M. TECH. MECHANICAL ENGINEERING (CAD/CAM) (1st Year)

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMEE1-102	Computer Aided Design	4	0	0	40	60	100	4
MMEE1-103	Robotics	4	0	0	40	60	100	4
MMEE1-104	Mechatronics	4	0	0	40	60	100	4
MMEE1-105	Lab -I	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MMEE1-156	Management Information System							
MMEE1-157	Modern Control of Dynamic Systems							
MMEE1-158	Total Quality Management							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE1-206	Computer Integrated Manufacturing	4	0	0	40	60	100	4
MMEE1-207	3D - Printing	4	0	0	40	60	100	4
MMEE1-208	Finite Element Modelling (FEM)	4	0	0	40	60	100	4
MMEE1-209	Micro-Electro Mechanical Systems (MEMS)	4	0	0	40	60	100	4
MMEE1-210	Lab-II	-	-	4	60	40	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE1-259	Geometrical Modelling & Analysis							
MMEE1-260	Artificial Intelligence							
MMEE1-261	Welding Technology and Processes							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 20 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE1-311	Machine Automation	4	0	0	40	60	100	4
MMEE1-312	Computer Aided Process Planning (CAPP)	4	0	0	40	60	100	4
MMEE1-313	Project & Seminar	0	0	4	40	60	100	4
MMEE1-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 3 Lab = 2**	**12**	**0**	**8**	**160**	**340**	**500**	**26**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MMEE1- 415	Final Thesis	0	0	0		20

Overall

Semester	Marks	Credits
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration: 45 hrs.**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data
Data Collection Methods: Questionnaire Designing, Construction
Sampling Design & Techniques – Probability Sampling and Non Probability Sampling
Scaling Techniques: Meaning & Types
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability
Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling
Report Writing: Essentials of Report Writing, Report Format
Statistical Software: Application of Statistical Soft wares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis
**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education, New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi.

6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

COMPUTER AIDED DESIGN

Subject Code: MMEE1-102 **L T P C** **DURATION: 40 Hrs.**
4 0 0 4

UNIT-I (6 Hrs.)

Introduction

Design process in general and using computers, hardware and software in CAD applications

UNIT-II (12 Hrs.)

Two Dimensional Transformations

Two dimensional geometric transformations-basic transformations, concatenation, reflection, shear and transformations between coordinate systems. Two and Three Dimensional Object Representations Parametric representation of synthetic curves, spline representations, cubic spline interpolation methods, Bezier curves and surfaces, B spline curves and surfaces, conversion between spline representations

UNIT-III (10 Hrs.)

Representation of Solids:

Half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS), solid manipulations. Three Dimensional Geometric Transformations: Transformations-translation, rotation, scaling, reflections, shears, concatenation transformations.

UNIT-IV (12 Hrs.)

Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids, CAD Standards, CAD and CAM integration, Introduction to reverse engineering and rapid prototyping**,** Practice on available CAD packages, computer programming for geometric modelling of curves, surfaces & solids, projects involving assembly and kinematics analysis of mechanisms, surface modeling in any available CAD package.

Recommended Books

1. Groover and Zimmer, 'CAD/CAM', Prentice Hall.
2. I. Zeid, 'CAD/CAM: Theory and Practice', McGraw Hill.
3. M.E. M, 'Geometric Modeling'.

ROBOTICS

Subject Code: MMEE1-103 **L T P C** **DURATION: 40 Hrs.**
4 0 0 4

UNIT-I (5 Hrs.)

Introduction

A sense of history, a sense of design, manipulators and manipulations, robot analysis and control in a nutshell.

UNIT-II (12 Hrs.)

Kinematics I: **Geometry**

Mathematics preliminary, position and orientation of a rigid body, co-ordinate transformation, Euler angle, homogeneous transformations. Kinematics modeling of manipulator arms, open kinematic chains, the denairt-Hartenberg notation, kinematics equations. Inverse kinematics:

introduction, solving the kinematic equation for the 5 RIP manipulators, solvability. Kinematics II: Differential Motion Kinematic modeling of instantaneous motions, differential relations, infinitesimal relations, computation of the manipulators, Jacobian, inverse instantaneous

UNIT-III (14 Hrs.)

Kinematics

Resolved motion rate, redundancy, optimal solutions. Static's Force and moment analysis, equivalent joint torques, duality, transformations of force and moments. Stiffness, introduction, endpoint compliance analysis, the principal transformation of compliance matrices.

Dynamics

Newton-Euler formulation of equation of motion, basic dynamic equation, closed form Dynamic equations, physical interpretation of the dynamic equation. Longrangian Formulation of the manipulator dynamics, LaGrange dynamics, the manipulators inertia tensor, deriving LaGrange motion equation, transformations of generalized co-ordinates. Inverse dynamics; introduction, recursive computation, moving co-ordinates, walker Paul's algorithm.

UNIT-IV (8 Hrs.)

Trajectory Control

Introduction, position control, load scheme work, trajectory control, sliding surfaces, Perfect tracking using switched control laws, continuous control law to approximate switched control. robust trajectory control for robot manipulators, practical evaluation of parametric uncertainties, the modeling/performance trade-off.

Recommended Books

1. J. Baillieul, D.P. Martin, R.W. Brockett, Bruce R. Donald, 'Robotics'.
2. Ben-Zion Sandler, 'Robotics: Designing the Mechanisms for Automated Machinery'.
3. Michael Jenkin, Gregory Dudek, 'Computational Principles of Mobile Robotics'.
4. R. Bruce, 'Error Detection and Recovery in Robotics', Donald – Technology.
5. Craig Sayers, 'Remote Control Robotics'.
6. Y. Shimon, 'Handbook of Industrial Robotics'.

MECHATRONICS

Subject Code: MMEE1-104 **L T P C** **Duration: 50** Hrs.

4 0 0 4

UNIT-I (6 Hrs.)

Control Engineering: Open loop and closed loop control system, system components, hydraulic, thermal, pneumatic processes and their electrical analogies.

UNIT-II (15 Hrs.)

Process Control: Concept of measurement of electrical and non-electrical parameters, displacement, force, temperature, pressure etc. and related signal conditioning techniques. Valves, drives and actuators, PID controllers, multivariable and multi-loop processes, basic circuits using pneumatic and PLC's.

UNIT-III (6 Hrs.)

Sensors and Signal Conditioners: Transducers for Industrial processes, signal conditioning, output devices and displays.

UNIT-IV (13 Hrs.)

Microprocessors and Interfacing: Microprocessors/Microcontroller architecture and programming memory, Input/output operations and interfacing, peripherals, typical applications of Microprocessors, system design concept through case studies.

Recommended Books

1. Koren, 'Computer Control of Manufacturing System', McGraw Hill.
2. Groover, 'Production Systems and CIM', PHI.
3. Maleki, 'Flexible Manufacturing Systems', Prentice Hall.
4. B.C. Kuo, 'Feedback Control Systems', PHI.
5. E.O. Doeblin, 'Measurement Systems', McGraw Hill.

MANAGEMENT INFORMATION SYSTEM

Subject Code: MMEE1-156 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

UNIT-I (12 Hrs.)

INFORMATION SYSTEMS

Information Systems -Establishing the Framework -Business Models - Information System Architecture- Evolution of formation Systems, Modern Information System**,** Modern Information System -Systems Development-life Cycle, Structured Methodologies -Designing Computer Based methods, Procedures Control Designing Structured Programs.

UNIT-II (12 Hrs.)

INTEGRATED CONSTRUCTION MANAGEMENT

Integrated Construction Management- Information System- Project Management- Information System- Functional Areas finance, Marketing Production, Personnel –levels, DSS, EIS, ES-Comparison Concepts and Knowledge representation –Managing International Information System

UNIT-III (9 Hrs.)

CODING TECHNIQUES

Control -Testing Security- Coding Techniques- Defection of Error – Validating -Cost Benefit Analysis -Assessing the value and risk of Information System.

UNIT-IV (12 Hrs.)

SOFTWARE ENGINEERING

Software engineering qualities- Design-Production- Service, Software specification- Software Metrics, Software quality assurance –Systems Methodology –Objectives-Time and Logic, Knowledge and Human Dimension -Software life cycle models- Verification and Validation. 27 CEM-2013 SRM(E&T)

Reference & Text Books

1. O. Brian, 'Introduction to Information System', McGraw Hill.
2. O. Brian, 'Management Information System', TMH.
3. Alter, 'Information Systems: A Management Perspective', Addison Wesley.
4. Arora & Bhatia, 'Information Systems for Managers', Excel.
5. Bansal, 'Information System Analysis & Design', TMH.
6. Jawadegar, 'Management Information System', TMH.
7. Murdick, 'Information System for Modern Management', PHI.
8. Alexis Leon, 'Enterprise Resource Planning', TMH.

MODERN CONTROL OF DYNAMIC SYSTEMS

Subject Code: MMEE1-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (5 Hrs.)

Introduction: Introduction to control system, Feedback and feedforward systems, design of control systems, classification of control systems.

UNIT-II (13 Hrs.)

Classical Control: Poles and zeros, Singularity functions, Frequency response, Laplace transform, transfer functions, Performance specifications, Stability of linear systems, Necessary conditions for stability, Root locus techniques, Bode plots, Nyquist plots, Routh Stability criterion, Polar plots, Robustness, Closed-loop compensation for SISO systems.

UNIT-III (12 Hrs.)

State-Space Representation: State variables and state models, Linear transformation for state-space representation, State models for linear continuous time systems, System characteristics, Canonical forms, Solution of the LTI state equations, State transition matrix.

UNIT-IV (15 Hrs.)

Control System Design in State-Space: Controllability, Observability, State feedback regulators, Pole-placement regulator design, Pole-placement design of tracking systems, Full order observer design, Design of compensators. Linear Optimal Control Optimal control problem, Infinite-time linear optimal regulator design, Optimal control of tracking systems, Output weighted linear optimal control, Solution of the Matrix Riccati Equation.

Recommended Books

1. A. Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley and Sons, **2002**.
2. K. Ogata, 'Modern Control Engineering', Prentice Hall of India Pvt. Ltd., **2010**.
3. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, **2006**.
4. B.C. Kuo, 'Digital Control Systems', Oxford University Press, **2006**.
5. C. Richard Dorf and H. Bishop Robert, 'Modern Control Systems', Pearson, **2011**.

TOTAL QUALITY MANAGEMENT (TQM)

Subject Code: MMEE1-158 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

UNIT-II (12 Hrs.)

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. Quality Management, Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products

and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

UNIT-III (12 Hrs.)

Human Factor in Quality

Attitude of top management, co-operation, of groups, operator's attitude, responsibility, causes of operator's error and corrective methods. Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

UNIT-IV (12 Hrs.)

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

Recommended Books

1. H. LaI, 'Total Quality management', Wiley Eastern Limited, **1990**.
2. Greg Bounds, 'Beyond Total Quality Management', McGraw Hill, **1994**.
3. H.G. Menon, 'TQM in New Product Manufacturing', McGraw Hill.

COMPUTER INTEGRATED MANUFACTURING

Subject Code: MMEE1-206 **L T P C** **Duration: 39 Hrs.**

4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Introduction to Product life cycle management. Need of CAD/CAM integration through computers, Benefits of integration, Types of production systems and their automation, CAD/CAM integration. Concept of FMS and CIMS. DNC based factory management and control, Integrated CAD/CAM system and shared database.

UNIT-II (11 Hrs.)

Elements of a General CIM System: Types of CIM systems, CAD-CAM link for CIMS, Benefits of CAM, FMS and CIMS, Automated material handling systems, equipment and their functions. Integration of Robots in CIMS, automated guided vehicle navigation system, Automatic Storage and Retrieval Systems (AS/RS), Carousel storage system, design of automatic material handling system, KWO analysis, work-part transfer mechanisms.

UNIT-III (08 Hrs.)

Group Technology: Concept and terminology, Part family formation, Classification and coding systems for components, Group technology machine cells.

UNIT-IV (10 Hrs.)

Computer Aided Production Planning and Control: Computer aided shop floor control, Computer aided inspection & quality control, Shop floor data collection systems, Sensors used in Automation, Tool management system, Automatic identification systems, Barcode system.

CIM Database and Database Management Systems: Types, Management information system, Manufacturing data preparation.

Recommended Books

1. M.P. Groover and E.W. Zimmers, 'CAD/ CAM', Dorling Kingsley, **2008.**
2. M.P. Groover, 'Automation, Production Systems and Computer Integrated Manufacturing', Pearson Education Asia, **2009.**
3. K.S. Vajpayee, 'Principles of Computer Integrated Manufacturing', Prentice Hall, **2006.**
4. P.N. Rao, N.K. Tewari and T.K. Kundra, 'Computer Integrated Manufacturing', McGraw Hill, **1998.**

3D PRINTING

Subject Code: MMEE1-207 **L T P C** **Duration: 49 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Introduction to 3D Printing: Students will understand how technology shifts throughout history have made 3D printing possible, interface and basic tools available in the CAD software, unique advantages of 3D printing to their designs, distinguish between various 3D printing technologies and materials and select appropriately for a given application, compare additive manufacturing to traditional technologies and choose the best technology for a given application.

UNIT-II (13 Hrs.)

Mesh: Define essential geometry terms and how they relate to a 3D mesh, create smooth and detailed 3D structures, repair a 3D mesh and prepare files for print, take advantage of model-sharing websites to accelerate learning and improve product designs, commands for moving from 2D to 3D in CAD, Use the CAM software to prepare files for 3D printing.

UNIT-III (11 Hrs.)

Basic Introduction to various types of engineering, dental and bio-materials, Introduction to fabrication techniques and methodologies for different types of composite materials, Simulation and Finite Element modelling techniques for characterization, advantages and limitations of 3D printing.

UNIT-IV (13 Hrs.)

Gear Systems: Build a gear system in CAD, Convert 2D gear drawings to 3D models, Design systems with 3D printing technology in mind, including minimum tolerance and material thickness, Dynamic Surfaces and Chains: Nest and orient 3D models on the build tray to conserve space and materials, Make more space- and cost-efficient use of 3D printing technology.

PROJECT WORK: Students will apply what they learn in this class to design and 3D print something that moves something. Distribute the final project description that lists the project requirements.

Recommended Books:

1. Norman Dowling, 'Mechanical Behavior of Materials (3E)', Pearson Publishers.
2. 'Mechanical Behavior of Materials', Bowman, John Wiley & Sons.

FINITE ELEMENT MODELLING

Subject Code: MMEE1-208 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Approximate Solution Methods: Finite Difference Method, Finite Element Methods, Ritz and Rayleigh Ritz methods, Method of weighed residuals, General concepts, Point collocation, Subdomain collocation, least squares, Galerkin method.

UNIT-II (12 Hrs.)

Introduction to Finite Element Method: Introduction to variational calculus, The differential of a function, Euler-Lagrange equation, Geometric & natural boundary conditions, Basic Concept of Finite Element Method, Principle of potential energy, 1D elements, Derivation of Stiffness and Mass matrices for a bar, A beam and A shaft, Comparison with Analytical results, Interpolation and shape functions,

UNIT-III (12 Hrs.)

Solution of static problems and case studies in stress analysis of mechanical components, FEA using 2D and 3D elements, Plain strain and plain stress problems, FE using plates / shell elements, analysis using Isoparametric Elements. Programming of the different concepts covered in lectures using C++/MATLAB language, demonstration of analysis software for finite element analysis.

UNIT-IV (10 Hrs.)

Students will be given different 2D /3D components for structural/thermal/ fluid flow FEM analysis to be done using C++/MATLAB programming. The components are to be analyzed using different linear / higher order elements i.e., triangular, axisymmetric, quadrilateral, tetrahedral and hexahedral elements.

Recommended Books

1. O.C. Zienkiewicz, 'The Finite Element Method', Butterworth Heinemann, **2002.**
2. K.H. Huebner, D.L. Dewhirst, D.E. Smith and T.G. Byrom, 'The Finite Element Methods for Engineers', John Wiley, **2000.**
3. J.N. Reddy, 'An Introduction to the Finite Element Method', McGraw Hill, **2001.**
4. K.J. Bathe, 'Finite Element Procedures', Prentice Hall of India, **2008.**
5. R.D. Cook, 'Concepts and Applications of Finite Element Analysis', John Wiley and Sons, **2001.**
6. G.R. Buchman, 'Finite Element Analysis', Schaum's Outlines, McGraw Hill, **1995.**

MICRO-ELECTRO MECHANICAL SYSTEMS (MEMS)

Subject Code: MMEE1-209 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Overview of MEMS and microsystems, microelectronics, microfabrication, miniaturization, typical MEMS and microsystems products

UNIT-II (11 Hrs.)

Working Principles of Microsystems: microsensors, microactuation, MEMS with microactuators, microfluidics, microvalves, micropumps, micro-heatpipes.

Overview of materials for MEMS and microsystems: atomic structure of matter, ions and ionization, doping of semiconductors, diffusion process, electrochemistry.

UNIT-III (11 Hrs.)

Microsystem Fabrication: photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, sputtering, etching.

Micromanufacturing: bulk micromanufacturing, surface micromanufacturing, LIGA process.

UNIT-IV (12 Hrs.)

Assembly, Packaging and Testing of Microsystems: overview of microassembly, microassembly processes, major technical problems of microassembly, microsystem packaging and its levels, essential packaging technologies, reliability and testing in MEMS packaging.

Recommended Books

1. Tai-Ran Hsu, 'MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering', John Wiley & Sons, Inc.
2. N.P. Mahalik, 'Micro manufacturing and Nanotechnology', Springer.
3. Nadim Maluf, Kirt Williams, 'An Introduction to Microelectromechanical Systems Engineering', Artech House, Inc.
4. Mark Ratner, Danier Ratner, 'Nanotechnology', Pearson Education Inc.
5. Charles P. Poole Jr. & Frank J. Owens, 'Introduction to Nanotechnology', John Wiley & Sons.

LAB-II

Subject Code: MMEE1-210 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 2nd Semester.

GEOMETRICAL MODELLING & ANALYSIS

Subject Code: MMEE1-259 **L T P C** **Duration: 46 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Geometric Modeling: Parametric sketching, Constrained model dimensioning, Material addition and removal for extruded, Revolved, Swept and blended features, References and construction features of points, Axis, Curves, Planes, Surfaces and customized analysis features, feature and sequence of feature editing. Cosmetic features, Chamfers, Rounds, Standard holes, File formats for data transfer.

UNIT-II (12 Hrs.)

Feature patterns, Duplication, Grouping, Suppression, Assembly modeling, Assembly analysis tools. Top-down vs. bottom-up design, Parametric relations and design optimization parameters creation, Mass property analysis, Automatic production drawing creation and detailing, Software automation and customization tools, Colors, Advanced features for non-parallel blend, Helical sweep, Swept blend, Variable section sweep, Draft, Ribs, Sketched holes, Mechanism design and assembly.

UNIT-III (11 Hrs.)

Mechanical Design Analysis and Optimization: Design analysis for mass properties, Stress, Thermal stress, using CAD/CAE packages, Optimum design of machine components using multivariable nonlinear optimization techniques using iterative CAD/CAE software tools.

UNIT-IV (11 Hrs.)

Research Assignments: Individual research assignments will be based on use of standard CAD and CAE packages for modeling of mechanical elements, Assembly and Automated Drawing. Project involving assembly, position, kinematic and dynamic analysis of a mechanism. Interference analysis in motion. Optimization of mechanical system design using CAD/CAE software tools, Project on mechanical systems design and analysis. Make a prototype for design validation.

Recommended Books

1. Kelley David S., 'Pro/ENGINEER Wildfire 5.0 Instructor', Tata McGraw Hill, **2011.**
2. Shih Randy H., 'Introduction to Finite Element Analysis Using Creo Simulate 1.0', SDC Publications, USA, **2011.**
3. Shih Randy H., 'Parametric Modeling with Creo Parametric 1.0-An Introduction to Creo Parametric 1.0', SDC Publications, USA, **2011.**
4. N. Sidheswar, P. Kannaiah and V.V.S. Sastry, 'Machine Drawing', McGraw Hill, **2001.**

ARTIFICIAL INTELLIGENCE

Subject Code: MMEE1-260 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Human and Machine Intelligence, Artificial Intelligence (AI), Programming in AI environment, Natural Language processing (NLP).

UNIT-II (12 Hrs.)

Architecture of an Expert System, Knowledge base, inference engine forward and backward chaining, use of probability and fuzzy logic. Selection of inference mechanism.

Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation.

UNIT-III (12 Hrs.)

Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering.

Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg.

UNIT-IV (11 Hrs.)

Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, object oriented expert systems.

Semantic nets, structure and objects, ruled systems for semantic nets, certainty factors, automated learning.

Recommended Books

1. T.R. Addis, 'Designing Knowledge Based System', Prentice Hall, **1985**.
2. D.W. Rolston, 'Principles of Artificial Intelligence and Expert Systems Development', McGraw Hill, **1988.**
3. R. Maus and J. Keyes, 'Handbook of Expert Systems in Manufacturing' McGraw Hill, **1991.**

4. Robert Levine, 'A Comprehensive Guide to Artificial Intelligence and Expert Systems',
5. Elain Rich, 'Artificial Intelligence'.

WELDING TECHNOLOGY AND PROCESSES

Subject Code: MMEE1-261 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Welding Metallurgy: Welding as compared with other fabrication processes, Classification of welding processes; Heat affected zone and its characteristics; Effects of alloying elements on weldability, Weldability of steels, stainless steel, cast iron, and aluminum and titanium alloys, Weld testing standards, Hydrogen embrittlement, Lamellar tearing, residual stresses and its measurement, heat transfer and solidification, Analysis of stresses in welded structures, Pre and post welding heat treatments, Metallurgical aspects of joining, Conditions of soldering, Brazing and welding of materials.

UNIT-II (10 Hrs.)

Weld Design & Quality Control: Principles of sound weld design, welding joint design, welding defects; Testing of weldament, Material joining characteristics, Welding positions, Allowable strength of welds under steady loads, Weld throat thickness; Weld quality, Discontinuities in welds, their causes and remedies and quality conflicts.

UNIT-III (12 Hrs.)

Modern Trends in Welding: Friction welding, Explosive welding, Diffusion bonding, High frequency induction welding, Ultrasonic welding, Electron beam welding, Plasma arc welding, Laser welding. Mechanization in Welding: Mechanization of flat/circular joints, Thin/thick sheets (resistance/arc weld), Mechanization of I beams (arc weld), Longitudinal circumferential SA welding (roller blocks, column booms, flux supports), Circular/spherical welding joints (rotating tables positioners), Manufacture of welding longitudinal welded pipes by induction, TIG, Plasma and SA welding of spiral welded pipes.

UNIT-IV (12 Hrs.)

Robotics in Welding: Robot design and applications in welding, Programming of welding robots, tolerances for assemblies for robot welding, New generation of welding robots, Self-alignment by current arc variation, Robots for car body welding, Microelectronic welding and soldering, Efficiency of robotics in welding.

Microwelding Technologies: Introduction to Microwelding techniques.

Recommended Books

1. Nikodaco & Shansky, 'Advanced Welding Processes', MIR Publications.
2. V.M. Radhakrishnan, 'Welding Technology and Design', New Age International.
3. M.M. Schwariz, 'Source Book of Innovative Welding Processes', American Society of Metals (Ohio).
4. J. Cornu, 'Advanced Welding Systems', Vol. I, II, III, Jaico Publishers.
5. P.N. Rao, 'Manufacturing Technology (Foundry, Forming and Welding)', Tata McGraw Hill.

MACHINE AUTOMATION

Subject Code: MMEE1-311 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

Introduction: NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling.

NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centres, Automatic tool changes (ATC), Turning centres.

UNIT II (11 Hrs.)

Machine control unit & tooling: Functions of MCU, NC actuation systems, Part program to command signal, MCU organization, Computerized numerical control, Transducers for NC machine tools, Tooling for NC machining centres and NC turning machines, Tool presetting.

UNIT-III (11 Hrs.)

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles. Manual part programming for milling operations, Turning operations, Parametric subroutines.

UNIT-IV (12 Hrs.)

Computer aided part programming: NC languages: APT, NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor.

APT programming: APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands. Macro subroutines. Part programming preparation for typical examples.

Recommended Books:

1. Numerical Control and Computer Aided Manufacturing by T.K. Kundra, P.N. Rao and N.K. Tewari, Tata McGraw-Hill Company Limited, New Delhi.
2. Numerical Control of Machine Tools by Yoram Koren and Joseph Ben-Uri, Khanna Publishers, Delhi

COMPUTER AIDED PROCESS PLANNING

Subject Code: MMEE1-312 **L T P C** **Duration: 43 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

Introduction

The Place of Process Planning in the Manufacturing cycle, Process planning and production planning, Process planning and Concurrent Engineering, CAPP, Group Technology.

UNIT-II (11 Hrs.)

Part Design Representation

Design, Drafting, Dimensioning, Conventional Toloerencing, Geometric Toloerencing, CAD – input/output devices, Topology, Geometric transformation, Perspective transformation, Data Structure Geometric modeling for process planning, GT coding, The OPITZ system, The MICLASS System.

UNIT-III (10 Hrs.)

Process Engineering and Process Planning

Experienced based planning, Decision table and Decision trees, Process capability analysis, Process planning, variant process planning, Generative approach, Forward and backward planning, Input format, A1

UNIT-IV (12 Hrs.)

Computer Aided Process Planning Systems

Logical Design of process planning, Implementation considerations, Manufacturing system components, Production Volume, No. of production families, CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

An Integrated Process Planning Systems

Totally integrated process planning systems, An Overview Modulus structure, Data structure, Operation, Report Generation, Expert process planning.

Recommended Books

1. Gideon Halevi and Roland D. Weill, 'Principle of Process Planning, Alogical Approach', Chapman & Hall, **1995**.
2. Tien-Chien-Chang, Richard A. Wysk, 'An Introduction to Automated Process Planning Systems', Prentice Hall, **1985**.
3. T.C. Chang, 'An Expert Process Planning System', Prentice Hall, **1985**.
4. Nanua Singh, 'Systems Approach to Computer Integrated Design and Manufacturing', John Wiley & Sons, **1996**.
5. Rao, 'Computer Aided Manufacturing', Tata McGraw Hill Publishing Co., **2000**.