R22

M.Tech. (ADVANCED MANUFACTURING SYSTEMS)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
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DEPARTMENT OF

MECHANICAL ENGINEERING

VISION OF THE DEPARTMENT

To develop into a Centre of Excellence in Education and interdisciplinary research with cutting edge technologies in the field of Mechanical Engineering, consistent with the contemporary and future societal needs of the country

MISSION OF THE DEPARTMENT

- To impart high quality education by using modern pedagogical tools so as to make the students technically competent in their chosen fields.
- To inculcate quality research by developing linkages with Industry and R & D organizations in India & abroad for developing technically competent and socially responsible engineers, managers and entrepreneurs.

M.TECH.
(ADVANCED MANUFACTURING SYSTEMS)

M.TECH. (AMS)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Graduates will pursue their professional career in manufacturing domain meeting the needs of Indian and global/multinational organizations.

PEO-II: Graduates will demonstrate strong foundation in the manufacturing domain enabling them to visualize, analyze and solve practical problems with due consideration for economical, safety and environmental concerns

PEO-III: Graduates will undertake research and engage in continuous upgradation of skills in the manufacturing domain

PEO-IV: Graduates will exhibit leadership qualities with demonstrable attributes in life-long learning to contribute to societal needs

M.TECH. (AMS)

PROGRAM OUTCOMES

PO-1: An ability to independently carry out research /investigation and development work to solve practical problems

PO-2: An ability to write and present a substantial technical report/document

PO-3: An ability to demonstrate a degree of mastery over the manufacturing systems and processes.

PO-4: An ability to design and develop a product or manufacturing system with due consideration for economical, safety, environmental and societal concerns.

PO-5: Ability to assimilate advancements and apply engineering judgment to solve problems in manufacturing.

PO-6: An ability to use skills, modern tools and techniques to solve engineering problems and understand the impact of solution in a global context with professional and ethical responsibilities.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(ADVANCED MANUFACTURING SYSTEMS)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1AM01	Automation in Manufacturing	3	0	0	3
Professional Core-II	22PC1AM02	Advances in CAD/CAM	3	0	0	3
Professional Core-III	22PC1AM03	Advanced Manufacturing Processes	3	0	0	3
Professional Elective-I	22PE1AM01	Precision Engineering	3	0	0	3
	22PC1CD03	Flexible Manufacturing Systems				
	22PE1AM02	Supply Chain Management				
	22PC1CD02	CNC Technologies and Programming				
	22PE1AM03	Micro Electro Mechanical Systems				
Professional Elective-II	22PE1CD04	IIOT and Industry 4.0	3	0	0	3
	22PE1AM04	Design for Manufacturing and Assembly				
	22PE1CD03	Product Life Cycle Management				
	22PE1AM05	Mechatronics				
	22PE1AM06	Non-Destructive Testing				
Professional Core Lab-I	22PC2AM01	CAD/CAM Laboratory	0	0	2	1
Professional Core Lab-II	22PC2AM02	Automation and Robotics Laboratory	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4AM01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(ADVANCED MANUFACTURING SYSTEMS)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1CD05	Additive Manufacturing	3	0	0	3
Professional Core-V	22PC1AM04	Modelling and Simulation of Manufacturing Systems	3	0	0	3
Professional Core-VI	22PC1CD04	Finite Element Analysis	3	0	0	3
Professional Elective-III	22PE1AM07	Quality Engineering in Manufacturing	3	0	0	3
	22PE1CD10	Product Design and Development Strategies				
	22PE1CD07	Optimization Techniques				
	22PE1AM08	Tool Design				
	22PE1CD08	Reverse Engineering				
Professional Elective-IV	22PC1CD06	Industrial Robotics	3	0	0	3
	22PE1AM09	Composite Materials				
	22PE1AM10	Micro and Nano Manufacturing				
	22PE1AM11	Materials Technology				
	22PE1AM12	Intelligent Manufacturing Systems				
Professional Core Lab-III	22PC2AM03	Manufacturing and Simulation Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2CD04	Computer Aided Engineering Laboratory	0	0	2	1
Industry Engagement	22SD5AM01	Industry Engagement	0	0	2	1
Project	22PW4AM02	Mini-Project	0	0	4	2
Mandatory	22MN6HS02	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(ADVANCED MANUFACTURING SYSTEMS)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1AM13	Design for Hydraulic and Pneumatic Systems	3	0	0	3
	22PE1CD12	Concurrent Engineering				
	22PE1CD11	Computer Aided Process Planning				
	22PE1AM14	Introduction to Machine Learning				
	22PE1AM15	Green Manufacturing				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4AM03	Project Part - I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4AM04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1AM01) AUTOMATION IN MANUFACTURING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Production Technology, Machine Tools

COURSE OBJECTIVES:

- To comprehend the basic principles of automation and analyze automated flow lines
- To impart design and control aspects of automated flow lines
- To apply line balancing methods for assembly lines
- To analyze manufacturing cells and recognize applications of automated material handling systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Implement concepts of a productive system in automation
CO-2: Apply the concepts and design technologies of automated flow lines
CO-3: Analyze automated flow lines and apply line balancing for assembly lines
CO-4: Analyze automated cells and recognize the applications of automated material handling systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	2	2	1	1
CO-2	-	-	2	2	2	2
CO-3	-	-	2	2	2	2
CO-4	-	-	2	2	2	2

UNIT-I:
Fundamentals of Manufacturing Automation: Basic Principles of automation, Types of automated systems, Degrees of automation, Automation - reasons, Production operations and automation strategies, Plant Layout, Production concepts and mathematical models, Design the parts for automation, Automatic loading Systems, introduction to direction and flow control valves and PLC.

UNIT-II:
High Volume Production Systems: Automated flow lines, Methods of workflow, Work part transfer mechanisms, buffer storage, Control functions, Automation for machining operations, Design and fabrication considerations.

UNIT-III:

Analysis of Automated Flow Lines: Analysis of transfer lines without storage, Partial automation, Automated flow lines with storage buffers, Implementation of automatic flow lines, Considerations in assembly line design.

UNIT-IV:

Assembly Systems and Line Balance: Manual assembly lines, line balancing problem, Methods of line balancing, Ways to improve line balancing, Flexible manual assembly lines, automated assembly systems, Analysis of multi station assembly.

UNIT-V:

Manufacturing Cells and Automated Material Handling: Single station automated cells, Analysis of Single Station Cells and applications, Types of equipment and functions, Design and analysis of material handling system, Conveyor system, Automated guided vehicle system, Types and vehicle guidance technology Design of automated guided vehicles and applications, Automated storage and Retrieval systems - Types, Basic components and Applications, Design for Automated Assembly, Communication Systems in Manufacturing.

TEXT BOOKS:

1. Automation, Production Systems and CIM, Mikell P. Groover, PHI, 1998
2. CAD/CAM/CIM, P. Radha Krishnan & S. Subrahamanyarn and Raju, New Age International, 2003
3. System Approach to Computer Integrated Design and Manufacturing, Singh, John Wiley,1996

REFERENCES:

1. Pneumatic and Hydraulic Systems, W. Bolton, Newnes, 1997

ONLINE RESOURCES:

1. http://nptel.ac.in/noc21_me120/preview

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1AM02) ADVANCES IN CAD/CAM

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge of CAD/CAM, Production Technology

COURSE OBJECTIVES:

- To comprehend the data exchange formats and know the different transformations in CAD modeling
- To understand parametric representation of synthetic entities
- To compare the different representation schemes and comprehend the applications of CAD
- To understand the NC Systems, NC part programming fundamentals & CNC Systems
- To understand the concept of Adaptive Control, and Computer Aided Inspection & Quality Control and implementation of CAD/CAM software and Post Processor

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Asses the various data exchange formats used and perform the transformations in geometric modeling techniques

CO-2: Derive and apply the parametric representation of synthetic curves and surfaces

CO-3: Validate the solid models through B-rep and CSG representation schemes and illustrate the applications of CAD

CO-4: Work on NC & CNC systems and program

CO-5: Apply the concepts of AC and CAI & QC and implement CAD/CAM software and Post Processor

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	1	1	-	1
CO-2	2	2	-	2	1	2
CO-3	2	2	-	2	1	2
CO-4	2	2	2	1	1	1
CO-5	1	2	1	1	3	2

UNIT-I:

Geometric Modeling: Wireframe modeling - Wire frame entities, Curve representation; Surface modeling - Surface entities, Surface representation; Solid modeling - Solid Entities, Solid Representation. 2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, Shear; Homogenous and Concatenated transformations.

Graphics Standards: Graphics standards – IGES & STEP structure and implementation.

UNIT-II:

Parametric Representation of Synthetic Entities: Parametric representation: Hermite Cubic Spline, Bezier curve, B-Spline curve; Hermite Bi-cubic surface, Bezier surface, B-Spline surface, COONs surface, NURBS

UNIT-III:

Representation Schemes: Boundary Representation (B-Rep), Constructive Solid Geometry (CSG) Advanced Modeling Applications: Feature Based and Parametric Modeling, Assembly Modeling – Bottom-Up and Top-Down approach, Mass property calculations, Finite Element Analysis

UNIT-IV:

NC Systems: NC Coordinate systems, elements of NC systems, Classification of NC Systems, Advantages & Disadvantages of NC Systems. NC Part Programming: Manual Part Programming fundamentals, word address format, Preparatory function, Feed, Speed, Tool Change functions, Dimensional words, Canned Cycles, Tool Offset, Tool Length Compensation, Tool nose radius compensation CNC Systems: CNC, Features of CNC, Functions of CNC, Advantages

Introduction to CAD/CAM Software: Computer assisted part programming, NC programming using CAD/CAM software, Tool path generation using CAD/CAM software

UNIT-V:

Adaptive Control: Adaptive control with optimization, Adaptive control with constraints, Adaptive control in machining processes – turning and grinding.

Computer Aided Inspection and Quality Control: CMM construction, Limitations of CMM, Computer Aided Testing, Optical inspection methods.

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, McGraw Hill International
2. Computer Aided Design Manufacturing, K. Lalit Narayan, K. Mallikarjuna Rao and M. M. M. Sarcar, Prentice Hall of India
3. Computer Control of Manufacturing Systems, Yoram Koren, McGraw Hill International

REFERENCES:

1. Mastering CAD-CAM, Ibrahim Zeid, McGraw Hill International
2. CAD/CAM, P. N. Rao, Tata McGraw Hill
3. Mathematical Elements for Computer Graphics, Roger D. F. and Adams A., McGraw Hill, 1989
4. Computer Aided Design and Manufacturing, Mikell P. Groover, E. W. Zimmers Jr., Prentice Hall of International
5. Computer Aided Manufacturing, T. C. Chang, Wysk, H. P. Wang, Pearson/ Prentice Hall International

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1AM03) ADVANCED MANUFACTURING PROCESSES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basics of Manufacturing Technology

COURSE OBJECTIVES:

- To provide the in-depth knowledge of the types of advanced manufacturing and machining processes
- To understand the working principle and applications of advanced manufacturing processes
- To have an overview on the pre and post treatment of manufacturing products

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Identify and utilize the manufacturing processes like advanced casting, and advanced welding

CO-2: Identify and utilize the manufacturing processes like advanced forming and advanced machining

CO-3: Apply the advanced techniques for materials processing including pre and post treatment techniques

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	2	1	1
CO-2	2	2	1	2	1	1
CO-3	2	2	1	1	2	1

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:

Advanced Casting Processes: Construction & principle of operation, advantages, limitations and applications of - Metal mould casting, Continuous casting, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting

UNIT-III:

Advanced Welding Processes: Construction & principle of operation, advantages, limitations and applications of - Electron beam welding (EBW), Laser beam welding (LBW), Ultrasonic welding (USW), Friction Stir welding (FSW)

Advanced Metal Forming Processes: Construction & principle of operation, advantages, limitations and applications of - High energy rate forming (HERF) process, Electro-magnetic forming, Explosive forming, Electro-hydraulic forming.

UNIT-IV:

Advanced Machining Processes: Construction & principle of operation, advantages, limitations and applications of - Ultrasonic machining (USM), Abrasive jet machining (AJM), Water jet machining (WJM), Abrasive water jet machining (AWJM), Electrochemical machining (ECM), Electro discharge machining (EDM), Electron beam machining (EBM), Laser beam machining (LBM)

UNIT-V:

Advanced Techniques for Materials Processing: Construction & principle of operation, advantages, limitations and applications of - Shape tube electrolytic machining, Electro jet machining, Electrolytic in-process dressing, Laser based heat treatment, Electrochemical grinding, Electrochemical etching

TEXT BOOKS:

1. Advanced Machining Processes, V. K. Jain, Allied Publishers, 2010
2. Manufacturing Engineering and Technology, Kalpak Jian, Adisson Wesley, 1995
3. Materials and Processes in Manufacturing, E. P. DeGarmo, J. T. Black, R. A. Kohser, 8th Edition, Prentice Hall of India, New Delhi

REFERENCES:

1. Non-traditional Manufacturing Processes, G. F. Benedict, Marcel Dekker Inc.
2. Introduction to Manufacturing Processes, John A. Schey, McGraw Hill
3. Process and Materials of Manufacturing, R. A. Lindburg, 4th Edition, PHI 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM01) PRECISION ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Machine Tools, Metrology, Accuracy and Tolerances, Geometric Dimensioning, Machine Drawing and Production Engineering

COURSE OBJECTIVES:

- To understand the concepts of GD & T, the datums, the grouped datum systems
- To understand the representation of tolerance, and cumulative effect of tolerances
- To understand the surface finish, the concept of accuracy and precision, process capability, quality costs, process sequencing of shaft type components
- To understand nano- processing and measuring systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of GD&T and datums in designing/ processing the Components, grouped datum systems to any sub-assembly to arrest the degrees of freedom.

CO-2: Apply the knowledge of Apply the knowledge of Tolerancing and cumulative effect of to learning

CO-3: Able to understand the concept of surface finish, accuracy and precision, process capability, quality cost, and processing of shaft type components

CO-4: Able to understand the nano-processing methods & nano-measuring systems.

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	3	2	3
CO-2	2	1	2	2	2	2
CO-3	3	1	3	2	2	2
CO-4	3	1	2	3	3	3

UNIT- I:

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

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: 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, 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.

TEXT BOOKS:

1. Precision Engineering in Manufacturing, Murthy R. L., New Age International, 1996
2. Geometric Dimensioning and Tolerancing, James D. Meadows, Marcel Dekker, 1995

REFERENCES:

1. Engineering Design – A Systematic Approach, Matousek, Blackie & Son Ltd.
2. Dimensioning and Tolerancing, ASME Y14.5-2009
3. Geometric Dimensioning and Tolerancing, P. S. Gill, 1st Edition, Katson Books, 2005
4. Statistical Process Control , John S. Oakland
5. Design for Manufacturability Handbook, James G. Bralla

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CD03) FLEXIBLE MANUFACTURING SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Knowledge of Manufacturing, Supply Chain Management

COURSE OBJECTIVES:

- To understand the knowledge about the design, operation, and selection of Flexible Manufacturing Systems and their integration in today's production environments
- To understand the integration of components of FMS under different production management approaches
- To learn about simulation software and database of FMS
- To calculation of performance measures, including throughput, in-process inventory, and meeting production commitments

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concepts of Sensor Technology Probability & Statistics to develop the manufacturing systems
CO-2: Plan, schedule and control a developed FMS
CO-3: Select suitable database and software required for FMS
CO-4: Apply preventive maintenance, Kanban system effectively

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	-	2	3	-
CO-2	2	3	3	3	3	1
CO-3	2	3	-	-	-	-
CO-4	2	3	1	-	-	-

UNIT-I:
Flexible Manufacturing Systems: Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS, Knowledge based scheduling, Types of Productions, Types of FMS, Types of FMS Layouts, advantages and disadvantages of FMS.

UNIT-II:
Computer Control and Functions: Hierarchy of computer control. Supervisory computer. Components of FMS, Types of flexibility, trade off, computer control and functions, coordinate measuring machines, types, working and capabilities.

UNIT-III:

Computer Software, Simulation and Database of FMS: Software for simulation and database of FMS, Specification and selection, Trends, Application of simulation software.

UNIT-IV:

Manufacturing Data Systems Data Flow: Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, Just in time characteristics, Pull method, Quality small lot sizes, Work station loads, Close supplier ties, Flexible workforce – Line flow strategy, types of FMS software's.

UNIT-V:

Just In Time: Preventive maintenance, Kanban system, Implementation issues, value engineering, MRP, JIT, lean manufacture, quality concepts, and Management.

TEXT BOOKS:

1. Hand Book of Flexible Manufacturing Systems, Jha N. K., Academic Press

REFERENCES:

1. Production System beyond Large Scale Production, Taiichi Ohno, Toyota, Productivity Press
2. Flexible Manufacturing Systems, Shivanad H. K., Benal M. M., Koti. V, New Age International, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM02) SUPPLY CHAIN MANAGEMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basics of Mechanical Engineering

COURSE OBJECTIVES:
- To identify decision phases and apply competitive and supply chain strategies
- To derive driver
- To provide a basic understanding with case studies on different fault diagnosis method
- To apply specific code, standard, or specification related to each testing method

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the decision phases and apply competitive and supply chain strategies.
CO-2: Understand drivers of supply chain performance
CO-3: Analyze factors influencing network design
CO-4: Analyze the role of forecasting in a supply chain
CO-5: Understand the role of aggregate planning, inventory, IT and coordination in a supply chain

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	1	2	1	1
CO-2	-	-	1	2	1	1
CO-3	-	-	1	2	1	2
CO-4	-	-	1	1	1	1
CO-5	-	-	1	2	1	2

UNIT-I:
Strategic Framework: Introduction to Supply Chain Management, Decision phases in a supply chain, Process views of a supply chain: push/pull and cycle views, Achieving Strategic fit, Expanding strategic scope.

UNIT- II:
Supply Chain Drivers and Metrics: Drivers of supply chain performance, Framework for structuring Drivers, Obstacles to achieving strategic fit.
Coordination in SC: Modes of Transportation and their performance characteristics, Supply Chain IT framework, Coordination in a SC and Bullwhip Effect.

UNIT- III:

Designing Supply Chain Network: Factors influencing Distribution Network Design, Design options for a Distribution network, E-Business and Distribution network, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.

UNIT-IV:

Forecasting in SC: Role of forecasting in a supply chain, Components of a forecast and forecasting methods, Risk management in forecasting.

UNIT-V:

Aggregate Planning and Inventories in SC: Aggregate planning problem in SC, Aggregate Planning Strategies, Planning Supply and Demand in a SC, Managing uncertainty in a SC: Safety Inventory.

TEXT BOOK:

1. Supply Chain Management - Strategy, Planning and Operation, Sunil Chopra and Peter Meindl, 4th Edition, Pearson Education Asia, 2010

REFERENCES:

1. Designing and Managing the Supply Chain - Concepts Strategies and Case Studies, David Simchi-Levi, Philp Kamintry and Edith Simchy Levy, 2nd Edition, Tata-McGraw Hill, 2000
2. Managing Supply Chains - A Logistics Approach, John J. Coyle, 9th Edition, Cengage Learning, 2013
3. Modeling the Supply Chain, Jeremy F. Shapiro, 2nd Edition, Cengage Learning, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CD02) CNC TECHNOLOGIES AND PROGRAMMING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the NC Systems, NC part programming fundamentals
- To understand the CNC systems, DNC systems APT programming language for 2D geometric shapes
- To understand the concepts of Tooling for CNC, Adaptive control, CAD/CAM software implementation, post postprocessor
- To understand the concept of Computer Aided Process Planning and Computer aided inspection & quality control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply knowledge and work on the NC systems & CNC systems and able to program
CO-2: Develop an optimal APT program for a given component (2D- milling & drilling)
CO-3: Able to understand Adoptive control systems, CNC Tooling systems, CAD/ CAM software, post processor
CO-4: Able to understand the concepts of CAPP and CAI & QC

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	1	3	2	1
CO-2	1	2	1	3	2	1
CO-3	1	2	1	3	2	1
CO-4	1	2	1	3	2	1

UNIT-I:
Introduction to Numerical Control: Numerical Control: Introduction, Applications of NC/CNC, Benefits of NC/CNC, Limitations of CNC. Classification of NC/CNC systems: Based on type of Control.
Components of CNC System: Basic components of CNC system, Design considerations, structure, Antifriction LM guideways, spindles, balls crews.

UNIT-II:
DNC Systems: DNC Concepts, Objectives of DNC, Components of DNC, Types of DNC, advantages and disadvantages of DNC
CNC Programming: Part programming: Introduction, Part Program and its elements, Methods of Programming: Manual and Computer Assisted Part programming, APT

Language & programming (statements & Programming), Examples of APT programming problems (2D machining- Milling & Drilling only)

UNIT-III:

Adaptive Control: Sample Text, Sample Text Adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, Grinding Tooling for CNC Machines: Types of CNC tooling for cutting3 (brief introduction of preset, qualified, Interchangeable, coolant fed, and modular tooling systems); Tool presetting4; Automatic tool changers4; Work holding (modular fixturing)4.

UNIT-IV:

Introduction to CAD/CAM Software: NC programming using CAD/CAM software, Tool path generation using CAD/CAM software, Technology of CAM, Computer assisted part programming

Post Processors for CNC: NC Introduction to Post Processors, necessity of a Post Processor, general structure of a Post Processor, functions of a Post Processor

UNIT-V:

Computer Aided Process Planning: Sample Text, Introduction, Manual process planning vs. Computer aided process planning, Basics of variant and generative process planning methods.

Computer Aided Inspection and Quality Control: CMM Construction, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods.

TEXT BOOKS:

1. Computer Aided Design Manufacturing, K. Lalit Narayan, K. Mallikarjuna Rao and M. M. M. Sarcar, PHI
2. CAD/CAM: Principles and Applications, P. N. Rao, McGraw Hill
3. Computer Control of Manufacturing Systems, Yoram Koren, McGraw Hill

REFERENCES:

1. Mastering CAD/CAM, Ibrahim Zeid, McGraw Hill
2. Numerical Control Machine Programming and Software Design, C. H. Chang, M. A. Melkanoff, Prentice Hall
3. Computer Aided Manufacturing, Shanmuga Sundar, T. Selwyn, C. Elanchezhian

ONLINE RESOURCES:

1. www.nptel.com, IIT Khargapur, Manufacturing Processes
2. www.nptel.com, IIT Madras, CNC Machines

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM03) MICRO ELECTRO MECHANICAL SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand MEMS, microsystems and their applications
- To impart knowledge on fabrication processes, microsystem packaging and assembly of micro systems
- To analyze micro devices, science and synthesis of nano materials
- To comprehend characterization techniques of nano materials

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand MEMS and microsystems

CO-2: Comprehend fabrication processes and micro system packaging

CO-3: Apply micro devices for engineering applications

CO-4: Perform synthesis and characterization of nano materials

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	3	2	2	1
CO-2	1	1	1	3	2	2
CO-3	1	1	1	1	1	2
CO-4	1	1	1	1	2	2

UNIT-I:

Overview of MEMS and Microsystems: Definition, properties, design and fabrication micro-system, microelectronics, working principle, applications and advantages of micro system. Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds - silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers.

UNIT-II:

Fabrication Processes and Micro System Packaging: Photolithography, photo resist applications, light sources, ion implantation, diffusion, Oxidation - thermal oxidation, silicon dioxide, chemical vapour deposition, sputtering - deposition by epitaxy, etching bulk and surface machining, LIGA process, LASER, Electron beam, Ion beam processes, Mask less lithography. Micro system packaging, packaging design, levels of micro system packaging -die level, device level and system level, interfaces in packaging, packaging technologies- Assembly of Microsystems.

UNIT-III:

Micro Devices: Sensors, classification, signal conversion ideal characterization of sensors micro actuators, mechanical sensors, measurands - displacement sensors, pressure sensor, flow sensors, Accelerometer, chemical and bio sensor - sensitivity, reliability and response of micro-sensor - micro actuators, applications.

Science and Synthesis of Nano Materials: Classification of nano structures, Effects of nano scale dimensions on various properties, structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics, Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture Nanoparticles.

UNIT-IV:

Synthesis of Nano Materials: Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes, Solid carbon source based production techniques, Gaseous carbon source based production techniques, Diamond like carbon coating. Top down and bottom up processes.

UNIT-V:

Characterization of Nano Materials: Nano-processing systems, Nano measuring systems, characterization, analytical imaging techniques, microscopy techniques, electron microscopy scanning electron microscopy, confocal LASER scanning microscopy - transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques, spectroscopy techniques, Raman spectroscopy, 3D surface analysis, Mechanical, Magnetic and thermal properties, Nano positioning systems.

TEXT BOOKS:

1. Introduction to Micro fabrication, Sami Franssila, John Wiley & Sons, 2004
2. Nano Technology, Norio Taniguchi, Oxford University Press, 2003
3. Introduction to Nano technology, Charles P. Poole, Frank J. Owens, John Wiley & Sons, 2003

REFERENCES:

1. Foundations of MEMS, C. Liu
2. An Introduction to Microelectromechanical Systems Engineering, N. Maluf
3. Modeling MEMS and NEMS, J. Pelesko & D. Bernstein
4. MEMS & Microsystems Design & Manufacture, Tai – Ran Hsu, Tata McGraw Hill, 2002
5. Emerging Nanotechnologies for Manufacturing, Waqar Ahmed and Mark J. Jackson, Elsevier, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CD04) IIOT AND INDUSTRY 4.0

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basics of Industry 4.0
- To understand the business model and impact of IIoT
- To understand the concepts of virtual reality, lean manufacturing
- To gain knowledge of various sensors and actuators
- To understand various data transmission technologies

COURSE OUTCOMES: After completion of the course the student will be able to
CO-1: Explain smart business perspective, cyber security, impacts of Industry 4.0
CO-2: Understand the basics of the Industrial Internet of Things
CO-3: Understand various key technologies
CO-4: Implement various sensors and actuators
CO-5: Understand different industrial transmission technologies and IIOT applications in real life

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	2	3	-	-
CO-2	-	-	2	-	2	3
CO-3	-	-	2	2	-	3
CO-4	-	-	2	-	2	3
CO-5	-	-	2	2	-	3

UNIT–I:

Industry 4.0 Basics: Industrial revolution: Phases, Evolution of Industry4.0, Environmental impacts of industrial revolution, Applications, Design requirements, Drivers of Industry 4.0, Sustainability Assessment of industries, Smart Business Perspective, Cyber security, Impacts of Industry 4.0.

UNIT–II:

Industrial Internet of Things- Basics: IIoT and Industry 4.0, IIC, Industrial Internet Systems, Design of industrial internet systems, Impact of industrial internet, Benefits of industrial internet, Industrial sensing, Industrial Processes, Features of IIoT for industrial processes, Industrial plant–The future architecture, Digital Enterprise

Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IIoT, Industrial Internet Reference Architecture

UNIT –III:

Key Technologies-Off-Site Technologies: Cloud Computing, Fog Computing

Key Technologies - On-site Technologies: Augmented Reality, Virtual Reality, Smart factories, Lean manufacturing system, Big Data and Advanced Analytics

UNIT –IV:

Sensors: Various sensor types and their underlying working principles, Characteristics of Sensors – Resolution, calibration, accuracy and others, Sensor Categories – Thermal, Mechanical, Electrical, Optical and Acoustic sensors.

Actuators: Thermal, Hydraulic, Pneumatic, Electro mechanical Actuator

UNIT–V:

Industrial Data Transmission and Acquisition: Architecture of various data transmission technologies like Foundation Fieldbus, Profibus, Highway Addressable Remote Transducer (HART), Interbus, Bitbus, DigitalSTROM, Controller Area Network, and other recent and upcoming Technologies. Distributed Control System, SCADA and PLC System.

IOT Applications: IoT Applications on Industrial automation, Factories and Assembly line, Plant Security and Safety, Transportation, Agriculture, Healthcare, Home Automation, Oil, Chemical and Pharmaceutical Industry and others.

TEXT BOOKS:

1. Introduction to Industrial Internet of Things and Industry 4.0, Sudip Misra, Chandana Roy, Anandarup Mukherjee, CRC Press
2. Ïnternet of Things - A Hands on Approach, Vijay Madisetti, Arshdeep Bahga, University Press
3. Introduction to Internet of Things: A practical Approach, Dr. S. R. N. Reddy, Rachit Thukral and Manasi Mishra, ETI Labs

REFERENCES:

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj and Anupama C. Raman, CRC Press
2. Designing the Internet of Things, Adrian McEwen, Wiley
3. Internet of Things: Architecture and Design, Raj Kamal, McGraw Hill
4. Getting Started with the Internet of Things, Cuno Pfister, O Reilly Media

ONLINE RESOURCES:

1. http://nptel.ac.in/moc20-cs69/preview
2. http://coursera.org/learn/industrial-internet-of-things#syllabus

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM04) DESIGN FOR MANUFACTURING AND ASSEMBLY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Production Technology, Machine Tools, Material Technology

COURSE OBJECTIVES:

- To impart the knowledge on steps involved in design process and material selection
- To understand about the design rules involved in machining and casting
- To understand about the design rules involved in metal joining, extrusion and sheet metal work
- To understand about the design principles involved in manual and automatic assembly transfer systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the knowledge on steps involved in design process and material selection

CO-2: Apply the knowledge on design rules involved in machining and casting

CO-3: Analyze the design rules involved in metal joining, extrusion and sheet metal work

CO-4: Design and analyze the principles involved in manual and automatic assembly transfer systems

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	2
CO-2	3	1	3	3	3	2
CO-3	3	1	3	3	3	2
CO-4	3	1	3	3	3	2

UNIT-I:

Introduction: Design philosophy, steps in design process, general design rules for manufacturability, basic principles of designing for economical production, creativity in design.

Materials: Selection of materials for design, developments in material technology, criteria for material selection, interrelationship with process selection, process selection charts.

UNIT-II:

Machining Process: Overview of various machining processes, design rules for machining, redesigning of components for machining ease with suitable examples.

Metal Casting: Appraisal of various casting processes, general design considerations for casting, overview of solidification simulation in casting design, product design rules for sand casting, casting defects.

UNIT-III:

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, welding defects, design of brazed joints.

Extrusion & Sheet Metal Work: Design guidelines for extruded sections, design principles for punching, blanking, bending, deep drawing, keeler goodman forming line diagram.

UNIT-IV:

Assembly Process: 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, 1992
2. Engineering Design – Material & Processing Approach, George E. Dieter, 2nd Edition, McGraw Hill, 2000

REFERENCES:

1. Handbook of Product Design, Geoffrey Boothroyd, Marcel and Dekker, 1990
2. Computer Aided Assembly Planning, A. Delchambre, Springer, 1992

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CD03) PRODUCT LIFE CYCLE MANAGEMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Industrial Engineering and Management

COURSE OBJECTIVES:

- To understand product information, product lifecycle management concept, product structures and product pains
- To apply business processes in the PLM environment and learn engineering change management
- To create PLM service information models and different ways to integrate PLM systems with other applications
- To implement end to end business process management and PLM applications in process and product industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand product data, information, structures, and PLM concepts

CO-2: Apply PLM systems in organization verticals including production, after sales, marketing, subcontracting, PLM concepts for service industry, E-Business, tools, and standards in PLM

CO-3: Measure benefits of PLM implementation in daily operations, material costs, productivity of labour and quality costs

CO-4: Create and Implement methods to deploy a PLM system in a global company

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	2	1	1	1
CO-2	-	-	3	2	2	2
CO-3	-	-	2	2	2	2
CO-4	-	-	1	2	2	2

UNIT-I:

Fundamentals of PLM: Product data or Product information, Product lifecycle management concept, The P L and M of PLM –PLM Paradigm –The PLM Environment – Issues in traditional environment – Product Data Issues – Product Pains - Opportunities

UNIT-II:

Business Processes in the PLM Environment – Introduction – Process reality in a typical company – Business process activities in a PLM initiative -Business process

improvement approaches - Configuration Management – Engineering Change Management

Product Structures: Standardized product data and materials data model, KPIs for product data – Generic issues with product data – Product data activities in the PLM initiative.

UNIT-III:

PLM Service Information Model: Categorizing services, Rational for building service products, how to make a service more like a tangible product? Making items out of product functions, PLM challenges in service business, An IT-service provider and a customer- specifically variable product.

UNIT-IV:

Integration of the PLM System with Other Applications: Different ways to integrate PLM systems, Goal of integrating PLM, SCM and ERP – Digital Transformation of PLM -IoT in Manufacturing – Convergence of PLM with IIoT.

UNIT-V:

Implementing End to End Business Process Management: Product lifecycle management as a business strategy tool, Product lifecycle management as an enabler of cooperation between companies, Contents of collaboration, Successful cooperation, Tools of collaboration, From changes in the business environment to product strategy, Business Benefits of PLM.

TEXT BOOKS:

1. Product Lifecycle Management (Volume 1): 21st Century Paradigm for Product Realisation (Decision Engineering), John Stark, Springer, 2020
2. Product Lifecycle Management, Antti Saaksvuori, Anselmilmmonen, 3rd Edition, Springer, 2008
3. Product Life Cycle Management (PLM), A Digital Journey using Industrial Internet of Things, Udhayan Elongovan, CRC Press, 2020

REFERENCES:

1. Product Lifecycle Management (Volume 2): The Devil is in the Details, John Stark, Springer, 2016
2. Product Lifecycle Management (Volume 4): The Case Studies (Decision Engineering), John Stark, Springer, 2016
3. Management Accounting, Anthony A. Atkinson, 6th Edition, Prentice Hall, 2012
4. Introduction to Operations and Supply Chain Management, Cecil B. Bozarth, Robert B. Handfield, 5th Edition, Pearson, 2019

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM05) MECHATRONICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the mechatronics systems
- To provide an in-depth understanding of components of knowledge-based systems
- To provide an understanding of artificial intelligence
- To design and develop automated process planning
- To develop group technology for intelligent manufacturing systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand and describe different mechatronics systems

CO-2: Explain the principle of operation of various solid-state devices

CO-3: Describe the working of hydraulic and pneumatic actuating systems and use them appropriately

CO-4: Use program logic controls effectively

CO-5: Design mechatronic systems

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	3	2	2	1
CO-2	1	1	1	2	3	1
CO-3	1	1	3	2	2	1
CO-4	1	1	1	2	3	1
CO-5	1	1	1	3	2	1

UNIT–I:

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature, and light sensors.

UNIT–II:

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT–III:
Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT–IV:
Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT–V:
System and interfacing and data acquisition, DAQS, SCADA, A to D and D to a conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXT BOOKS:

1. Mechatronics Integrated Mechanical Electronics Systems, K. P. Ramachandran & G. K. Vijaya Raghavan, Wiley India, 2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W. Bolton, 3rd Edition, Pearson Education, 2005
3. Mechatronics System Design, Devdas Shetty, Richard, Thomson

REFERENCES:

1. Mechatronics Source Book, Newton C. Braga, Thomson
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publishers
3. Mechatronics, M. D. Singh, J. G. Joshi, PHI
4. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, 4th Edition, Pearson, 2012
5. Mechatronics – Principles and Application, Godfrey C. Onwubolu, Elsevier, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1AM06) NON-DESTRUCTIVE TESTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To know various methods of non-destructive testing
- To understand the concept of non-destructive testing
- To describe the various types of NDT tests carried out on components
- To understand the ultrasonic and acoustic emission techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Comprehend the theory of non-destructive testing and use visual methods
CO-2: Distinguish between the various NDT like Thermography, Eddy Current, Liquid Penetrant and Magnetic Particle methods
CO-3: Applied the knowledge of NDT processes like Radiography, Ultrasonic and Acoustic Emission

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	1	1	1
CO-2	1	1	2	2	1	1
CO-3	1	1	2	3	3	3

UNIT-I:
Introduction: Fundamentals of destructive and non-destructive testing, Scope and limitations of NDT
Visual Tests: Visual examination methods - Unaided and aided.

UNIT-II:
Thermography and Eddy Current Testing:
Thermography: Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentation and methods, Applications
Eddy Current Test: Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, Advantages, Limitations, Interpretation

UNIT-III:
Liquid Penetrant and Magnetic Particle Tests:
Liquid Penetrant Tests: Characteristics of liquid penetrants, Different washable systems, Developers, Applications

Magnetic Particle Tests: Methods of production of magnetic fields, Principles of operation of magnetic particle test, Applications, Advantages and limitations

UNIT-IV:

Radiography: Principle, Interaction of X-Ray with matter, Imaging, Film and film square less techniques, Types and use of filters and screens, Geometric factors, Inverse square, Law, Characteristics of films – graininess, density, speed, contrast, characteristic curves; Penetrameters, Exposure charts, Radiographic equivalence; Fluoroscopy - Xeroradiography, Computed radiography, Computed Tomography

UNIT-V:

Ultrasonic Techniques: Production of ultrasonic waves, Different types of waves, General characteristics of waves, Pulse echo method - A, B, C scans

Acoustic Emission Techniques: Principles of acoustic emission techniques, Advantages and limitations, Instrumentation, Applications

TEXT BOOKS:

1. Non-Destructive Testing, Louis Cartz, Barry Hull John, MacMillan, 1988
2. Practical Non-Destructive Testing, Baldev Raj, T. Jayakumar & M. Thavasimuthu, Narosa Publishing House, 2009
3. Non-Destructive Testing Techniques, Ravi Prakash, 1st Revised Edition, New Age International, 2010

REFERENCES:

1. Non-Destructive Testing, Louis Cartz, ASM International
2. Non-Destructive Evaluation and Quality Control, ASM Metals Handbook, Vol. 17, ASME
3. Introduction to Non-Destructive Testing: A Training Guide, Paul E. Mix, 2nd Edition, Wiley, 2005
4. Handbook of Non-Destructive Evaluation, Charles, J. Hellier, McGraw Hill, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2AM01) CAD/CAM LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Knowledge of CAD, Machine Tools

COURSE OBJECTIVES:
- To comprehend the tools used in CAD software
- To perform sketching, modeling of parts, surface modeling and sheet metal working tools
- To create steps and commands in part programming and tool selection
- To evaluate the use of various CAM softwares

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Construct 2D sketches and 3D part models
CO-2: Utilize the part models in creating assemblies and obtain the drafted views, surface models and sheet metal parts
CO-3: Demonstrate part programming for CNC lathe and execute the same for the part production
CO-4: Develop the manufacturing of components through CAM Software

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	2	-	-	2	-
CO-2	1	2	-	-	2	1
CO-3	2	2	1	1	-	1
CO-4	1	2	2	1	2	2

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

12 exercises from the following syllabus:

1. CAD
- Sketching
- Modeling
- Assembly
- Drafting
- Surface modeling
- Sheet metal design

Note: Each topic shall consist of atleast one exercise on engineering components

Softwares: CATIA

2. CAM

- Preparation of manual part programs for Turning operations using point-to-point, Linear and circular interpolation Techniques. a) Facing, Plain Turning, Step turning, Taper turning , Grooving and Thread cutting
- Preparation of manual part programs for Milling operations using point-to-point, Linear and circular interpolation Techniques. Face Milling, End milling and Pocket Milling
- Part programming using Fixed or Canned Cycles for turning operations.
- Generation of Tool path, NC code and its Simulation for Turning and Milling operations using Off-line NC simulation and CAM packages like MasterCAM/EdgeCAM softwares.
- Machining of simple components on NC lathe machine by transferring NC Code from a CAM package through RS 232.
- Machining of simple components on NC Milling machine by transferring NC Code from a CAM package through RS 232.

SOFTWARES: CNC Offline Simulation, EdgeCAM, MasterCAM

REFERENCE:

1. CATIA V5 Help Manual

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2AM02) AUTOMATION AND ROBOTICS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Introductory Mechanics of Fluids, Instrumentation and control system, logic systems

COURSE OBJECTIVES:

- To develop knowledge in various drive system, i.e., pneumatics, hydraulics and electrical
- To impart skills in kinematics analysis of robot systems
- To provide knowledge and skills associated with programming and control system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate knowledge of the relationship between different drive system i.e. (Pneumatics, Hydraulic and Electrical)
CO-2: Demonstrate an ability to solve forward and inverse kinematics of simple robot manipulators
CO-3: Demonstrate knowledge of robot programming and controllers

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	3	3	2
CO-2	2	2	2	1	1	2
CO-3	1	2	2	1	2	2

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

1. To design a pneumatic circuit to actuate a single acting pneumatic cylinder using 3/2 manual push button and roller lever type DCV's.
2. To control double acting single hydraulic cylinder by manually operated DCV
3. To simulate a hydraulic circuit using automation studio
4. To determine the torque vs. speed characteristics using VVVF Electrical drive system
5. To control a robot by applying direct and inverse kinematics using robot simulation software and actuate a robot with teach pendant
6. Demonstration on PLC with ladder logic
7. To study the working of sensors like strain gauge, angular measuring unit, LVDT
8. Determination of Water level using capacitive transducer.
9. Demonstration on microprocessor-based stepper motor
10. To compare an open loop and closed loop control system for temperature monitoring

11. To simulate Pneumatic sequential circuit using Automation Studio
12. To simulate PLC controlled pneumatic sequential circuit using Automation Studio

TEXT BOOKS:

1. Fluid Power Control, Blackburn J. F., G. Reethof, and J. L. Shearer, Technology Press of M. I. T. and Wiley
2. Oil Hydraulic Power and its Industrial Applications, Ernst W., McGraw Hill

REFERENCES:

1. Fluid Power Control Systems, Fitch Jr. E. C., McGraw Hill
2. Hydraulic control systems, Herbert E. Merritt, John Wiley and Sons
3. Fundamentals of Pneumatics/Electropneumatics, Hasebrink J. P., and Kobler R., FESTO Didactic Publication No. 7301, Esslingen Germany, 1979
4. Hydraulic and Pneumatic Control of Machine Tools, Khaimovitch
5. Electro-hydraulic Servomechanism, Morse A. C., McGraw Hill

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22SD5HS01) COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	1	3	1	1
CO-2	2	3	2	3	2	2
CO-3	3	3	2	3	2	2
CO-4	3	3	3	3	2	1
CO-5	2	3	2	3	2	1

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

CO-5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	-	-	-	-
CO-2	2	3	-	-	-	-
CO-3	-	-	3	2	-	-
CO-4	-	-	-	3	2	-
CO-5	-	-	-	-	2	3

UNIT–I:

Meaning of research problem, Sources of research problem, 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:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT–III:
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:
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: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CD05) ADDITIVE MANUFACTURING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: CAD

COURSE OBJECTIVES:
- To know the fundamentals and process chain involved in AM
- To understand the liquid based and solid based AM Systems
- To understand the powder based processes, rapid tooling & data formats involved in AM
- To know about the applications and post processing of AM

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the knowledge of fundamentals and process chain involved in AM
CO-2: Explain about the liquid and solid based AM Systems
CO-3: Explain the powder based processes, rapid tooling & data formats involved in AM
CO-4: Apply the knowledge of applications and plan the post processing methods involved in AM

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	-	3	3
CO-2	3	1	3	-	3	3
CO-3	3	1	3	-	3	3
CO-4	3	1	3	-	3	3
CO-5	3	1	3	-	3	3

UNIT–I:
Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, AM Process Chain, Advantages and Limitations of AM, Classification of AM process, Distinction between AM and CNC.

UNIT–II:
Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Principle, Process, Applications, Advantages and Disadvantages, Solid ground curing (SGC): Principles, Processes, Applications, Advantages and Disadvantages, Poly jet: Principle, Process, Applications, Advantages and Disadvantages.

Solid-based AM Systems: Laminated Object Manufacturing (LOM): Principle, Process, Applications, Advantages and Disadvantages, Fused Deposition Modeling (FDM): Principle, Process, working principle, Applications, Advantages and Disadvantages, Multi-Jet Modelling (MJM): Principle, Process, Applications, Advantages and Disadvantages.

UNIT–III:

Powder Based AM Systems: Selective laser sintering (SLS): Principle, Process, Applications, Advantages and Disadvantages, Three-dimensional Printing (3DP): Principle, Process, Applications, Advantages and Disadvantages

Laser Engineered Net Shaping (LENS): Principle, Process, Applications, Advantages and Disadvantages, Electron Beam Melting (EBM): Principle, Process, Applications, Advantages and Disadvantages

Rapid Tooling: Introduction to Rapid Tooling (RT), Indirect Methods of Rapid Tooling: Investment Cast Tooling, 3D Keltool, Spray Metal Tooling. Direct Methods of Rapid Tooling: SLS, EBM Tooling, Direct Metal Laser Sintering (DMLS) and Laminated Tooling

UNIT–IV:

AM Data Formats: Basic concept, CAD data formats, CAD model preparation, Part orientation and support generation, about STL File & its errors and Overview of Reverse Engineering.

AM Software: Overview of various AM software's like Materialise Magics and Mimics only.

UNIT–V:

Applications and Post Processing of AM:

AM Applications: Applications in Engineering, Analysis and Planning, Applications in Aerospace & Defense Industry, Automotive Industry, Bio-Medical Applications, Applications in Jewelry, Coin & Tableware Industry.

Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing for FDM Techniques and Overview of Post Processing involved in Metal Additive Manufacturing.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping, Gebhardt A., Hanser Gardener Publications, 2003

REFERENCES:

1. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific Publishers, 2010
2. Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
3. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
4. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1AM04) MODELING AND SIMULATION OF MANUFACTURING SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basics of simulation modeling and its applications in manufacturing
- To evaluate the parameters, develop and validate simulation models
- To random number and random variate generation using different techniques
- To create awareness on various simulation languages and analyzing the output data

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify the types of models and summarize the applications of simulation
CO-2: Estimate the parameters through hypothesis testing
CO-3: Build and validate simulation model
CO-4: Generate random numbers and variates to execute a simulation model
CO-5: Analyze and interpret the output data of using simulation languages

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	3	2	1
CO-2	2	1	1	3	3	2
CO-3	1	1	2	3	3	3
CO-4	1	2	2	3	2	2
CO-5	2	2	2	2	3	3

UNIT-I:
Introduction: Simulation – advantages and disadvantages, System environment, Components of a system, Model of a system, Types of models, Steps in a simulation study
Applications of Simulation: Simulation of queuing system, Simulation of Inventory system, Simulation of manufacturing and material handling system

UNIT-II:
Parameter Estimation: Introduction, Estimator – properties, Estimate - Point estimate, Estimation of confidence interval, Hypothesis testing, Steps and errors in hypothesis testing, The Strong law of large numbers.

UNIT-III:

Building of Simulation Model and 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 distributions and their suitability in modeling

UNIT-IV:

Generation of Random Variates: Factors for selection, Methods: Inverse transform, Composition, Convolution and acceptance-rejection, Generation of random variants for Uniform, Exponential, Weibull and Normal distributions, Generation of discrete random variants for Bernoulli, Binomial, Uniform and Poisson distributions

UNIT-V:

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.

Simulation Languages: Introduction, Comparison of simulation packages with programming languages, Classification of simulation software, Desirable software features, General purpose simulation packages

TEXT BOOKS:

1. Simulation Modelling and Analysis, Law A. M. & Kelton, McGraw Hill Edition, 1991
2. Discrete Event System Simulation, Banks J. & Carson J. S., PH/Englewood Cliffs, 1984

REFERENCES:

1. A Course in Simulation, Ross S. M., McMillan, 1990
2. Simulation of Manufacturing Systems, Carrie A., Wiley, 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CD04) FINITE ELEMENT ANALYSIS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Numerical Methods, Engineering Mechanics, Solid Mechanics

COURSE OBJECTIVES:

- To understand the concept of Finite Element Method, Identify the areas of application of FEM and study the procedure
- To solve linear problems by numerical methods and differentiate them
- To apply the concept of FEM to solve basic non-linear problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and Apply the concepts of FEM to one-dimensional structural systems
CO-2: Analyze two dimensional and three-dimensional cases
CO-3: Formulate scalar field variables
CO-4: Analyze time dependent systems to determine Eigen vectors
CO-5: Formulate flexural behavior of plates and material nonlinearity

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	-	2	-	-
CO-2	2	3	-	2	-	-
CO-3	-	3	-	2	-	-
CO-4	-	3	-	2	-	-
CO-5	2	3	-	2	-	-

UNIT-I:

Introduction to FEM: basic concepts, historical background, application of FEM, general description, comparison of FEM with other methods, variational approach, Galerkin Methods.

Co-ordinates, basic element shapes, interpolation function, Virtual energy principles, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, Basic equations of elasticity, strain displacement relations and equilibrium equations.

One Dimensional Problems: Formulation of Stiffness Matrix for a Bar Element by the Principle of Minimum Potential Energy, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions.

UNIT-II:

Analysis of Trusses: Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.

Analysis of Beams: Derivation of Stiffness matrix for linear beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams, Beam on elastic supports.

UNIT-III:

Finite Element – Formulation of 2D Problems: Derivation of Element stiffness matrix for two dimensional CST Element, Derivation of shape functions for CST Element, Elasticity Equations, constitutive matrix formulation, Formulation of Gradient matrix. Two dimensional Isoparametric Elements and Numerical integration.

Finite Element – Formulation of 3D Problems: Derivation of Element stiffness matrix for Tetrahedron Element, Properties of Shape functions for 3D Tetrahedral Element, Stress-Strain Analysis for 3D Element, Strain Displacement for Relationship Formulation. Problems on Axisymmetric analysis

UNIT-IV:

Steady State Heat Transfer Analysis: One Dimensional Finite Element analysis of fin and composite slabs. Two-dimensional steady state heat transfer problems: Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems. Problems on Axisymmetric heat transfer analysis. Introduction to Torsional problems.

Dynamic Analysis: Formulation of mass matrices for uniform bar, beam and 2D triangular Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

UNIT-V:

Plate Bending: Introduction – Plate behavior – C1 (Kirchoff) Plate elements – C0 (Mindlin) Plate elements – Mindlin beam – More devices for C0 Plate elements – Boundary conditions - Analytical problems.

Nonlinear Finite Element of Solids: Material Nonlinearities, objective rates, nonlinear elasticity, Plasticity, viscoplasticity, viscoelasticity

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, Chandrupatla and Belegundu, 4th Edition, Prentice Hall of India
2. A First Course in Finite Element Method, Logan Deryl L., 5th Edition, Thomson Brook/Cole
3. Concepts and Applications of Finite Element Analysis, Cook R. D., 4th Edition, Wiley

REFERENCES:

1. Finite Element Procedures in Engineering Analysis, Bathe K. J., Cliffs, Eastern Economy Edition, PHI Learning
2. The Finite Element Methods in Engineering, S. S. Rao, Pergamon
3. An Introduction to Finite Element Methods, J. N. Reddy, McGraw Hill
4. The Finite Element Method in Engineering Science, O. C. Zienkowitz, McGraw Hill
5. Fundamentals of Finite Element Analysis, Hutton D. V.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM07) QUALITY ENGINEERING IN MANUFACTURING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To comprehend the various quality tools and principles of Quality Loss Function
- To apply the robust design methodology in solving practical engineering problems
- To determine the variation in experimental data and analyze the residuals through regression

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Value the concept of quality, use quality tools and evaluate the quality loss

CO-2: Design and conduct the experiments using appropriate array for predicting optimal results

CO-3: Analyze and interpret the experimental data for variation and residuals

CO-4: Develop and assess regression models

CO-5: Perform & interpret a proper response surface analysis using appropriate experimental designs

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	-	3	2	3
CO-2	3	-	-	3	2	3
CO-3	3	-	-	3	3	3
CO-4	3	-	-	2	3	3
CO-5	3	-	-	2	3	3

UNIT-I:

Quality Value and Engineering: Quality engineering in product design, design of production processes and production, Overview of Quality Tools - Fishbone diagram, Brainstorming, Quality circles, Benchmarking, Six-sigma, ISO-9000 Quality system

Loss Function and Quality Level: Quality Loss Function (QLF) for N-type, S-type and L-type characteristics, Use of QLF, Economic consequences of tightening tolerances as a means to improve quality

UNIT-II:

Orthogonal Arrays: Introduction, Degrees of Freedom, Linear Graphs & Interaction tables, Strategies in Experimentation - Typical, Better & efficient, Steps in designing, conducting and analyzing an experiment

UNIT-III:

Analysis of Variance (ANOVA): No-way ANOVA, One-way ANOVA, Two-way ANOVA, Types of Errors, ANOVA for four level factors, Critique of F-test, Interpretation of experimental results, Percent contribution.

UNIT-IV:

Parameter Design: Introduction to parameter design, Signal to noise ratios, Parameter design strategy, Numericals on S/N analysis

Tolerance Design: Functional limits, Tolerance design for N-type, L-type and S-type characteristics, Tolerance allocation for multiple components

UNIT-V:

Regression Modeling: Introduction, Linear regression models, Estimation of linear regression models, Hypothesis testing and confidence intervals in multiple regression, Prediction of New Response Observations, Regression Model diagnostics

Response Surface Design: Introduction, Method of steepest ascent, Analysis of a second-order response surface, Experimental designs for fitting response surfaces

TEXT BOOKS:

1. Taguchi Techniques for Quality Engineering, Philip Ross, McGraw Hill, 2005
2. Quality Engineering in Production Systems, G. Taguchi, El Sayed, T. C. Hsiang, McGraw Hill, 1989
3. Design and Analysis of Experiments, D. C. Montgomery, 8th Edition, Wiley & Sons, 2013

REFERENCES:

1. Quality Engineering using Robust Design, M. S. Phadke, Pearson Education, 2008
2. Taguchi's Quality Engineering Handbook, G. Taguchi, Subir Chowdhary, Yuin Wu, Wiley & Sons, 2005

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg48/preview

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CD10) PRODUCT DESIGN AND DEVELOPMENT STRATEGIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Engineering Drawing, Engineering Design, Manufacturing

COURSE OBJECTIVES:

- To comprehend the basic concepts of product design and development process
- To apply structural approach to concept generation, selection and testing in product development
- To analyze the product features and its architecture so as to incorporate them suitably in product
- To apply economic analysis in product development and recognize intellectual property issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Implement the product design and development process and the integrate customer requirements in product design

CO-2: Apply structural approach to concept generation, selection and testing

CO-3: Demonstrate the skills in creation of a product by considering various aspects like product architecture, industrial design and design for manufacture

CO-4: Evaluate the economics of product design and development

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	2	1	3	1
CO-2	2	2	2	1	3	1
CO-3	3	2	1	2	2	1
CO-4	1	1	2	1	2	1

UNIT-I:

Introduction: Introduction to product design and development, Characteristics of successful product development, Composition of product development team, Challenges of product development, Generic product development process and its adaptation, Process flows for various product developments, Product development organizations.

UNIT-II:

Customer Needs: Raw data collection, Its interpretation in terms of customer needs, Organizing the needs into hierarchy, Establishing the relative importance of needs and its reflection on the results.

Product Specifications: Definitions, When to establish specifications, Establishing target specifications, Setting final specifications

UNIT-III:

Concept Generation, Selection & Testing: Activity of concept generation, Five step method, Introduction to concept selection, Benefits of structured method, Concept screening, Concept scoring, Concept testing methodology

UNIT-IV:

Product Architecture: Introduction, Its implications, Establishing the architecture, Platform planning, Design issues, DFE Industrial Design: Industrial design process – Need, Impact, Management and Assessment

UNIT-V:

Design for Manufacturing & Prototyping: DFM defined, DFM process, Introduction to prototyping - Principles Technologies, Planning for prototypes.
Economics of Product Development: Elements, Economic analysis process, Factors for success of project, Qualitative analysis

TEXT BOOKS:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw Hill
2. Product Design, Kevin Otto and Kristin Wood, Pearson Education

REFERENCES:

1. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw-Hill International
2. Engineering Design Process, Yousef Haik, T. M. M. Shahin, Cengage Learning
3. Engineering Design: A Project-based Introduction, Clive L. Dym, Patrick Little, John Wiley & Sons

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CD07) OPTIMIZATION TECHNIQUES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the classification of optimization techniques and its practical use
- To understand about the optimization of one dimensional optimization methods
- To knows about constrained minimization method
- To understands Geometric and dynamic programming

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the different types of optimization techniques for different purposes

CO-2: Formulates and solve the problems by using one dimensional unconstrained minimization methods

CO-3: Formulates and solve the problems (industrial/research) by using the geometric programming

CO-4: Formulate and solve the industrial problems by using the dynamic programming methods and genetic algorithms

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	3	3	3	-	-
CO-2	-	3	3	3	-	-
CO-3	-	3	3	3	-	-
CO-4	-	3	3	3	-	-

UNIT-I:

Introduction to optimization, classification of optimization problems, classical optimization techniques.

UNIT-II:

One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacce and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.

UNIT-III:

Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods. Constrained Minimization Methods: Characteristics of a constrained problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.

UNIT-IV:

Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problems.

UNIT-V:

Genetic Algorithms: Introduction to Genetic Algorithms, Operators, applications to engineering optimization, Problems.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath
2. Engineering Optimization, S. S. Rao, New Age International, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM08) TOOL DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Design Principles, Machine Tools, Process Engineering

COURSE OBJECTIVES:

- To list and inspect the properties of tool materials such as ferrous, non-ferrous, non-metallic materials and their heat treatment
- To interpret the single and multi-point cutting tools for various applications
- To build the sheet metal tools for blanking, piercing, bending, forming and drawing etc.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply an appropriate heat treatment process for the tools
CO-2: Evaluate the design and performance of single and multi-point cutting tools for various methods
CO-3: Examine the design of sheet metal tools for blanking, piercing, bending, forming and drawing

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	1	1
CO-2	3	-	-	1	1	-
CO-3	3	1	1	1	-	1

UNIT-I:
Tool Materials: Properties of materials- Tools steels, Cast Iron, Mild or low carbon steels, Nonmetallic and Nonferrous materials and its Heat treatment.

UNIT-II:
Design of Cutting Tools: Basic requirements of a cutting tool, Single Point cutting tools, Milling cutters, Drills, 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, Locating methods and devices, Basic principles of clamping, Jigs-Definition, Types, General considerations in the design of Drill jigs, Drill bushing, Fixtures- Vise fixtures, Milling, Boring, Lathe and Grinding fixtures.

UNIT-IV:

Design of Sheet Metal Blanking and Piercing Dies: Fundamentals of Die cutting operation, Power press types, General press information, Cutting action in Punch, Die operations, Die clearance, Die design fundamentals-Blanking and piercing die construction, pilots, stripper and pressure pads.

UNIT-V:

Design of Sheet Metal Bending, Forming and Drawing Dies: Bending dies, drawing dies, forming dies, drawing operations, Variables that effect metal flow during drawing. Determination of blank size, drawing force.

TEXT BOOKS:

1. Tool Design, Donaldson, Tata McGraw Hill
2. Production Technology, HMT/ Tata McGraw Hill

REFERENCES:

1. Production Technology, R. K. Jain and S. C. Gupta
2. Mechanical Metallurgy, George F. Dieter, Tata McGraw Hill
3. Machine Tools, C. Elanchezhian & M. Vijayan, Anuradha Publications
4. Principles of Machine Tools, Battacharya A. and Sen G. C., New Central Book Agency

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CD08) REVERSE ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Additive Manufacturing

COURSE OBJECTIVES:
- To understand the reverse engineering and its methodologies
- To comprehend data acquisition techniques for reverse engineering
- To understand integration between reverse engineering and additive manufacturing
- To know the applications of reverse engineering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of reverse engineering and its methodologies
CO-2: Understanding the data acquisition techniques for reverse engineering
CO-3: Understanding of amalgamation between reverse engineering and additive manufacturing
CO-4: Adapt the knowledge gained in reverse engineering for various applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	-	-	1	-
CO-2	-	1	-	2	-	1
CO-3	-	-	3	-	2	-
CO-4	1	-	-	1	-	2

UNIT-I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Overview of Applications

UNIT-II:
Methodologies and Techniques: Potential for Automation with 3-D Laser Scanners, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering

UNIT-III:
Data Acquisition Techniques: Contact Methods: Coordinate Measurement Machine and Robotic Arms, Noncontact Methods: Triangulation, Structured Light and Destructive Method

UNIT-IV:

Integration Between Reverse Engineering and Additive Manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling.

UNIT-V:

Applications:

Automotive: Workflow for Automotive Body Design, Reverse Engineering for Better Quality

Aerospace: RE in Aerospace–A Work in Progress, Reducing Costs of Hard Tooling

Medical: Orthodontics, Hearing Instruments, Knee Replacement

TEXT BOOKS:

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer-Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Rapid Prototyping, Ali Kamrani, Emad Nasr, Springer, 2006

REFERENCES:

1. Smart Product Engineering, Michael Abramovici, Rainer Stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

ONLINE RESOURCES:

1. https://www.polyga.com/reverse-engineering-101-scan-to-cad/
2. https://www.bftinternational.com/en/artikel/bft_Reverse_engineering_techniques_From_3D_sc anning_to_the _CAD_file_in_the_3357131.html
3. https://physicaldigital.com/what-is-reverse-engineering/
4. https://all3dp.com/2/reverse-engineering-software-reverse-engineering-tools/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CD06) INDUSTRIAL ROBOTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Mathematics and Logic Gates

COURSE OBJECTIVES:
- To understand the anatomy, classification, basic components, and motions of the robot
- To study various types of drive systems, end effectors and sensors
- To impart knowledge in robot kinematics and programming
- To study robot cell design and industrial applications of robots

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge of robot anatomy to choose the robot
CO-2: Analyze robot drive systems and end effectors, kinematics, sensors and machine vision system
CO-3: Program the robot
CO-4: Build robot cell and choose robots for industrial applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	-	1	-
CO-2	2	2	2	-	1	-
CO-3	2	2	2	-	1	-
CO-4	2	2	2	-	1	-

UNIT-I:
Fundamentals of Robot: Definition, Anatomy, Coordinate Systems, Work Envelope, Types and Classification, Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load, Robot Parts and their functions, Configuration of robot controller, Need for Robots, applications.

UNIT-II:
Robot Drive Systems and End Effectors: Pneumatic Drives-Hydraulic Drives-Mechanical Drives, Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT-III:

Robot Sensors and Machine Vision: Position sensors, velocity sensors, tactile sensors, proximity and range sensors, uses of sensors in robotics.

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.

UNIT-IV:

Robot Kinematics: Introduction to manipulator kinematics, Joint coordinates, and world coordinates, Forward and inverse Kinematics, Problems.

Robot Programming: Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT-V:

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

Robot Applications: Material transfer, Machine loading/unloading, Processing operation, assembly Inspection, Future Applications.

TEXT BOOKS:

1. Industrial Robotics - Technology Programming and Applications, Groover M. P., McGraw Hill, 2001
2. Robotic Engineering - An Integrated Approach, Klafter R. D., Chmielewski T. A. and Negin M., Prentice Hall, 2003

REFERENCES:

1. Introduction to Robotics Mechanics and Control, Craig J. J., Pearson Education, 2008
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw Hill, 1994
3. Robotics for Engineers, Koren Y., McGraw Hill, 1992
4. Robotics Control, Sensing, Vision and Intelligence, Fu K. S., Gonzalz R. C. and Lee C. S., McGraw Hill, 1987
5. Robotics and Image Processing, Janakiraman P. A., Tata McGraw Hill, 1995

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM09) COMPOSITE MATERIALS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Maths, Physics, Chemistry, Engineering Mechanics, Mechanics of Solids

COURSE OBJECTIVES:

- To understand composite materials and their properties, relationship between them and manufacturing methods
- To understand the principles of material science applied to composite materials
- To study the equations to analyze problems by making good assumptions and learn systematic engineering methods to solve practical composite mechanics problems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply fundamental knowledge of mathematics to modeling and analysis of composite materials

CO-2: Understand the manufacturing methods of various composite materials

CO-3: Analyze the Strength of composites for lamina and laminate level

CO-4: Analyze the failure modes of composites

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	2	-	1	3	-
CO-2	3	1	-	2	-	-
CO-3	-	2	3	-	1	-
CO-4	-	3	2	2	-	-

UNIT-I:

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. Nature made composites.

UNIT-II:

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.
Mechanical Behavior of Composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III:
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications, Introduction to Machining of Composites.

UNIT-IV:
Macro-mechanical Analysis of a Lamina: Introduction, Definitions Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT-V:
Macro-mechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates.
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Mechanics of Composite Materials, (Mechanical Engineering), Autar K. Kaw, 2nd Edition, CRC
2. Engineering Mechanics of Composite Materials, Isaac and M. Daniel, Oxford University Press, 1994
3. Material Science and Technology, Vol. 13–Composites, R. W. Cahn, VCH

REFERENCES:

1. Mechanics of Composite Materials, Robert M. Jones, 2nd Edition, Scripta Book Company
2. Analysis and performance of Fibre Composites, B. D. Agarwal and L. J. Broutman, Wiley Inderscience, 1980
3. Materials Science and Engineering-An Introduction, W. D. Callister Jr., Adapted by R. Bala Subramaniam, John Wiley & Sons, 2007
4. Composite Materials, K. K. Chawla
5. Composite Materials Science and Applications, Deborah, D. L. Chung

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM10) MICRO AND NANO MANUFACTURING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To know different techniques of creating nanomaterials along with characterization and synthesis
- To demonstrate photolithographic process to fabricate miniature devices
- To introduce micro-nano manufacturing approaches for MEMS
- To know about various applications of MEMS and nanofabrication approaches

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand manufacturing techniques of nanomaterials along with synthesis and characterization
CO-2: Create and analyze methods and tools for micro-manufacturing
CO-3: Select micro and nano-manufacturing methods for MEMS
CO-4: To provide understanding of nanofabrication techniques and MEMS applications specially sensors

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	2	1	1
CO-2	2	2	2	2	1	1
CO-3	2	2	2	1	1	1
CO-4	2	2	2	1	1	1

UNIT-I:
Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology, Scaling Laws in Mechanics, fluids, thermodynamics, Electromagnetism, tribology and Examples. Trimmer force scaling vector.

UNIT-II:
Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of nano-materials- sol-gel process, Liquid solid reactions; Gas Phase synthesis of nano-materials Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation (CVC)- Cold Plasma Methods, Laser ablation, Vapour – liquid –solid growth, particle precipitation aided CVD, summary of Gas Condensation Processing (GPC).

UNIT-III:

Structural Characterization: X-ray diffraction, Small angle X-ray Scattering, Optical Microscope and their description, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM).

UNIT-IV:

Micro-fabrication Techniques: Lithography, Thin Film Deposition and Doping, Etching and Substrate Removal, Substrate Bonding, MEMS Fabrication Techniques, Bulk Micromachining, Surface Micromachining, High- Aspect-Ratio Micromachining.

UNIT-V:

Nanofabrication Techniques: E-Beam and Nano-Imprint Fabrication, Epitaxy and Strain Engineering, Scanned Probe Techniques, Self-Assembly and Template Manufacturing

MEMS Devices and Applications: Pressure sensor, Inertial sensor, Optical MEMS and RFMEMS, Micro-actuators for dual-stage servo systems.

TEXT BOOKS:

1. MEMS and Microsystems: Design and Manufacture, Tai-Ran Hsu, McGraw- Hill, 2008
2. Fundamentals of Microfabrication: The Science of Miniaturization, Marc Madou, 2nd Edition, CRC Press, 2002
3. Microfabrication and Nano manufacturing, Mark James Jackson, CRC Press, 2005

REFERENCES:

1. Introduction to Nanoscience and Nanotechnology, Gabor L. Hornyak, H. F. Tibbals, Joydeep Dutta & John J. Moore, CRC Press, 2009
2. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, Ray F. Egerton, Springer, 2005
3. Thermal Analysis of Materials, Robert F. Speyer, Marcel Dekker, 1994
4. Elements of X-Ray Diffraction, B. D. Cullity, 3rd Edition, Prentice Hall, 2002
5. Micromanufacturing & Nanotechnology, N. P. Mahalik, Springer

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM11) MATERIALS TECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To comprehend the basic principles of elasticity and plasticity
- To impart design and development aspects of Fracture mechanics
- To understand selection process of relevant to properties of materials
- To evaluate the development of modern materials and applications

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Implement concepts of elasticity and plasticity for material analysis
CO-2: Apply the concepts and selection techniques for preventing materials failure
CO-3: Design materials using various failure theories for different applications
CO-4: Understand the development of modern materials and technological aspects

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	3
CO-2	3	2	2	3	2	3
CO-3	2	2	3	2	2	1
CO-4	1	1	1	3	2	2

UNIT–I:

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, stren and strain rate of plastic behaviour, super plasticity, deformation of non crystalline material

UNIT–II:

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, 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:
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:
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. Non-metallic 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, Si3 N4, CBN and Diamond – properties, Processing and applications.

TEXT BOOKS:

1. Mechanical Behavior of Materials, Thomas H. Courtney, 2nd Edition, McGraw Hill, 2000
2. Mechanical Metallurgy, George E. Dieter, McGraw Hill, 1998

REFERENCES:

1. Selection and Use of Engineering Materials, Charles J. A., 3rd Edition, Butterworth Heinemann
2. Engineering Materials Technology, James A. Jacob, Thomas F. Kilduff, Pearson
3. Material Science and Engineering, William D. Callister, John Wiley and Sons

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1AM12) INTELLIGENT MANUFACTURING SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To understand the computer integrated manufacturing systems
- To provide an in-depth understanding of components of knowledge based systems
- To provide an understanding of artificial intelligence
- To design and develop automated process planning
- To develop group technology for intelligent manufacturing systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select the necessary tools for computer integrated manufacturing systems
CO-2: Use appropriate knowledge of components of knowledge based systems
CO-3: Use machine learning techniques for intelligent manufacturing systems
CO-4: Apply the concepts of automated process planning
CO-5: Apply the group technology for intelligent manufacturing systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	3	1	2	3
CO-2	2	3	3	1	2	3
CO-3	2	3	3	1	2	3
CO-4	2	3	3	1	2	3
CO-5	2	3	3	1	2	3

UNIT - I:
Computer Integrated Manufacturing Systems: Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems - MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

UNIT - II:
Components of Knowledge Based Systems: Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT - III:

Machine Learning: Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT - IV:

Automated Process Planning: Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES) - Manufacturing system design. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT - V:

Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation - Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology - Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm.

TEXT BOOKS:

1. Intelligent Manufacturing Systems, Andrew Kusiak, Prentice Hall
2. Artificial Neural Networks, Yagna Narayana, PHI, 2006

REFERENCES:

1. Neural Networks: A Comprehensive Foundation, Simon Haykin, PHI
2. Neural Networks, James A. Freeman, David M. S., Pearson Education, 2004
3. Introduction to Artificial Neural Systems, Jacek M. Zurada, JAICO Publishing House, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2AM03) MANUFACTURING AND SIMULATION LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Knowledge of Manufacturing Processes and Simulation

COURSE OBJECTIVES:
- To understand the basics of machining operations and joining processes
- To understand the fused deposition-based 3D printing process
- To understand fabrication of composite materials
- To study simulation of queuing systems, inventory systems and Job shop systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Experiment on eccentric turning and fabrication of composite materials
CO-2: Joining similar and dissimilar metals using Friction Stir Welding and TIG welding processes
CO-3: Build 3D printed prototype of mechanical engineering components
CO-4: Develop, model and simulate real-world problems involving queuing, inventory, planning and scheduling systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	-	2	-	3
CO-2	3	3	2	3	2	3
CO-3	3	2	2	3	2	3
CO-4	3	-	-	3	3	3

LIST OF EXERCISES:

MANUFACTURING PROCESSES
1. Lathe: Eccentric turning & Facing of Square and Rectangular Block
2. Milling: Spur Gear cutting
3. To perform Friction Stir Welding Process on similar metals
4. To perform Friction Stir Welding Process on dissimilar metals
5. To prepare butt joint using TIG welding using pulsed/non-pulsed current
6. Fabrication of composites using vacuum bag technique
7. Development of prototype component using Fused Deposition Modeling

MANUFACTURING SIMULATION
1. Simulation of Single Server Single Queue System
2. Simulation of Multiple Server Single Queue System

3. Simulation of Inventory System
4. Simulation of Flexible Manufacturing System
5. Simulation of Job Shop Production System

SOFTWARES: Flexsim

NOTE:
1. Processors, Operators, Conveyors, AGVS, Transporters, Racks, Robots, Cranes etc. may be used at appropriated places in the exercises
2. Exercises may include Material Handling Systems, AGV Planning, ASRS Simulation, MRP, Shop Floor scheduling, JIT System, Kanban flow.

REFERENCES:
1. Flexsim 2022 Help Manual

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2CD04) COMPUTER AIDED ENGINEERING LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Engineering Mechanics, Mechanics of Solids, Heat Transfer

COURSE OBJECTIVES:

- To introduce fundamentals of the analysis software, its features and applications
- To learn the basic element types in Finite Element analysis
- To know the concept of discretization of continuum, Loading conditions and
- To analyze the structure using pre-processor and postprocessor conditions

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Classify the types of uniaxial members in plane and space to and Evaluate the stiffness matrix, B matrix and loading matrices of beam/in plane/solid elements using MATLAB software

CO-2: Generalize Plane stress, plane strain conditions & axisymmetric loading on in plane members to predicting the failure behavior and finding the SCF

CO-3: Analyse connecting rod with solid elements, performing static analysis on flat & curved shells to determine stresses, strains with different boundary conditions.

CO-4: Predict the natural frequencies and modes shapes using Modal, Harmonic analysis. Also finding the critical load using Buckling analysis

CO-5: Simulate steady state heat transfer analysis of chimney, Transient heat transfer of castings, Non-linear, Buckling analysis of shells &CFD analysis

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	2	2	-	1
CO-2	1	3	2	2	-	1
CO-3	1	3	2	2	-	1
CO-4	1	3	2	2	-	1
CO-5	1	3	2	2	-	1

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

1. Analysis of Plane Truss & Spatial Truss with various cross sections and materials under static, thermal and combined loading
2. A) 2D & 3D beam analysis with emphasize on sections, materials, loads (forces and moments) and supports
    i. Use of MATLAB for finding B matrix, stiffness matrix and loading matrices of beam/in plane/solid elements.

3. Static analysis of plate (isotropic and orthotropic material) with a hole to determine the deformations, the stresses to study the failure behavior and SCF.
4. Structural analysis in Plane stress, plane strain and axisymmetric loading on the in plane members with in plane loading.
5. Static analysis of connecting rod with tetrahedron and brick elements.
6. Static Analysis of flat and curved shell due to internal pressure and moments to estimate the strains, stresses and reactions forces and moments with different boundary conditions
7. Buckling analysis of plates, shells and beams to estimate BF and modes
8. Modal analysis of beams, plates and shells for natural frequencies and mode shapes
9. Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plate subjected to stepped and ramped loading with varying time
10. Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.
11. Nonlinear analysis of cantilever beam with non-linear materials at tip moment and post Buckling analysis of shells for critical loads
12. Coupled field analysis.
13. Flow analysis of pipe with different fluids/gasses/air for velocity and pressure gradients
14. CFD analysis of aerofoil design
15. CFD analysis of ducts/impeller/fan

Note:

1. Any of FEA software ANSYS/ABAQUS/NASTRAN/NISA/CAEFEM/ADINA may be used
2. Any 12 experiments to be conducted

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4AM02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiarize learners with major sequential development in Indian science, engineering and technology

CO-2: Understand eco-friendly, robust and scientific planning and architecture system of ancient India

CO-3: Trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge

CO-4: Understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system,

Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1AM13) DESIGN FOR HYDRAULIC AND PNEUMATIC SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Computer Aided Design, Computer Aided Manufacturing, Machine Tools, Operations Research

COURSE OBJECTIVES:
- To introduce the industrial hydraulics and pneumatics, their parts, functions and their structure
- To give the required information about hydraulics and pneumatics
- To teach the fundamentals of hydraulic and pneumatic circuit design
- To teach the hydraulic and pneumatic automation and basics of PLC controls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify hydraulic and pneumatic system components and their applications
CO-2: Design hydraulic and pneumatic circuits
CO-3: Explore the similarities and differences of the electrical, pneumatic and hydraulic systems
CO-4: Interpret PLC applications in hydraulic and pneumatic circuits

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	2	2	1
CO-2	2	3	3	3	2	2
CO-3	1	2	3	2	1	1
CO-4	3	3	3	2	3	2

UNIT–I:
Fluid Power Principles and Fundamentals: Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal's Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws.

UNIT–II:
Hydraulic System and Components:
Sources of Hydraulic Power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders – Types and construction, Hydraulic motors Control Components: Direction

control, Flow control and Pressure control valves- Types, Construction and Operation- Applications.

UNIT–III:

Hydraulic Circuits: Industrial hydraulic circuits- Regenerative, Sequence, Reciprocation, Fail-safe, Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits.

UNIT–IV:

Pneumatic System: Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Pneumatic actuators, Pneumatic logic circuits, Time and pilot control.

UNIT–V:

Design of Hydraulic and Pneumatic Circuits: Design of circuits using the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press, Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components.

Applications: Microprocessor and PLC- Applications in Hydraulic and Pneumatic- Low cost Automation – Hydraulic and Pneumatic power packs.

TEXT BOOKS:

1. Fluid Power with Applications, Anthony Esposito, PHI, Pearson Education, 2005
2. Hydraulic and Pneumatic Controls, Shanmugasundaram K., Chand & Co., 2006

REFERENCES:

1. Oil Hydraulics Systems – Principles and Maintenance, Majumdar S. R., Tata McGraw Hill, 2001
2. Pneumatic Systems – Principles and Maintenance, Majumdar S. R., Tata McGraw Hill, 2007
3. Power Hydraulics, Micheal J., Pinches and Ashby J. G., Prentice Hall, 1989
4. Basic Fluid Power, Dudelyt A. Pease and John J. Pippenger, Prentice Hall, 1987
5. Hydraulic and Pneumatic Control, Srinivasan R., 2nd Edition, Tata McGraw Hill, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1CD12) CONCURRENT ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Computer-Aided Design

COURSE OBJECTIVES:

- To comprehend the methodologies and role of information technology in Concurrent Engineering
- To provide a systematic approach to the integrated, concurrent design of products and their related processes
- To analyze and apply manufacturing concepts for intelligent design of manufacturing system
- To perform concurrent mechanical design and project management for new product development

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the need of concurrent engineering and strategic approaches for product design
CO-2: Apply concurrent design principles to product design
CO-3: Analyze the manufacturing concepts in qualitative and physical approach
CO-4: Perform computer-based assembly planning
CO-5: Understand the concurrent mechanical design and new product development

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	1	2	-
CO-2	1	1	2	1	1	1
CO-3	1	1	1	1	2	-
CO-4	1	1	2	1	2	-
CO-5	1	1	1	1	1	-

UNIT - I:
Introduction: Extensive definition of CE - CE design methodologies - Organizing for CE -CE tool box 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:

Design Stage: 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:

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.

TEXTBOOK:

1. Concurrent Engineering: Automation Tools and Technology, Andrew Kusaik, Wiley John and Sons, 1992

REFERENCES:

1. Integrated Product Development, Anderson M. M. and Hein L. Berlin, Springer Verlog, 1987
2. Design for Concurrent Engineering, Cleetus J., Concurrent Engineering Research Centre, Morgantown W. V., 1992

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1CD11) COMPUTER AIDED PROCESS PLANNING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: CAD, CAM, Manufacturing Processes

COURSE OBJECTIVES:
- To understand process planning techniques
- To understand various manufacturing parameters effectively in production rate
- To understand Manufacturing tolerances in design and manufacturing process

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concept of computer aided process planning
CO-2: Design appropriate tolerances in design and manufacturing and tool paths
CO-3: Implement techniques of CAPP

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	1	2	3	1
CO-2	2	2	2	2	2	1
CO-3	1	1	2	2	2	1

UNIT-I:
Introduction to CAPP: Introduction and definition of process planning, Scope of process planning, Information requirement for process planning system in CAD/CAM, Role of process planning, Advantages of conventional process planning over CAPP, Structure of Automated process planning system, Feature recognition, Methods.

UNIT-II:
Approaches of Process Planning: Manual approach, CAPP approaches. Generative CAPP System: Importance, Principle of Generative CAPP system, Automation of logical decisions, Knowledge based systems, Inference Engine, Implementation, Benefits. Generative approach-Forward and backward planning,

UNIT-III:
Retrieval CAPP System: Significance, Group technology, Structure, Relative advantages, Implementation and applications. Examples of process planning system-CAM-I, Automated process planning, D-CLASS (CAPP). Logical Design of process planning.

UNIT-IV:

Determination of Manufacturing Tolerances: Design tolerances, Manufacturing tolerances, Methods of tolerance allocation, Sequential approach, Integration of design and manufacturing tolerances, Advantages of integrated approach over sequential approach.

UNIT-V:

Implementation Techniques for CAPP: MIPLAN system, Computer programming languages for CAPP, Criteria for selecting a CAPP system and benefits of CAPP, Computer integrated planning systems and Capacity planning system. Practical use of CAPP in real Manufacturing area

TEXT BOOKS:

1. Automation, Production systems and Computer Integrated Manufacturing System, Mikell P. Groover
2. Computer Aided Design and Manufacturing, Dr. Sadhu Singh

REFERENCES:

1. Computer Aided Process Planning, H. P. Wang & J. K. Li, 1st Edition, Elsevier, 1991
2. Computer Aided Engineering, David Bedworth
3. Principles of Process Planning-A Logical Approach, Gideon Halevi and Roland D. Weill, Chapman & Hall, 1995

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1AM14) INTRODUCTION TO MACHINE LEARNING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To introduce the concepts of machine learning and need for data preparation
- To understand and apply linear and non-linear algorithms
- To understand and apply neural networks and ensemble algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Comprehend concepts of Machine Learning and need for data preparation
CO-2: Understand and apply linear and non-linear algorithms
CO-3: Analyze and apply neural networks, ensemble algorithms

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	1	2	3	2
CO-2	-	-	1	2	3	2
CO-3	-	-	1	2	3	2

UNIT - I:
Introduction to Machine Learning and Data Preparation: Introduction to machine learning, Data Loading, scaling of data- normalize and standardize data, algorithm evaluation methods, evaluation metrics, simple examples

UNIT - II:
Linear Algorithms: Simple linear regression, multi variate linear regression, logistic regression, perceptron, prediction using simple datasets.

UNIT - III:
Non-Linear Algorithms: Classification and regression trees, Naïve Bayes, k-NN, Back propagation algorithm, predictions with simple datasets

UNIT -IV:
Neural Networks: Introduction to Perceptron and Neural Networks, Activation and Loss functions, 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.

UNIT-V:

Computer Vision: Introduction to Convolutional Neural Networks (CNNs), What is CNN, Common uses for CNN, CNN's Basic Architecture, simple image processing examples.

Ensemble Algorithms: Introduction on ensemble methods, Bootstrap Aggregation, Random Forest, stacked generalization algorithms, simple examples.

TEXTBOOK:

1. Machine Learning Algorithms from Scratch with Python, Brownlee Jason, Machine Learning Mastery, 2016

REFERENCES:

1. Artificial Intelligence: A Modern Approach, Stuart Russell & Peter Norvig, 3rd Edition Prentice Hall, 2009
2. Artificial Intelligence, Ela Kumar, Wiley, 2021
3. Artificial Intelligence: Concepts and Applications, Lavika Goel, Kindle Edition, Wiley, 2021
4. Nature-Inspired Optimization in Advanced Manufacturing Processes and Systems, Edited by Ganesh M. Kakandikar and Dinesh G. Thakur, 1st Edition, CRC Press, 2021

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1AM15) GREEN MANUFACTURING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Manufacturing, Environmental Science

COURSE OBJECTIVES:

- To provide knowledge on Sustainable Manufacturing, its scope, tools, techniques
- To impart knowledge on Environmental Impact Assessment towards sustainable manufacturing
- To design Eco friendly products and to have knowledge on various recycling methods
- To implement idea towards frameworks for measuring sustainability

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Identify the link between manufacturing process models and sustainable manufacturing metrics for product and process improvement

CO-2: Understand the three pillars of sustainability and how they are manifested in sustainable manufacturing

CO-3: Incorporate economic, environmental, and social aspects into decision making processes using multi-criteria decision-making methods

CO-4: Exhibit competence on the usage and applicability of sustainability tools, Compute sustainability performance through the indicators

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	2	2	2
CO-2	2	2	2	2	2	3
CO-3	2	2	2	2	3	2
CO-4	2	2	2	3	2	2

UNIT-I:

Concepts of sustainability and sustainable development – Need for sustainable development - Components of sustainability- Social, Economic, Environmental dimensions - Linkages between technology and sustainability - Sustainable Manufacturing –Scope, Need and Benefits

UNIT-II:

Tools and Techniques of Sustainable Manufacturing – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly -Sustainable Product Development – Various Phases.

UNIT-III:
EIA Methods –CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters - Interactions between energy and technology and their implications for environment and sustainable development.

UNIT-IV:
Design for recycling – Eco friendly product design methods – Methods to infuse sustainability in early product design phases – Multi-Criteria Decision Making in Sustainability.

UNIT-V:
Frameworks for measuring sustainability- Indicators of sustainability – Environmental, Economic, Societal and Business indicators - Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment– Corporate Social Responsibility

TEXT BOOK:
1. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar Publishing Limited, 2007

REFERENCE:
1. Industrial Development for the 21st Century: Sustainable Development Perspectives, D. Rodick, UN, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

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:

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 without Outcome Probabilities, Decision Trees, The 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, Christopher M. Starkey, Pearson
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston, 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publishers
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw Hill, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut
2. Engineering Optimization, S. S. Rao, New Age International, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

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 processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis 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. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

REFERENCES:

1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill, 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing, 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996