
3. Analyze the behavior of advanced materials like composites and ceramics.
4. Apply knowledge of material properties in design and manufacturing decisions.
5. Explore recent advancements and future trends in materials technology.

UNIT - I: Plastic Deformation and Strengthening

Elasticity in Metals and Polymers, Mechanism of Plastic Deformation, Role of Dislocations, Yield Stress, Shear Strength of Perfect and Real Crystals, Strengthening Mechanism, Work Hardening, Solid Solution, Grain Boundary Strengthening. Poly Phase Mixture, Precipitation, Particle, Fiber and Dispersion Strengthening, Effect of Temperature, Strain and Strain Rate on Plastic Behavior, Super Plasticity, Deformation of Non-Crystalline Material.

UNIT - II: Fracture, Creep and Toughening Mechanisms

Griffth's Theory, Stress Intensity Factor and Fracture Toughness, Toughening Mechanisms, Ductile and Brittle Transition in Steel, High Temperature Fracture, Creep, Larson – Miller Parameter, Deformation and Fracture Mechanism Maps.

UNIT - III: Fatigue and Failure Analysis

Fatigue, Low and High Cycle Fatigue Test, Crack Initiation and Propagation Mechanism and Paris Law, Effect of Surface and Metallurgical Parameters on Fatigue, Fracture of Non-Metallic Materials, Fatigue Analysis, Sources of Failure, Procedure of Failure Analysis.

UNIT - IV: Material Selection and Case Studies

Motivation for Selection, Cost Basis and Service Requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep. Selection for Surface Durability, Corrosion and Wear Resistance, Relationship Between Materials Selection and Processing, Case Studies in Materials Selection with Relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

UNIT - V: Metallic and Nonmetallic Materials

Modern Metallic Materials: Dual Steels, Micro Alloyed, High Strength Low Alloy (HSLA) Steel, Transformation Induced Plasticity (TRIP) Steel, Maraging Steel, Inter Metallics, Ni and Ti Aluminides, Smart Materials, Shape Memory Alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials.

Nonmetallic Materials: Polymeric Materials and Their Molecular Structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of Engineering Polymers, Advanced Structural Ceramics WC, Tic, Tac, A12 O3, Sic, Si3N4, CBN and Diamond, Properties, Processing and Applications.

TEXT BOOKS:

1. Mechanical Behavior of Materials, Thomas H. Courtney, McGraw Hill, 2nd Edition, 2000
2. Mechanical Metallurgy, George E. Dicter, McGraw-Hill, 3rd Edition, 1988.

REFERENCES BOOKS:

1. Selection and Use of Engineering Materials, J. A. Charles, Butterworth-Heinemann, 3rd Edition, 1997.
2. Engineering Materials Technology, James A. Jacobs and Thomas F. Kilduff, Prentice-Hall and Pearson, 5th Edition, 2004.
3. Materials Science and Engineering: An Introduction, William D. Callister Jr, John Wiley and Sons, 10th Edition, 2019.
4. Engineering Materials: Properties and Selection, Kenneth G. Budinski and Michael K. Budinski, Pearson Education, 11th Edition, 2023.
5. Introduction to Materials Science for Engineers, James F. Shackelford, Pearson Education, 10th Edition, 2023.
6. Mechanical Metallurgy, George E. Dieter, McGraw-Hill Education, 4th Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

QUALITY ENGINEERING IN MANUFACTURING

(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: Statistics and Probability, Manufacturing Processes

Course Objective:

1. To understand the principles of quality management and quality engineering in manufacturing.
2. To study statistical quality control tools and techniques for process improvement.
3. To explore design of experiments (DOE) and robust design methods.
4. To analyze process capability and control chart applications.
5. To familiarize students with modern quality systems such as Six Sigma and TQM.

Course Outcomes: At the end of the course, the student is able

1. Apply quality engineering principles for process control and improvement.
2. Use statistical tools like control charts and capability analysis in manufacturing.
3. Design experiments to optimize process parameters and product quality.
4. Implement quality management systems and methodologies like Six Sigma.
5. Analyze quality data for decision-making and continuous improvement in manufacturing environments.

UNIT-I: Quality Value and Engineering

An Overall Quality System, Quality Engineering in Production Design, Quality Engineering in Design of Production Processes. Loss Function and Quality Level: Derivation and Use of Quadratile Loss Function, Economic Consequences of Tightening Tolerances to Improve Quality, Evaluations and Types of Tolerances. (N-Type, S-Type and L-Type).

UNIT-II: Tolerance Design and Tolerancing

Functional Limits, Tolerance Design for N-Type. L-Type and S-Type Characteristics, Tolerance Allocation for Multiple Components. Parameter and Tolerance Design: Introduction to Parameter Design, Signal to Noise Ratios, Parameter Design Strategy, Some of the Case Studies on Parameter and Tolerance Designs.

UNIT-III: Analysis of Variance (ANOVA)

NO-Way ANOVA, One-Way ANOVA, Two-Way ANOVA, Critique of F- Test, ANOVA for Four Level Factors, Multiple Level Factors.

UNIT-IV: Orthogonal Arrays

Typical Test Strategies, Better Test Strategies, Efficient Test Strategies, Steps in Designing, Conducting and Analyzing an Experiment. Interpolation of Experimental Results: Interpretation Methods, Percent Contributor, Estimating the Mean.

UNIT-V: Quality Systems and Problem Solving Tools

ISO-9000 Quality System, BDRE, Six Sigma, Bench Marking, Quality Circles Brain Storming, Fishbone Diagram, Problem Analysis.

TEXT BOOKS:

1. Taguchi Techniques for Quality Engineering , Phillip J. Ross , McGraw Hill, Intl. 2nd Edition, 1995
2. Introduction to Quality Engineering: Designing Quality into Products and Processes, Genichi Taguchi, Asian Productivity Organization, 2nd Edition, 1993.

REFERENCE BOOKS:

1. Taguchi Methods Explained: Practical Steps to Robust Design, Tapan P. Bagchi, Prentice-Hall of India Pvt. Ltd, 1st Indian Edition, 1993.
2. Quality Engineering in Production Systems, Genichi Taguchi, Elsayed A. Elsayed and Thomas C. Hsiang, McGraw-Hill International, 1st Edition, 1989.
3. Quality Engineering Using Robust Design, Madhav S. Phadke, Pearson Education, 2nd Edition, 2023.
4. Design and Analysis of Experiments, Douglas C. Montgomery, Wiley, 10th Edition, 2024.
5. Six Sigma for Engineers and Managers, Basem El-Haik and David M. Roy, Wiley, 2nd Edition, 2022.
6. Quality Control and Industrial Statistics, Acheson J. Duncan, Irwin/McGraw-Hill, 7th Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

ADVANCED TOOL DESIGN

(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisite: Production Technology

Course Objectives:

1. To understand the principles and methodologies of advanced tool design.
2. To study the design of cutting tools, dies, and fixtures for manufacturing applications.
3. To analyze tool materials, coatings, and tool life considerations.
4. To explore advanced tool design techniques using CAD/CAM integration.
5. To familiarize students with tool design for automation and high-precision manufacturing.

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

1. Identify standard tool materials and their properties.
2. Design cutting tools for different processes.
3. Design jigs and fixtures for different machining processes.
4. Design dies for sheet metal processes like blanking and piercing.
5. Design bending and forming dies for sheet metal working.

UNIT – I: Tool Materials

Prosperities of Materials: Tools Steels, Cast Iron, Mild or Low Carbon Steels, Nonmetallic and Nonferrous Materials, Heat Treating

UNIT – II: Design of Cutting Tools

Single Point Cutting Tools: Milling Cutters, Drills, Selection of Carbide Steels, Determination of Shank Size for Single Point Carbide Tools, Determining the Insert Thickness for Carbide Tools

UNIT – III: Design of Jigs and Fixtures

Basic Principles of Location and Clamping: Locating Methods and Devices, Jigs-Definition Types, General Considerations in the Design of Drill Jigs, Drill Bushing, Methods of Construction. Fixtures-Vice Fixtures, Milling, Boring Lathe Grinding Fixtures.

UNIT – IV: Design of Sheet Metal Blanking and Piercing Dies

Fundamentals of Die Cutting Operation, Power Press Types, General Press Information, Materials Handling Equipment. Cutting Action in Punch and Die Operations. Die Clearance, Types of Die Construction. Die Design Fundamentals, Banking and Piercing Die Construction, Pilots, Stripper and Pressure Pads Presswork Material, Strip Layout, Short Run Tooling for Piercing.

UNIT – V: Design of Sheet Metal Dies

Bending Dies, Drawing Dies, Forming Dies, Drawing Operations, Variables that Effect Metal Flow During Drawing. Determination of Blank Size, Drawing Force, Single, and Double Action Draw Dies.

TEXT BOOKS:

1. Tool Design, Cyril Donaldson, George H. LeCain and V. C. Goold, Tata McGraw Hill Education, 5th Edition, 2012.
2. Production Technology, HMT, Tata McGraw Hill Education, 1st Edition, 2001.

REFERENCE BOOKS:

1. Mechanical Metallurgy, George F Dieter, Tata McGraw Hill, 3rd Edition, 1998.
2. Machine Tools, C. Elanchezhian and M. Vijayan, Anuradha Publications, 2008.
3. Principles of Machine Tools, Gopal Chandra Sen and Amitabha Bhattacharyya, New Central Book Agency, 2nd Edition, 2009.
4. Fundamentals of Tool Design, American Society of Tool and Manufacturing Engineers (ASTME), Industrial Press, 7th Edition, 2023.
5. Design of Jigs, Fixtures and Press Tools, K. Venkataraman, Wiley India, 2nd Edition, 2022.
6. Principles of Metal Manufacturing Processes, J. Beddoes and M. J. Bibby, CRC Press, 2nd Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

ARTIFICIAL INTELLIGENCE IN MANUFACTURING

(Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisite: Production Systems, Fundamentals of Artificial Intelligence

Course Objectives:

1. To introduce the fundamentals of artificial intelligence and its relevance in manufacturing.
2. To study AI techniques applicable to production planning, process control, and quality management.
3. To explore machine learning algorithms for predictive maintenance and process optimization.
4. To apply AI for real-time monitoring, robotics, and automation in manufacturing environments.
5. To familiarize students with case studies and industrial applications of AI in manufacturing.

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

1. Understand the basic concepts of AI and its applications in manufacturing systems.
2. Apply machine learning techniques for manufacturing process optimization.
3. Analyze manufacturing data for predictive analytics and decision-making.
4. Implement AI-based solutions in robotics, automation, and process control.
5. Evaluate AI-driven manufacturing systems for productivity and quality improvement.

UNIT - I: AI and Search Methods

Definition, History, Present State of Artificial Intelligence (AI), Phases of AI, Approaches to AI - Hard or Strong AI, Soft or Weak AI, Applied AI, Cognitive AI, and Applications Domains Focused on Manufacturing-Role of AI in Industrial Revolution 4.0, Components, Advantages, Challenges. Problem Solving Methods- 1. Uninformed Search Includes Depth First Search (DFS), Breadth First Search (BFS), Uniform Cost Search (UCS), Depth Limited Search, Iterative Deepening Depth First Search (IDDFS) And Bidirectional Search. 2. Informed Search (Heuristic Search) Includes Greedy Best First Search, A* Search, Memory Bounded Heuristic Search, Learning to Search Better, Simple Problems

UNIT - II: Neural Networks

Introduction to Perceptron and Neural Networks, Activation and Loss Functions, Single Neuron of Human and Human Brain Modelling, ANN Architecture-Input Layer, Hidden Layer and Output Layer, Types of Neural Networks- Single Layer Feed-Forward Network, Multilayer Feed-Forward Network, Multi-Layer Perceptron (MLP), Recurrent Networks or Feedback ANN, Characteristics of Neural Networks, Simple Problems on Back Propagation Algorithms to Minimize the Error.

UNIT - III: Computer Vision and CNNs

Introduction to Convolutional Neural Networks (CNNS), What is CNN, Common Uses for CNN, CNN's Basic Architecture- Lenet, Alexnet, Vggnet, Googlenet, Resnet, Introduction to Images, Representation, Image Extraction, Segmentation, Analysis, Simple Demonstration on Image Processing Using ANN - Face Detection, Fingerprint Recognition etc.

UNIT - IV: Supervised and Unsupervised Learning

Unsupervised Learning, Definition, Basic Concepts, Applications, K-Means Clustering, Hierarchical Clustering, Dimension Reduction-PCA, Simple Examples.

Supervised Learning: Definition, Basic Concepts, Applications, Linear Regression, Multiple Variable Linear Regression, Logistic Regression, Naive Bayes Classifiers, K-NN Classification, Support Vector Machine, Simple Examples.

UNIT - V: Reinforcement and Ensemble Learning

Reinforcement Learning: Reinforcement Learning (RL) Framework, Component of RL Framework, Types of RL Systems. Q-Learning, Simple Examples. Ensemble Learning Techniques: Introduction on Ensemble Methods, Decision Trees, Bagging, Random Forests, Boostin, Simple Examples.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice-Hall, 3rd Edition (2009)
2. Nature-Inspired Optimization in Advanced Manufacturing Processes and Systems, Ganesh M. Kakandikar and Dinesh G. Thakur, CRC press, 1st Edition, 2021.

REFERENCES:

1. Artificial Intelligence, Ela Kumar, Wiley-India, 1st Edition, 2020.
2. Artificial Intelligence: Concepts and Applications, Lavika Goel, Wiley-India, 1st Edition, 2021.
3. Artificial Intelligence for Robotics and Industrial Applications, Abhishek Arora and Sanjeev Kumar, Wiley India, 1st Edition, 2023.
4. Machine Learning for Manufacturing, Davide Polonio and Paolo Rizzi, Springer, 1st Edition, 2022.
5. Deep Learning for Vision Systems, Mohamed Elgendy, Manning Publications, 1st Edition, 2021.
6. Hands-On Artificial Intelligence for Smart Manufacturing, Francesco Carlo Morabito, Springer, 1st Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

CONCURRENT ENGINEERING

(Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisites: Computer-Aided Design

Course objective:

1. To introduce the concept of concurrent engineering and integrated product development.
2. To promote teamwork across functions such as design, manufacturing, and quality.
3. To apply concurrent engineering principles to optimize product design and performance.
4. To study tools and methodologies for real-time design decision-making.
5. To understand project management strategies for concurrent product realization.

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

1. Understand the need and benefits of concurrent engineering in product development.
2. Apply IT tools and collaborative platforms in engineering design.
3. Integrate lifecycle design and real-time analysis in concurrent engineering.
4. Use concurrent design strategies in manufacturing and assembly planning.
5. Manage product realization projects using concurrent engineering frameworks.

UNIT - I: CE and IT Applications

Introduction, Extensive Definition of CE, CE Design Methodologies, Organizing for CE, CE Toolbox, Collaborative Product Development.

Use Of Information Technology: IT Support, Solid Modeling, Product Data Management, Collaborative Product Commerce, Artificial Intelligence, Expert Systems, Software Hardware Co - Design.

UNIT - II: Life Cycle Design and Automation

Life Cycle Design of Products, Opportunity for Manufacturing Enterprises, Modality of Concurrent Engineering Design. Automated Analysis Idealization Control, Concurrent Engineering in Optimal Structural Design, Real Time Constraints.

UNIT - III: Manufacturing Concepts and Analysis

Manufacturing Competitiveness, Checking the Design Process, Conceptual Design Mechanism, Qualitative, Physical Approach, An Intelligent Design for Manufacturing System.

UNIT - IV: Assembly Planning and Project Management

JIT System, Low Inventory, Modular, Modeling and Reasoning for Computer, Based Assembly Planning, Design of Automated Manufacturing.

Project Management: Life Cycle Semi Realization, Design for Economics, Evaluation of Design for Manufacturing Cost.

UNIT - V: Concurrent Mechanical Design

Decomposition in Concurrent Design, Negotiation in Concurrent Engineering Design Studies, Product Realization Taxonomy, Plan for Project Management on New Product Development, Bottleneck Technology Development.

TEXT BOOK:

1. Concurrent Engineering: Automation, Tools, and Techniques, Andrew Kusiak, Wiley John and Sons Inc., 1st Edition, 1992.
2. Concurrent Product and Process Design, David Ullman, CRC Press, 1st Edition, 2003.

REFERENCE BOOKS:

1. Integrated Product Development, Anderson MM and Hein, L. Berlin, Springer Verlog, 1st Edition, 1987.
2. Design for Concurrent Engineering, Cleetus, J. Concurrent Engineering Research Centre, Morgantown W V, 1st Edition, 1992.
3. Concurrent Engineering Fundamentals: Integrated Product and Process Organization, Prasad B. S., Prentice Hall, 2nd Edition, 2021.
4. Concurrent Engineering in Product Design and Development, I. Moustapha, New Age International, 1st Edition, 2022.
5. Collaborative Engineering: Theory and Practice, Peter T. L. Popov, Springer, 1st Edition, 2024.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

INDUSTRIAL ROBOTICS

(Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisites: Kinematics of machinery

Course Objectives:

1. To introduce the fundamentals of industrial robotics and robot configurations.
2. To analyze forward and inverse kinematics of robotic manipulators.
3. To study robot dynamics, end effectors, and machine vision systems.
4. To learn robot programming, control techniques, and path planning.
5. To explore industrial applications of robotics in manufacturing and automation.

Course Outcomes: After doing this course, the student will be able to,

1. Understand robot structures, drive systems, sensors, and actuators.
2. Perform kinematic and dynamic analysis of robotic arms.
3. Evaluate and apply vision systems for robotic inspection and control.
4. Develop robot programs using different programming methods.
5. Design robotic cells for manufacturing tasks and analyze their performance.

UNIT-I: Robot Basics and Sensors

Introduction, Automation and Robotics, Robot Anatomy Configuration, Motions Joint Motion and Notation, Work Volume, Robot Drive System, Control System and Dynamic Performance, Precision of Movement.

Control System and Components: Basic Concept and Modals Controllers Control System Analysis, Robot Actuators and Feedback Components (Sensors): Internal and External Sensors, Positions Sensors, Velocity Sensors, Desirable Features, Tactile, Proximity and Range Sensors, Uses Sensors in Robotics, Power Transmission Systems.

UNIT-II: Motion Analysis and Control

Manipulator Kinematics, Position Representation Homogeneous Transformation, D-H Notation, D-H Transformation Matrix, Forward and Inverse Transformations, Problems on Planar and Spatial Manipulators, Differential Kinematics, Jacobian Formulation, Problems. Manipulator Path Control: Slew, Joint Interpolated and Straight Line Motions. Trajectory Planning: Joint Space Scheme, Cartesian Space Scheme, Cubic Polynomial Fit Without and with Via Point, Blending, Problems.

UNIT-III: Dynamics, End Effectors and Vision

Robot Dynamics: Lagrange – Euler and Newton - Euler formulations, problems on two link planar manipulators, configuration of robot controller, Problems.

End Effectors: Grippers types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.

Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques,

Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT-IV: Robot Programming and Languages

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, Wait, Signal and Delay commands, Branching capabilities and Limitations.

Robot Languages: Textual robot languages, Generation, Robot language structures, Elements and functions.

UNIT-V: Work Cell Design and Applications

Robot Cell Design and Control: Robot cell layouts, Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.

Robot Applications: Material transfer, Machine loading, unloading. Processing operations, Assembly and Inspection, Future Applications.

TEXT BOOKS:

1. Introduction to Robotics Mechanics and Control, John J. Craig, Pearson Education, 3rd Edition, 2005.
2. Industrial Robotics: Technology, Programming, and Applications, Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, McGraw-Hill, 1st Edition, 1986.

REFERENCE BOOKS:

1. Robotics: Control, Sensing, Vision and Intelligence, K. S. Fu and R. C. Gonzalez and C. S. G. Lee, McGraw-Hill Education, 2nd Edition, 2023.
2. Robot Analysis: The Mechanics of Serial and Parallel Manipulators, Lung-Wen Tsai, John Wiley and Sons, 2nd Edition, 2022.
3. Robot Analysis and Control, H. Asada and J. E. Slotine, Wiley, 2nd Edition, 2021.
4. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education, 2nd Edition, 2022.
5. Robotics for Engineers, Yoram Koren, McGraw-Hill Education, 2nd Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
COMPUTER INTEGRATED MANUFACTURING LAB

L	T	P	C
0	0	4	2

Pre-Requisites: Manufacturing processes, Basic CAD/CAM concepts, Programming fundamentals and concepts of automation and robotics.

Course Objectives:

1. To provide hands-on experience with CNC machine programming, operation, and part production.
2. To familiarize students with CAD/CAM software for product modelling and manufacturing simulation.
3. To introduce computer-aided process planning and manufacturing data management techniques.
4. To develop skills in integrating robotics, material handling, and automated inspection into manufacturing systems.
5. To enable students to analyse and optimize computer-integrated manufacturing workflows for improved productivity.

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

1. Develop and execute CNC programs for manufacturing components with desired accuracy.
2. Create and simulate product models using CAD/CAM software.
3. Implement computer-aided process planning for efficient manufacturing operations.
4. Integrate robotics and automated inspection systems into manufacturing setups.
5. Analyse and improve productivity in computer-integrated manufacturing environments.

List of Experiments

1. Practice in part programming and operation of CNC turning machines, including subroutine techniques and use of cycles.
2. Practice in part programming and operation of a CNC machining centre, including tool planning, sequence of operations, and tool setting.
3. Practice in APT-based NC programming.
4. Geometric modelling of 2D and 3D objects using CAD packages such as AutoCAD, PRO/E, CATIA V5, Unigraphics and Iron CAD.
5. Analysis of objects using analysis packages such as ANSYS.
6. Simulation of manufacturing systems using AutoMOD, PROMOD, SLAM-II, CAFIMS, and FlexSim.
7. Writing subroutines in C-language and interlinking with manufacturing simulation packages.
8. AGV (Automated Guided Vehicle) planning.
9. AS/RS (Automated Storage and Retrieval System) simulation and performance evaluation.
10. Integrated simulation of machines, AGVs, and AS/RS.
11. JIT (Just-In-Time) system simulation.
12. Kanban flow simulation.
13. Simulation and analysis of material handling systems.
14. Solving MRP (Material Requirements Planning) problems.
15. Shop floor scheduling simulation and analysis.

Note: Conduct any 12 out of 15 exercises from the list.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

SIMULATION OF MANUFACTURING SYSTEMS LAB

L	T	P	C
0	0	4	2

Prerequisites: Manufacturing Systems, Simulation Modelling

Course Objectives:

1. To provide hands-on experience in simulating manufacturing processes and systems.
2. To develop skills in using simulation software for production planning and control.
3. To analyze manufacturing system performance using simulation models.
4. To apply simulation for resource optimization and process improvement.
5. To prepare simulation-based reports for decision-making in manufacturing.

Course Outcomes: Upon completion of the lab, students will be able to

1. Develop simulation models for different manufacturing processes.
2. Use simulation tools to analyze production system performance.
3. Apply statistical analysis for interpreting simulation results.
4. Optimize manufacturing resources and workflows through simulation.
5. Document and present simulation studies effectively.

List of Experiments

A. Manufacturing and Simulation

1. Study and Application of AutoMOD Software to Manufacturing Problems.
2. Study and Application of PROMODEL Software to Manufacturing Problems.
3. Study and Application of SLAM-II Software to Manufacturing Problems.
4. Study and Application of CAFIMS Software to Manufacturing Problems.
5. Study and Application of Flexsim Software to Manufacturing Problems.

Write Subroutines in C-Language and Interlinking with Simulation Packages for the following Experiments.

1. AGV Planning Simulation.
2. ASRS Simulation and Performance Evaluation.
3. Integrated Simulation of Machines, AGVs, and AS/RS.
4. JIT System Simulation.
5. Kanban Flow Simulation.
6. Material Handling System Simulation.
7. MRP Problem Simulation.
8. Shop Floor Scheduling Simulation.

B. Precision Engineering (Using Suitable Software)

1. Simulation of Hydraulic and Pneumatic Circuits.
2. Simulation of Closed Loop Control Systems.
3. Study of Operation of Tool and Cutter Grinder, Twist Drill Grinder, Centreless Grinder.
4. Determination of Cutting Forces in Turning.
5. Experiments on AJM and Study of USM, EDM, Laser Machining, and Plasma Spraying.
6. Inspection of Parts Using Tool Makers Microscope.
7. Surface Roughness Measurement and Form Testing.
8. Study of Microcontrollers and Programming for CNC Machine Tools and Controllers.
9. Studies on PLC Programming.
10. Study and Programming of Robots.
11. Condition Monitoring in Machining Process Using Acoustic Emission.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
PRODUCTION AND OPERATIONS MANAGEMENT
(Professional Elective - V)

L	T	P	C
3	0	0	3

Prerequisites: Operations Research, Production Planning and Control

Course Objectives:

1. To understand the principles and functions of production and operations management in manufacturing and service organizations.
2. To analyze forecasting methods, capacity planning, and facility layout strategies.
3. To explore inventory control techniques, production planning, and scheduling tools.
4. To evaluate quality control methods and continuous improvement systems.
5. To introduce lean systems, supply chain management, and project planning techniques.

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

1. Understand the strategic role of production and operations management in business performance.
2. Apply demand forecasting and capacity planning models to real-world scenarios.
3. Use inventory models and production scheduling techniques to optimize operations.
4. Implement quality control tools and lean principles in manufacturing systems.
5. Design supply chain strategies and managing projects using standard tools.

UNIT- I: Operations Management and Process Design

Overview of Production and Operations Management (POM): Introduction, Definition, Importance, Historical Development of POM-POM Scenario Today.

Product and Process Design: Role of Product Development, Product Development Process, Tools for Efficient Product Development, Determination of Process Characteristics, Types of Processes and Operations Systems, Continuous, Intermittent, Technology Issues in Process Design, Flexible Manufacturing Systems, Automated Material Handling Systems.

UNIT –II: Forecasting and Capacity Planning

Value Analysis: Definition, Objectives, Types of Values, Phases, Tools, FAST Diagram, Steps, Advantages, Matrix Method Steps.

Plant Location and Plant Layout: Factors Affecting Locations Decisions, Location Planning Methods, Location Factor Rating, Centre of Gravity Method, Load Distance Method. Plant Layout, Definition, Objectives, Types of Layouts, Design of Product Layout, Line Balance, Terminology, RPW Method.

UNIT- III: Inventory and Production Control

Aggregate Planning: Definition, Objectives, Basic Strategies for Aggregate Production Planning, Aggregate Production Planning Method, Transportation Model, Master Production Scheduling. Material Requirement Planning: Terminology, Logic, Lot Sizing Methods, Advantages and Limitations.

UNIT – IV: Quality Management and Lean Systems

Work Study: Method Study, Definition, Objectives, Steps, Charts Used, Work Measurement, Time Study, Definition, Steps Determination of Standard Time, Performance Rating, Allowances. Work Sampling, Steps, Comparison with Time Study.

Quality Management: Economics of Quality Assurance, Control Charts for Variables and for Attributes, Acceptance Sampling Plans, Total Quality Management ISO 9000 Series Standards, Six Sigma.

UNIT – V: Supply Chain and Project Management

Scheduling: Need-Basis for Scheduling, Scheduling Rules, Flow Shop and Job Shop Scheduling. Line of Balance. Project Management: PERT, Critical Path Determination-Probability of Completing Project in a given time CPM, Types of Floats, Critical Path Determination, Crashing of Simple Networks, Optimum Project Schedule.

TEXT BOOKS:

1. Operations Management for Competitive Advantage, Richard B. Chase, F. Robert Jacobs, Nicholas J. Aquilano, Tata McGraw-Hill Education, 11th Edition, 2009.
2. Operations Management: Theory and Practice, B. Mahadevan, Pearson Education India, 3rd Edition, 2015.

REFERENCE BOOKS:

1. Industrial Engineering and Management, Dr. Ravi Shankar, Galgotia Publications Pvt. Ltd., RPT, 2006.
2. Modern Production and Operations Management, Elwood S. Buffa, John Wiley and Sons, 8th Edition, 1987.
3. Theory and Problems in Production and Operations Management, SN Chary, Tata McGraw-Hill Publishing Co. Ltd., 2009.
4. Operations Management 8e Process and Value Chains, Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman, Pearson Education, 8th Edition, 2009.
5. Operations and Supply Chain Management, Roberta S. Russell and Bernard W. Taylor, Wiley, 11th Edition, 2023.
6. Introduction to Materials Management, J. R. Tony Arnold and Stephen N. Chapman and Lloyd M. Clive, Pearson Education, 9th Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
MEMS
(Professional Elective - V)

L	T	P	C
3	0	0	3

Prerequisites: Electronic Circuits, Basic knowledge in material science

Course Objectives:

1. To introduce the fundamentals, design principles, and applications of MEMS devices.
2. To study microfabrication and micromachining processes used in MEMS manufacturing.
3. To understand the operation of micro sensors, micro actuators, and microstructures.
4. To explore materials, modeling, and simulation techniques for MEMS design.
5. To examine packaging, testing, and reliability aspects of MEMS products.

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

1. Explain the structure, working principles, and applications of MEMS devices.
2. Select suitable materials and fabrication techniques for MEMS manufacturing.
3. Analyze the design and performance of micro sensors and micro actuators.
4. Use modeling and simulation tools for MEMS product development.
5. Evaluate packaging, reliability, and industrial applications of MEMS.

UNIT-I: MEMS and Microsystems

MEMS and Microsystems, Evolution of Micro Fabrication, Microsystems and Microelectronics, Microsystems and Miniaturization, Applications of Mems in Industries, Micro Sensors, Micro Actuation, MEMS with Micro Actuators Micro Accelerometers, Micro Fluidics.

UNIT-II: Engineering Science for Microsystems Design

Atomic Structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

UNIT-III: Engineering Mechanics for Microsystems Design

Static Bending of Thin plates, Mechanical Vibration, Thermomechanics, Fracture Mechanics, Thin Film Mechanics and Overview of Finite Element Stress Analysis.

UNIT-IV: Thermo Fluid Engineering and Microsystems Design

Overview of Basics of Fluid Mechanics in Macro and Micro scales, Basic equations in Continuum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and solids in Sub Micrometer Scale, Design Considerations, Process Design Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

UNIT-V: Materials for MEMS and Microsystems

Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

TEXT BOOKS:

1. MEMS and Microsystems: Design and Manufacturing, Tia-Ran Hsu, Tata McGraw-Hill, 1st Edition, 2002.
2. Foundations of MEMS, Chang Liu, Pearson Education, 2nd Edition, 2012.

REFERENCE BOOKS:

1. An Introduction to Microelectromechanical Systems Engineering, Nadim Maluf, Artech House, 1st Edition, 2000.
2. Micro Robots and Micromechanical Systems, W.S.N. Trimmer, Sensors and Actuators, Volume 19, 1989.
3. Applied Partial Differential Equations, D.W. Trim, PWS-Kent Publishing, Boston, 1st Edition, 1990.
4. MEMS: Introduction and Fundamentals, Mohamed Gad-el-Hak, CRC Press, 3rd Edition, 2022.
5. Microelectromechanical Systems: Design and Analysis, Tai-Ran Hsu, John Wiley and Sons, 2nd Edition, 2023.
6. Design and Development Methodologies for MEMS and Microfluidic Devices, Paul Kirby and Philip LeDuc, Elsevier, 1st Edition, 2022.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
FLEXIBLE MANUFACTURING SYSTEMS
(Professional Elective - V)

L	T	P	C
3	0	0	3

Prerequisites: Machine Tools, Basics of Industrial Engineering

Course Objectives:

1. To introduce the concepts, types, and advantages of flexible manufacturing systems (FMS).
2. To understand the design and operational aspects of FMS components such as AGVs, ASRS, and robots.
3. To study system layout, scheduling, and control strategies for FMS.
4. To apply group technology and computer-integrated manufacturing in flexible production environments.
5. To analyze planning, simulation, and performance evaluation methods for FMS.

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

1. Describe the structure and components of flexible manufacturing systems.
2. Design and implement FMS layouts and scheduling algorithms.
3. Integrate AGVs, ASRS, robots, and machining centers in a coordinated FMS.
4. Apply group technology and FMS control strategies for real-time decision making.
5. Analyze system performance using planning and simulation techniques.

UNIT-I: Concepts of FMS

Evolution of Manufacturing Systems, Definition, Objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push Type.

UNIT-II: Classification of FMS Layout

Layouts and Their Salient Features, Single Line, Dual Line, Loop, Ladder, Robot Centre Type.

UNIT-III: FMS Scheduling and Control

Processing Stations: Salient Features Machining Centers, Turning Centre, Coordinate Measuring Machine (CMM), Washing, Deburring Station.

UNIT-IV: Group Technology and Integration

Material Handling System: An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS). Management Technology: Tool Management, Tool Magazine, Tool Preset, Identification, Tool Monitoring and Fault Detection, Routing, Production Planning and Control, Scheduling and Loading of FMS.

UNIT-V: Planning, Simulation and Analysis

Design of FMS: Performance Evaluation of FMS, Analytical Model and Simulation Model of FMS Case Studies, Typical FMS Problems from Research Papers.

TEXT BOOKS:

1. Flexible Manufacturing Cells and System by William W Luggen, Prentice Hall of Inc New Jersey, 1991
2. Flexible Manufacturing system by Reza A Maleki, Prentice Hall of Inc New Jersey, 1991

REFERENCE BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing, Groover M.P., Prentice Hall, 4th Edition, 2015.
2. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education, 5th Edition, 2023.
3. Flexible Manufacturing System, J. Talavage and R. Alting, North-Holland, 2nd Edition, 2022.
4. Group Technology and Cellular Manufacturing, N. Singh, Springer, 2nd Edition, 2023.
5. Design and Operation of FMS, H. Tempelmeier and H. Kuhn, Springer, 2nd Edition, 2021.
6. Computer-Aided Manufacturing, Tien-Chien Chang and Richard A. Wysk and Hsu-Pin Wang, Pearson Education, 4th Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic English Grammar and Composition, Fundamentals of Technical Writing

Course objectives: Students will be able to:

1. To improve the quality and clarity of academic writing specifically for research papers.
2. To provide students with the structure, style, and conventions of scholarly communication.
3. To help students understand how to write titles, abstracts, introductions, literature reviews, methods, results, and conclusions effectively.
4. To guide students in avoiding common grammatical, structural, and ethical mistakes in writing.
5. To build competence in reviewing and editing research manuscripts for publication.

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

1. Write grammatically correct, well-structured, and coherent research papers.
2. Use appropriate academic language and tone for different parts of a research article.
3. Construct effective titles, abstracts, and concise conclusions.
4. Apply standard referencing styles and avoid plagiarism.
5. Critically revise and refine research drafts for clarity and publication readiness.

UNIT-I: Effective Writing and Sentence Structuring
Planning And Preparation, Word Order, Breaking up Long Sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II: Academic Writing and Research Ethics
Clarifying Who Did What, Highlighting your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and Introduction

UNIT-III: Research Paper Structure and Finalization
Review of the Literature, Methods, Results, Discussion, Conclusions and Final Check.

UNIT-IV: Essential Academic Writing Skills for Research Papers
Key Skills are needed when Writing a Title, Key Skills are needed when Writing an Abstract, Key Skills are needed when Writing an Introduction, Skills needed when writing a Review of the Literature.

UNIT-V: Advanced Research Writing Skills
Skills are needed when Writing the Methods, Skills needed when writing the Results, Skills are needed when writing the Discussion, and Skills are needed when writing the Conclusions.

UNIT-VI: Perfecting Your Research Paper

Useful Phrases, How to ensure Paper is as Good as it could possibly be the First Time Submission.

TEXT BOOKS:

1. Writing for Science, Robert Goldbort, Yale University Press, 1st Edition, 2006.
2. How to Write and Publish a Scientific Paper, Robert A. Day & Barbara Gastel, 6th Edition (Cambridge University Press), 2006.

REFERENCE BOOKS

1. Handbook of Writing for the Mathematical Sciences, Nicholas J. Higham, SIAM, 2nd Edition, 1998.
2. English for Writing Research Papers, Adrian Wallwork, Springer, 1st Edition, 2011.
3. How to Write and Publish a Scientific Paper, Barbara Gastel, Robert A. Day, Cambridge University Press, 8th Edition, 2016
4. The Elements of Style, William Strunk Jr., E.B. White, Pearson Education, 4th Edition, 2000
5. Scientific Writing and Communication: Papers, Proposals, and Presentations, Angelika H. Hofmann, Oxford University Press, 3rd Edition, 2016
6. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded, Joshua Schimel, Oxford University Press, 1st Edition, 2012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

DISASTER MANAGEMENT

(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Environmental Science, Basic Geography or Earth Science

Course Objectives: Students will be able to

1. To introduce the concepts, phases, and classifications of disasters and disaster management.
2. To develop an understanding of disaster risk reduction and mitigation strategies.
3. To impart knowledge on institutional frameworks, legal aspects, and community-based approaches.
4. To build the ability to assess risks and prepare emergency management plans.
5. To create awareness about post-disaster recovery, rehabilitation, and resilience planning.

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

1. Identify different types of natural and man-made disasters and their causes.
2. Analyze risk factors and develop suitable mitigation and preparedness strategies.
3. Understand the role of government agencies, NGOs, and international bodies in disaster management.
4. Apply principles of emergency response planning and coordination.
5. Contribute to post-disaster rehabilitation and sustainable development planning.

UNIT-I: Disaster

Definition, Factors and Significance, Difference between Hazard and Disaster, Natural and Manmade Disasters, Difference between Nature Types and Magnitude.

UNIT-II: Repercussions of Disasters and Hazards

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches. Man made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III: Disaster Prone Areas in India

Study of Seismic Zones, Areas Prone to Floods and Droughts, Landslides and Avalanches, Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami, Post Disaster Diseases and Epidemics

UNIT-IV: Disaster Preparedness and Management

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard, Evaluation of Risk, Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V: Risk Assessment Disaster Risk

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation, Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

UNIT-VI: Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS:

1. Disaster Management in India: Perspectives, Issues and Strategies, R. Nishith & A. K. Singh, New Royal Book Company, 1st Edition, 2007
2. Disaster Mitigation: Experiences and Reflections, Pardeep Sahni et al. (Eds.), Prentice Hall India, 1st Edition, 2001

REFERENCE BOOKS:

1. Disaster Administration and Management: Text and Case Studies, S. L. Goel, Deep & Deep Publications, 1st Edition, 2007.
2. Introduction to International Disaster Management, Damon P. Coppola, Butterworth-Heinemann, 3rd Edition, 2015.
3. Disaster Management and Preparedness, Thomas D. Schneid, Larry Collins, CRC Press, 1st Edition, 2001.
4. Disaster Science and Management, Tushar Bhattacharya, McGraw Hill Education, 1st Edition, 2013.
5. Natural Disasters, Patrick L. Abbott, McGraw Hill Education, 9th Edition, 2016.
6. Environmental Hazards: Assessing Risk and Reducing Disaster, Keith Smith, Routledge, 6th Edition, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic understanding of Indian heritage and classical languages

Course Objectives:

1. To expose students to Sanskrit as a classical language of knowledge and science.
2. To introduce technical terms and concepts embedded in ancient Sanskrit texts.
3. To enable understanding of foundational texts related to mathematics, engineering, and philosophy.
4. To build linguistic skills for reading and interpreting original Sanskrit sources.
5. To appreciate the relevance of Sanskrit in the context of modern scientific discourse.

Course Outcomes: Students will be able to

1. Understand the structure and grammar of Sanskrit relevant to technical usage.
2. Recognize and interpret key technical terms and concepts from ancient Sanskrit literature.
3. Translate and explain Sanskrit verses that relate to scientific and engineering disciplines.
4. Develop an interdisciplinary perspective connecting ancient wisdom with contemporary science.
5. Appreciate the contribution of Sanskrit to Indian scientific, philosophical, and cultural heritage.

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past / Present / Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of Roots,

UNIT-IV:
Technical Information about Sanskrit Literature

UNIT-V:
Technical Concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS:

1. Abhyaspustakam, Dr. H. R. Vishwasa, Samskrita Bharati Publication, New Delhi, 1st Edition, 2012.
2. Teach Yourself Sanskrit: Prathama Diksha, edited by Vempati Kutumbashastri, Rashtriya Sanskrit Sansthanam, New Delhi, 1st Edition, 2002.

REFERENCE BOOKS:

1. Technical Literature in Sanskrit, S. Balachandra Rao, Rashtriya Sanskrit Vidyapeetha, 1st Edition, 2005.
2. Sanskrit and Science, Prabhakar Apte, Central Institute of Indian Languages, 1st Edition, 2003.
3. Scientific Heritage of India in Sanskrit, R. Ganapathi, Bharatiya Vidya Bhavan, 1st Edition, 1990.
4. Sanskrit and Artificial Intelligence, Rick Briggs, AI Magazine (Journal Paper), 1st Edition, 1985.
5. Essentials of Sanskrit Language for Engineering Students, M. Sampath Kumar, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, 1st Edition, 2010.
6. Vyavaharika Samskritam (Functional Sanskrit), R.S. Vadhyar, R.S. Vadhyar & Sons, 3rd Edition, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

VALUE EDUCATION

(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic Understanding of Ethics and Social Responsibility

Course Objectives: Students will be able to

1. To help students understand the importance of values in personal and professional life.
2. To promote ethical behavior and decision-making based on human values.
3. To develop a sense of responsibility, empathy, and integrity.
4. To cultivate respect for diversity, equality, and sustainable living.
5. To encourage self-reflection and a commitment to lifelong value-based learning.

Course Outcomes: Students will be able to

1. Recognize and apply core human values such as honesty, compassion, and respect.
2. Analyze ethical dilemmas and make morally sound decisions.
3. Demonstrate socially responsible behavior in both personal and professional contexts.
4. Promote harmony in relationships, society, and the environment.
5. Engage in continuous personal development guided by ethical principles.

UNIT-I: Values and Ethics

Values and Self-Development, Social Values and Individual Attitudes, Work Ethics, Indian Vision of Humanism, Moral and Non- Moral Valuation, Standards and Principles, Value Judgements.

UNIT-II: Core Personal Values

Importance of Cultivation of Values, Sense of Duty, Devotion, Self-Reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of Faith, National Unity, Patriotism, Love for Nature, Discipline.

UNIT-III: Personality Traits

Personality and Behavior Development, Soul and Scientific Attitude, Positive Thinking, Integrity and Discipline, Punctuality, Love and Kindness.

UNIT-IV: Virtuous Living

Avoid Fault Thinking, Free from Anger, Dignity of Labour, Universal Brotherhood and Religious Tolerance, True Friendship, Happiness vs Suffering, Love for Truth, Aware of Self-Destructive Habits, Association and Cooperation, Doing Best for Saving Nature.

UNIT-V: Character and Wisdom

Character and Competence, Holy Books vs Blind Faith, Self-Management and Good Health, Science of Reincarnation, Equality, Nonviolence, Humility, Role of Women, All Religions and Same Message, Mind Your Mind, Self-Control, Honesty, Studying Effectively.

TEXT BOOKS:

1. Values and Ethics for Organizations: Theory and Practice, S. K. Chakraborty, Oxford University Press, 1st Edition, 1998 (paperback reprint 1999.
2. Value Education and Professional Ethics, R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, 1st Edition, 2010.

REFERENCE BOOKS:

1. Education in Values: A Source Book, UNESCO, NCERT Publication, 1st Edition, 2002.
2. Value Education: Principles and Practice, S. Ignacimuthu, Don Bosco Publications, 1st Edition, 2009.
3. Value Education: Theory and Practice, G. Rajagopalan, Bharatiya Vidya Bhavan, 1st Edition, 2011.
4. Education for Values in Schools – A Framework, NCERT, NCERT Publication, 1st Edition, 2012.
5. Education in Human Values, A.C. Bhaktivedanta Swami Prabhupada, Bhaktivedanta Book Trust, 1st Edition, 2001.
6. Teaching of Values: Some Reflections, M. M. Goel, Shipra Publications, 1st Edition, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

CONSTITUTION OF INDIA

(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic knowledge of Indian history and Governance

Course Objectives: Students will be able to:

1. To provide a comprehensive understanding of the Indian Constitution, its structure, and significance.
2. To familiarize students with the fundamental rights, duties, and directive principles.
3. To introduce the key organs of government and their roles in a democratic system.
4. To promote awareness of constitutional values, governance mechanisms, and public responsibility.
5. To understand the relationship between the Constitution and the legal-administrative framework of India.

Course Outcomes: Students will be able to:

1. Describe the history, evolution, and philosophy behind the Constitution of India.
2. Explain the fundamental rights and duties of citizens and the structure of the Indian government.
3. Analyze the functioning of constitutional bodies and judicial systems.
4. Understand the significance of constitutional amendments and landmark legal cases.
5. Demonstrate responsible citizenship and awareness of constitutional governance

UNIT-I: Constitution Drafting History

History of Making of the Indian Constitution, History Drafting Committee, (Composition and Working)

UNIT-II: Constitutional Philosophy

Philosophy of the Indian Constitution**,** Preamble**,** Salient Features

UNIT-III: Rights and Duties Framework

Contours of Constitutional Rights and Duties, Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

UNIT-IV: Organs of Governance

Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions

UNIT-V: Local Administration

District's Administration Head, Role and Importance. Municipalities: Introduction, Mayor and Role of Elected Representative, CEO of Municipal Corporation. Panchayat Raj: Introduction, PRI: Zila Panchayat, Elected Officials and their Roles, CEO Zila Panchayat, Position and Role, Block Level, Organizational Hierarchy (Different Departments), Village Level, Role of Elected and Appointed Officials, Importance of Grass Root Democracy.

UNIT-VI: Election Commission

Role and Functioning, Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and Women.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India (Bare Act), Government Publication, 1st Edition, 1950.
2. Dr. B. R. Ambedkar: Framing of Indian Constitution, Dr. S. N. Busi, Ava Publications, 1st Edition, 2016.

REFERENCE BOOKS:

1. Introduction to the Constitution of India, M. P. Jain, LexisNexis, 7th Edition, 2014.
2. Introduction to the Constitution of India, D. D. Basu, LexisNexis, 22nd Edition, 2015.
3. Indian Polity, M. Laxmikanth, McGraw Hill Education, 6th Edition, 2021.
4. Our Constitution, Subhash Kashyap, National Book Trust, 1st Edition, 2011.
5. The Constitution of India: A Contextual Analysis, Arun K. Thiruvengadam, Bloomsbury Publishing, 1st Edition, 2017.
6. The Constitution of India, P.M. Bakshi, Universal Law Publishing, 17th Edition, 2020.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

L	T	P	C
2	0	0	0

PEDAGOGY STUDIES

(Audit Course - II)

Prerequisite: Basic understanding of Teaching-Learning processes

Course Objectives: Students will be able to

1. To understand the concepts, principles, and theories of pedagogy and their application.
2. To evaluate the effectiveness of different teaching approaches in varied educational contexts.
3. To analyze the impact of teacher behavior, classroom environment, and instructional strategies on learning.
4. To assess the challenges in implementing pedagogical innovations in diverse settings.
5. To enable the design of learner-centered, inclusive, and effective educational practices.

Course Outcomes: Students will be able to understand

1. Explain key pedagogical theories and their relevance to classroom teaching.
2. Compare traditional and modern teaching strategies based on evidence from research.
3. Identify factors affecting student engagement, motivation, and learning outcomes.
4. Design instructional plans that incorporate effective pedagogical principles.
5. Critically evaluate and adapt teaching practices to meet diverse learner needs.

UNIT-I: Pedagogical Foundations

Introduction and Methodology, Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II: Global Pedagogical Practices

Thematic Overview, Pedagogical Practices are being used by Teachers in Formal and Informal Classrooms in Developing Countries, Curriculum, Teacher Education.

UNIT-III: Effective Pedagogy Evidence

Evidence on the Effectiveness of Pedagogical Practices, Methodology for the Indepth Stage, Quality Assessment of Included Studies, How Can Teacher Education (Curriculum And Practicum) and the School Curriculum and Guidance Materials best Support Effective Pedagogy? Theory of Change, Strength and Nature of the body of Evidence for Effective Pedagogical Practices, Pedagogic Theory and Pedagogical Approaches, Teachers' Attitudes and Beliefs and Pedagogic Strategies.

UNIT-IV: Professional development

Alignment with Classroom Practices and Follow-Up Support, Peer Support, Support from the Head Teacher and the Community, Curriculum and Assessment, Barriers to Learning, Limited Resources and Large Class Sizes.

UNIT-V: Future Pedagogical Research

Research Gaps and Future Directions, Research Design**,** Contexts**,** Pedagogy**,** Teacher Education**,** Curriculum and Assessment**,** Dissemination and Research Impact.

TEXT BOOKS:

1. Classroom interaction in Kenyan primary schools Ackers, J., and Hardman, F., Compare a Journal of Comparative and International Education, Volume 31, 2001.
2. Curricular reform in schools: The importance of evaluation, Agrawal, M, Journal of Curriculum Studies, Volume 36, 2003.

REFERENCE BOOKS:

1. Teacher training in Ghana - does it count? , Akyeampong, K, Multi-site teacher education research project (MUSTER) country report 1. Department for International Development (DFID), London, 1st Edition, 2003.
2. How Learning Works: Seven Research-Based Principles for Smart Teaching, Susan A. Ambrose, Jossey-Bass, 1st Edition, 2010.
3. Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement, John Hattie, Routledge, 1st Edition, 2009.
4. Teaching for Quality Learning at University, John Biggs, Catherine Tang, McGraw-Hill Education, 4th Edition, 2011.
5. The Skillful Teacher: On Technique, Trust, and Responsiveness in the Classroom, Stephen D. Brookfield, Jossey-Bass, 3rd Edition, 2015.
6. Learning Theories: An Educational Perspective, Dale H. Schunk, Pearson Education, 7th Edition, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

STRESS MANAGEMENT BY YOGA

(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic awareness of mental and physical health

Course Objectives:

1. To introduce the concept of stress and its impact on physical and mental well-being.
2. To provide an understanding of yoga as a tool for stress relief and emotional balance.
3. To teach various yogic practices including asana, pranayama, and meditation for managing stress.
4. To cultivate self-awareness, relaxation, and resilience through regular yogic practice.
5. To promote a healthy lifestyle by integrating yogic discipline in daily life.

Course Outcomes: Students will be able to:

1. Understand the causes and physiological effects of stress.
2. Apply basic yogic techniques to reduce stress and enhance focus.
3. Practice breathing techniques and meditation to maintain emotional stability.
4. Demonstrate improved physical flexibility, mental clarity, and stress tolerance.
5. Incorporate yoga as a sustainable approach to managing academic, professional, and personal pressures.

UNIT-I:

Definitions of Eight parts of yoga. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III: Do`s and Dont`s in Life

Ahinsa, Satya, Astheya, Bramhacharya and Aparigraha. Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan

UNIT-IV:

Aasan and Pranayam

UNIT-V:

Various Yoga Poses and their Benefits for Mind and Body. Regularization of Breathing Techniques and its Effects, Types of Pranayam

TEXT BOOKS:

1. Yogic Asanas for Group Training – Part I, Janardan Swami Yogabhyasi Mandal, Janardan Swami Yogabhyasi Mandal, Nagpur, Standard Edition, 1990.
2. Rajayoga or conquering the Internal Nature, Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata, 2010.

REFERENCE BOOKS:

1. The Heart of Yoga: Developing a Personal Practice, T.K.V. Desikachar, Inner Traditions, 1st Edition, 1999.
2. Yoga for Stress Relief, Swami Shivapremananda, Jaico Publishing House, 1st Edition, 2002.
3. Light on Yoga, B.K.S. Iyengar, HarperCollins, Revised Edition, 2015.
4. The Relaxation Response, Herbert Benson, HarperTorch, Updated Edition, 2000.
5. Yoga for Wellness, Shri Yogendra, The Yoga Institute, 1st Edition, 2001.
6. Yoga as Medicine, Timothy McCall, Bantam Books, 1st Edition, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic Communication and Interpersonal skills

Course Objectives:

1. To understand the concept of personality and its development through ethical and moral grounding.
2. To enhance self-awareness, confidence, and emotional intelligence.
3. To inculcate life-enlightening values drawn from Indian wisdom and philosophy.
4. To improve communication, leadership, and decision-making abilities.
5. To promote a positive attitude and holistic approach toward life and career.

Course Outcomes: Students will be able to

1. Explain the key elements of personality and factors influencing its growth.
2. Demonstrate improved self-confidence, empathy, and interpersonal relationships.
3. Apply principles from enlightened texts (e.g., Bhagavad Gita, Upanishads) to everyday decision-making.
4. Exhibit qualities of ethical leadership and responsible citizenship.
5. Lead a balanced, purposeful, and value-driven personal and professional life.

UNIT-I:

Neetisatakam-Holistic development of personality

1. Verses- 19,20,21,22 (wisdom)
2. Verses- 29,31,32 (pride & heroism)
3. Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

1. Verses- 52,53,59 (dont's)
2. Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day-to-day work and duties.

1. Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
2. Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
3. Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

1. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
2. Chapter 12 -Verses 13, 14, 15, 16,17, 18
3. Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

1. Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
2. Chapter 4-Verses 18, 38,39
3. Chapter18 – Verses 37,38,63

TEXT BOOKS:

1. Srimad Bhagavad Gita, Swami Swarupananda, Advaita Ashram (Publication Department), Kolkata, 2018.
2. Bhartrihari's Three Satakas, (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi, 1st Edition, 2002.

REFERENCE BOOKS:

1. Awakening the Giant Within, Anthony Robbins, Free Press, 1st Edition, 1992
2. The 7 Habits of Highly Effective People, Stephen R. Covey, Simon and Schuster, 30th Anniversary Edition, 2020
3. Wings of Fire: An Autobiography, A.P.J. Abdul Kalam, Universities Press, 30th Impression, 2014
4. Living with the Himalayan Masters, Swami Rama, Himalayan Institute Press, Revised Edition, 2002
5. The Monk Who Sold His Ferrari, Robin Sharma, Jaico Publishing House, 1st Edition, 1997
6. The Power of Now, Eckhart Tolle, New World Library, 1st Edition, 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

BUSINESS ANALYTICS

(Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: Statistics and Probability, Mathematics for Analytics

Course objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision-making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools and Operations research techniques.

Course Outcomes: At the end of the course,

1. Understand and apply key business analytics concepts in various functional areas.
2. Analyze historical data using descriptive analytics for business reporting.
3. Develop predictive models to forecast business trends and customer behavior.
4. Apply prescriptive analytics techniques to support strategic decision-making.
5. Use tools such as Excel, R, Python, or Tableau for data analysis and visualization in a business setting.

UNIT- I: Business analytics

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, Competitive Advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical Methods, Review of Probability Distribution and Data Modelling, Sampling and Estimation Methods Overview.

UNIT- II: Trendiness and Regression Analysis

Modelling Relationships and Trends in Data, Simple Linear Regression, Important Resources, Business Analytics Personnel, Data and Models for Business Analytics, Problem Solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III: Business Analytics Structure and Techniques

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV: Forecasting Techniques

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting, Appropriate Forecasting Models, Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V: Decision Analysis

Formulating Decision Problems, Decision Strategies With and Without Outcome Probabilities, Decision Trees and Value of Information, Utility and Decision Making. Recent Trends in Embedded and Collaborative Business Intelligence, Visual Data Recovery, Data Storytelling and Data Journalism.

TEXT BOOKS:

1. Business Analytics: Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, Pearson FT Press, 1st Edition, 2014.
2. Business Analytics, James R. Evans, Pearson Education, 3rd Edition, 2020.

REFERENCE BOOKS:

1. Business Analytics: Data Analysis and Decision Making, S. Christian Albright and Wayne L. Winston, Cengage Learning, 6th Edition, 2016.
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media, 1st Edition, 2013.
3. Business Analytics: The Science of Data-Driven Decision Making, U. Dinesh Kumar, Wiley India, 1st Edition, 2017.
4. Data Science for Business, Foster Provost, Tom Fawcett, O'Reilly Media, 1st Edition, 2013.
5. Predictive Analytics: The Future of Big Data, Eric Siegel, Wiley, 1st Edition, 2013.
6. Principles of Business Analytics, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson Education, 1st Edition, 2014.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

WASTE TO ENERGY

(Open Elective)

L	T	P	C
3	0	0	3

Prerequisites: Renewable Energy Engineering and Technology

Course Objectives:

1. To understand various types of waste and their energy potential.
2. To study the technologies used for converting waste into energy, including thermal, biological, and chemical processes.
3. To explore waste handling, segregation, and preprocessing techniques.
4. To evaluate the environmental and economic aspects of waste-to-energy (WTE) systems.
5. To examine policies, challenges, and case studies related to WTE implementation.

Course Outcomes:

1. Classify different types of waste and assess their suitability for energy recovery.
2. Explain and compare WTE technologies such as incineration, gasification, pyrolysis, anaerobic digestion, and landfill gas recovery.
3. Analyze the performance and efficiency of WTE systems.
4. Assess environmental impacts and propose mitigation measures for WTE plants.
5. Design and evaluate small- and large-scale WTE projects considering technical and economic factors.

UNIT-I: Energy From Waste

Classification of Waste as Fuel, Agro Based, Forest Residue, Industrial Waste, MSW, Conversion Devices, Incinerators, Gasifiers and Digesters.

UNIT-II: **Biomass Pyrolysis**

Pyrolysis, Types, Slow Fast, Manufacture of Charcoal, Methods, Yields and Application, Manufacture of Pyrolytic Oils and Gases, Yields and Applications. Biomass Gasification: Gasifiers, Fixed Bed System, Downdraft and Updraft Gasifiers, Fluidized Bed Gasifiers, Design, Construction and Operation, Gasifiers Burner Arrangement for Thermal Heating, Gasifier Engine Arrangement and Electrical Power, Equilibrium and Kinetic Consideration in Gasifier Operation.

UNIT-III: **Biomass Combustion**

Biomass stoves, Improved Chullahs, Types, Some Exotic Designs, Fixed Bed Combustors, Types, Inclined Grate Combustors, Fluidized Bed Combustors, Design, Construction and Operation, Operations of all the above Biomass Combustors.

UNIT-IV: Biogas

Properties of Biogas (Calorific Value and Composition), Biogas Plant Technology and Status, Bio Energy System, Design and Constructional Features, Biomass Resources and their Classification, Biomass Conversion Process.

UNIT-V: Biomass Conversion and Waste to Energy

Thermo Chemical Conversion, Direct Combustion, Biomass Gasification, Pyroloysis and Liquefaction, Biochemical Conversion, Anaerobic Digestion, Types of Biogas Plants, Applications Alcohol Production from Biomass, Bio Diesel Production, Urban Waste to Energy Conversion, Biomass Energy Programme in India.

TEXT BOOKS:

1. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern Ltd., 1st Edition, 1990.
2. Biogas Technology – A Practical Handbook, Vol. I & II, K.C. Khandelwal and S.S. Mahdi, Tata McGraw-Hill Publishing Co. Ltd., 1st Edition, 1983.

REFERENCE BOOKS:

1. Food, Feed and Fuel from Biomass, D.S. Challal, IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. Biomass Conversion and Technology, C.Y. WereKo-Brobby and E.B. Hagan, John Wiley and Sons, 1st Edition, 1996.
3. Renewable Energy Engineering and Technology: Principles and Practice, V.V.N. Kishore, TERI Press, 1st Edition, 2009.
4. Biomass to Renewable Energy Processes, Jay Cheng, CRC Press, 2nd Edition, 2017.
5. Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Gary C. Young, Wiley, 1st Edition, 2010.
6. Anaerobic Digestion – Making Biogas – Making Energy: The Earthscan Expert Guide, Tim Pullen, Routledge, 1st Edition, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

PRINCIPLES OF AUTOMATION

(Open Elective)

L	T	P	C
3	0	0	3

Prerequisites: Control Systems, Manufacturing Processes

Course Objectives:

1. To understand the fundamentals of automation and its role in manufacturing and process industries.
2. To introduce the elements of automation systems such as sensors, actuators, and controllers.
3. To study the working principles of pneumatics, hydraulics, and programmable logic controllers (PLCs).
4. To develop knowledge of automated material handling and inspection systems.
5. To analyze the integration of automation systems with manufacturing processes for improved productivity.

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

1. Explain the role and types of automation in modern industry.
2. Apply knowledge of sensors, actuators, and control strategies in automation systems.
3. Design pneumatic and hydraulic circuits for industrial applications.
4. Develop and troubleshoot basic PLC programs for manufacturing automation.
5. Evaluate and integrate automation technologies to optimize production systems.

UNIT- I: Introduction to Automation

Automation In Production Systems, Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing Operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of Automated Systems, Advanced Automation Functions, Levels of Automation.

UNIT- II: Material Handling and Storage Systems

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and Other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic Data Capture-Overview of Automatic Identification Methods, Bar Code Technology, Other ADC Technologies.

UNIT – III: Manual Assembly Line Design and Analysis

Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design For Assembly, Analysis of Single Model Assembly Lines, Line Balancing Problem, Largest Candidate Rule, Kilbridge and Wester Method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in Assembly Line Design.

UNIT- IV: Automated Production and Transfer Line Systems

Transfer Lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with No Internal Storage, Analysis of Transfer Lines with Storage Buffers.

UNIT- V: Automated Assembly Systems and Analysis

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, And Quantitative Analysis of Assembly Systems, Parts Delivery System at Work Stations, Multi Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Education, 4th Edition, 2015.
2. CAD/CAM: Principles, Practice and Manufacturing Management, Chris McMahon and Jimmie Browne, Pearson Edu. (LPE), 2nd Edition, 1999.

REFERENCE BOOKS:

1. Automation, Buckingham W, Haper and Row Publishers, New York, 1st Edition, 1961.
2. Automation for Productivity, Luke H.D, John Wiley and Sons, New York, 1st Edition, 1972.
3. Industrial Automation: Hands-On, Frank Lamb, McGraw-Hill Education, 2nd Edition, 2023.
4. Mechatronics: Principles and Applications, Godfrey C. Onwubolu, Elsevier, 3rd Edition, 2023.
5. Fundamentals of Industrial Automation, A.K. Gupta, New Age International, 1st Edition, 2016.
6. Robotics and Automation Handbook, Thomas R. Kurfess, CRC Press, 2nd Edition, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
ARTIFICIAL NEURAL NETWORKS
(Open Elective)

L	T	P	C
3	0	0	3

Prerequisites: Linear Algebra and Probability, Basics of Machine Learning
Course Objectives: Objectives of this course are

1. To introduce the architecture and learning principles of artificial neural networks.
2. To explain perceptron learning, activation functions, and error minimization.
3. To study supervised and unsupervised learning methods in depth.
4. To explore advanced models like radial basis function networks and self-organizing maps.
5. To apply neural networks for pattern recognition and classification problems.

Course Outcomes: After this course, the student will be able to:

1. Understand the structure, types, and operation of artificial neural networks.
2. Apply learning algorithms such as backpropagation and perceptron learning.
3. Analyze multilayer and deep feedforward networks.
4. Design and implement unsupervised models including clustering and self-organizing maps.
5. Solve engineering problems using appropriate neural network architectures.

UNIT – I: Foundations of Artificial Neural Networks

Introduction To Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin Huxley Neuron Model, Integrate and Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials Of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy Of ANN, Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT – II: Perceptron Models and Multilayer Learning

Feed Forward Neural Networks: Single Layer Feed Forward Neural Networks, Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence Theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed Forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT – III: Backpropagation and Multilayer Networks

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules,

Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory). Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem.
Architecture of Hopfield Network: Discrete and Continuous Versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT – IV: Set Theory in Classical and Fuzzy Domains
Introduction to Classical Sets, Properties, Operations and Relations, Fuzzy Sets, Membership, Uncertainty, Operations, Properties, Fuzzy Relations, Cardinalities, Membership Functions.

UNIT – V: Fuzzy Logic System
Fuzzification, Membership Value Assignment, Development of Rule Base and Decision-Making System, Defuzzification to Crisp Sets, Defuzzification Methods.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, S. Rajasekaran and G.A. Vijayalakshmi Pai, PHI Publication, 1st Edition, 2003.
2. Neural Networks: A Classroom Approach, Satish Kumar, TMH, 1st Edition, 2004.

REFERENCE BOOKS:

1. Neural Networks: A Comprehensive Foundation, James A. Freeman and David M. Skapura, Pearson Education, 2nd Edition, 2002.
2. Neural Networks and Learning Machines, Simon Haykin, Pearson Education, 3rd Edition, 2008.
3. Neural Engineering: Computation, Representation, and Dynamics in Neurobiological Systems, Chris Eliasmith and Charles H. Anderson, PHI, 1st Edition, 2003.
4. Introduction to Artificial Neural Systems, Jacek M. Zurada, West Publishing Company, 2nd Edition, 2022.
5. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2nd Edition, 2023.
6. Pattern Recognition and Neural Networks, Brian D. Ripley, Cambridge University Press, 2nd Edition, 2022.