M. TECH. MECHANICAL ENGINEERING (AUTOMATION & ROBOTICS)

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
MMEE3-102	Mechatronics	4	0	0	40	60	100	4
MMEE3-103	Robotics	4	0	0	40	60	100	4
MMEC0-104	Computer Aided Design	4	0	0	40	60	100	4
MMEE3-105	Lab -I	0	0	4	100	-	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MMEE3-156	Management Information System							
MMEE3-157	Automatic Control System							
MMEE3-158	Industrial Automation							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**300**	**300**	**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**	
MMEE3-206	Computer Integrated Manufacturing Systems	4	0	0	40	60	100	4
MMEE3-207	Drives and Control System for Automation	4	0	0	40	60	100	4
MMEE3-208	Sensor Application in Manufacturing	4	0	0	40	60	100	4
MMEE3-209	Kinematics & Dynamics of Robots	4	0	0	40	60	100	4
MMEE3-210	Lab-II	-	-	4	60	40	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE3-259	Rapid Prototyping							
MMEE3-260	Computer Concept for Automation							
MMEE3-261	Microprocessors and Micro Controllers							
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**	
MMEE3-311	Artificial Intelligence	4	0	0	40	60	100	4
MMEE3-312	Robot Programming	4	0	0	40	60	100	4
MMEE3-313	Project & Seminar	0	0	4	40	60	100	4
MMEE3-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 2 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**	
MMEE3- 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 Hours**
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 Softwares 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.

MECHATRONICS

Subject Code: MMEE3-102 **L T P C** **Duration: 40 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 Book

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

ROBOTICS

Subject Code: MMEE3-103 **L T P C** **Duration: 43 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Definitions, Types of Robots, Application of Robots, Representing Position and Orientation, Representing Pose in 2-Dimensions, Representing Pose in 3-Dimensions, Representing Orientation in 3-Dimensions, Combining Translation and Orientation.

UNIT-II (13 Hrs.)

Time and Motion: Trajectories, Smooth One-Dimensional Trajectories, Multi-Dimensional Case, Multi-Segment Trajectories, Interpolation of Orientation in 3D, Cartesian Motion, Time Varying Coordinate Frames, Rotating Coordinate Frame, Incremental Motion, Inertial Navigation Systems. Mobile Robot Vehicles, Mobility, Car-like Mobile Robots, moving to a

Point, following a Line, Following a Path. Navigation: Reactive Navigation, Braitenberg Vehicles, Simple Automata, Map-Based Planning, Distance Transform, Voronoi Roadmap Method, Probabilistic Roadmap Method, Localization, Dead Reckoning, Modeling the Vehicle, Estimating Pose, using a Map, Creating a Map, Localization and Mapping, Monte-Carlo Localization.

UNIT-III (12 Hrs.)

Robot Arm Kinematics: Describing a Robot Arm, Forward Kinematics, a 2-Link Robot, A 6-Axis Robot, Inverse Kinematics, Closed-Form Solution, Numerical Solution, Under-Actuated Manipulator, Redundant Manipulator, Trajectories, Joint-Space Motion, Cartesian Motion, Motion through a Singularity.Installing ROS, Understanding the ROS File system level, Packages, Stacks, Messages, Services, Understanding the ROS Computation Graph level, Nodes, Topics, Services, Messages, Bags, Master, Parameter Server, creating workspace, Creating & Building an ROS package, Creating & Building the node, Visualization of images.

UNIT-I (10 Hrs.)

Robot Programming: Using Sensors and Actuators with ROS, SCORBOT structure, joint movements, work envelop, motors, encoders, micro switch, transmission, gripper, SCORBOT programming, IS-14533: 2005 Manipulating industrial robots -Performance criteria related test methods, Mobile Robot Programming, Industrial Robot Programming.

Recommended Books

1. Peter Corke Robotics, 'Vision and Control: Fundamental Algorithms in MATLAB', Springer Tracts in Advanced Robotics, Vol. 73, **2011**.
2. Aaron Martinez & Enrique Fernández, 'Learning ROS for Robotics Programming', Packt Publishing, **2013**.

COMPUTER AIDED DESIGN

Subject Code: MMEE3-104 **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'.

LAB-I

Subject Code: MMEE3-105 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem of one semester will be allocated to each student related to the subjects related to the subjects taught in 1st semester.

MANAGEMENT INFORMATION SYSTEM

Subject Code: MMEE3-156 **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 Inter- National 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)

Recommended 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.
7. Murdick, 'Information System for Modern Management', PHI.
8. Alexis Leon, 'Enterprise Resource Planning', TMH.

AUTOMATIC CONTROL SYSTEMS

Subject Code: MMEE3-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Motivation for control. Review of differential equations, impulse response and Laplace transformations, Introduction to state equations and transfer functions. Interpretation of poles and zeros of transfer functions**.** Time domain response of second order system. Comm and tracking and system type. Rough/Hurwitz test.

UNIT-III (12 Hrs.)

Frequency Response and Frequency Domain Methods. Nyquist stability test. Bode plots. Phase and gain margins. Bode phase formula. Robustness. Uncertainty and performance weights. Robust stability test. Robust performance test. Loop shaping necessary and sufficient conditions. Bode integral formula.

UNIT-IV (10 Hrs.)

Applications of Root Locus, Sensitivity of roots of characteristics equation, Tool for design and analysis of control systems, Case studies using mat lab on Bode, Nyquist and Root locus.

UNIT-II (11 Hrs.)

State Variable Analysis and Design, Introduction, Concepts of state variables for linear discrete time systems, Diagonalization solutions of state equations, Concepts of controllability and observability, Pole placement by state feedback, Observer systems, problems.

Recommended Books

1. Franklin, Powell, and Enami-Naeini, 'Feedback Control of Dynamical Systems', 5th Edn., Addison-Wesley, **2006.**
2. I.J. Nagrath, M. Gopal, 'Control Systems Engineering', 5th Edn., New Age International (P) Ltd, Publishers.

INDUSTRIAL AUTOMATION

Subject Code: MMEE3-158 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines.

UNIT-II (12 Hrs.)

Material handling and Identification Technologies: Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools,

UNIT-III (13 Hrs.)

Control Technologies in Automation: Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. Computer Based Industrial Control**:** Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems & RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems.

UNIT-IV (9 Hrs.)

Modeling and Simulation for Plant Automation: Introduction, need for system Modeling, Building Mathematical Model of a Plant, Modern Tools & Future Perspective. Industrial Control Applications: Cement, Thermal Water Treatment & Steel Plants.

Recommended Books

M.P. Groover, 'Automation, Production Systems and Computer Integrated Manufacturing', 5th Edn., Pearson Education, **2009**.

COMPUTER INTEGRATED MANUFACTURING SYSTEM

Subject Code: MMEE3-206 **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 (8 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**.

DRIVES AND CONTROL SYSTEM FOR AUTOMATION

Subject Code: MMEE3-207 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Concepts of linear and frameless motors, Selection of feedback system, Duty cycle, V/F control, Flux Vector control.

UNIT-II (12 Hrs.)

Industrials Drives: DC and AC motors operation and selection, method of control and application of brushless DC motor, PMSM, stepper motor, A.C servomotor, selection criteria for servo motor and servo amplifier, universal motor, electric drive, types of industrial drives, the characteristics of drive, advantages of drives over other prime movers, motor rating, heating effects,

Motion laws for rotary and linear systems: converting rotary to linear system, concepts and principles of ball screws, rack and pinion, belt and pulley, chain drives, gear drives, Selection of converting systems, Dynamic response gearing, and control approaches of Robots, Control loops using Current amplifier.

UNIT-III (10 Hrs.)

Introduction to Programmable Logic Controllers: Definitions of PLC, basic structure of PLC, working principles, data storage methods, inputs / outputs flag processing's, types of variables, definition of firmware, software, programming software tool and interfacing with PC (RS232 & TCP-IP), methods of PLC programming (LD, ST, FBD & SFC), function blocks logical / mathematical operators & data types, array & data structure, PID, types of tasks and configuration, difference between relay logic and PLC, selection of PLC controller

UNIT-IV (10 Hrs.)

Logic, instructions & Application of PLC: What is logic, Conventional Ladder v/s PLC ladder, series and parallel function of OR, AND, NOT logic, Ex or logic, Analysis of rung. Timer and Counter Instructions; on delay and Off delay and retentive timer instructions, PLC counter up and down instructions, combining counters and timers, Comparison and data handling instructions, Sequencer instruction, Visualization Systems, Types of visualization system, PC based Controller, Applications of HMI's, and Interfacing of HMI with controllers.

Recommended Books

1. Johnson Curties, 'Process Control Instrumentation Technology', 8th Edn., Prentice hall of India,
2. Andrew Parr, 'Industrial drives', Butterworth – Heineamann.
3. G.K. Dubey, 'Fundamentals of Electrical Drives'.
4. W. Bolton, 'Programmable Logic Controllers'.

SENSOR APPLICATION IN MANUFACTURING

Subject Code: MMEE3-208 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

Fundamentals of Sensors and Transducers: Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, signal processing and signal conditioning. Operational amplifiers, filters, protection devices, analog to digital converter, digital to analog converter.

UNIT-II (12 Hrs.)

Sensors and their applications: Inductive, capacitive, magnetic, various types of photo sensors, detection methods, through-beam detection, reflex detection & proximity detection, ultrasonic and microwave sensors. Applications and understanding of the above sensors.

Advanced Sensor Technologies: Laser production, characteristics of lasers, types of laser sensors, bar code sensors, benefits of bar coding, transponder, RFID (Radio Frequency Identification), electro-magnetic identifier, optical encoders, color sensors, sensing principles, color theory, unit color measurement, colour comparator, color sensing algorithm, fuzzy logic color sensor. fuzzy logic for opt-electronic colour sensor in manufacturing.

UNIT-III (10 Hrs.)

Sensors in Flexible Manufacturing Systems: Vision sensors, image transformations, robot visual sensing tasks, detecting partially visible objects, sensors in flexible manufacturing system cell.

Sensors for Special Applications: A multi objective approach for selection of sensors in manufacturing**,** cryogenic manufacturing applications, semiconductor absorption sensors, semiconductor temperature detector using photoluminescence temperature detectors using point-contact, sensors in process manufacturing plants, measurement of high temperature, robot control through sensors, other sensors, collection and generation of process signals in decentralized manufacturing system.

UNIT-IV (10 Hrs.)

Networking: Networking of sensors, control of manufacturing process, tracking- the mean time between operations interventions, tracking the yield and mean process time, detection of machining faults, diagnostic systems, resonance vibration analyzer, sensing motor current for signature analysis, temperature sensing.

Recommended Books

1. Sabnesoloman, 'Sensors & Control Systems in Manufacturing', McGraw Hill Book Company Network, **1994**.

2. W. Bolton, 'Mechatronics'.
3. Jon S. Wilson, 'Sensor Technology Handbook'.
4. N.L. Buck & T.G. Buckwith, 'Mechanical Measurement'.
5. Ian Sinclai, 'Sensors and Transducers'.

KINEMATICS & DYNAMICS OF ROBOTS

Subject Code: MMEE3-209 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

INTRODUCTION

Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates.

UNIT-II (11 Hrs.)

DIRECT KINEMATICS

Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.

INVERSE KINEMATICS

The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axes, Articulated robot.

UNIT-III (10 Hrs.)

WORKSPACE ANALYSIS AND TRACJECTORY PLANNING

Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT-IV (10 Hrs.)

MANIPULATOR DYNAMICS

Introduction, Lagrange's equation kinetic and potential energy. Link inertiTensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar roboNewton Euler formulation, Lagrange – Euler formulation, problems.

Recommended Books

1. Robert J. Schilling, 'Fundamentals of Robotics Analysis and Control', PHI Learning, **2009**.
2. Richard D. Klafter, A. Thomas, Chri Elewski, Michael Negin, 'Robotics Engineering an Integrated Approach', PHI Learning, **2009**.
3. P.A. Janaki Raman, 'Robotics and Image Processing: An Introduction', Tata McGraw Hill Publishing Company Ltd., **1995**.
4. Francis N-Nagy Andras Siegler, 'Engineering foundation of Robotics', Prentice Hall Inc., **1987**.

LAB-II

Subject Code: MMEE3-210 **L T P C**
0 0 2 1

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.

RAPID PROTOTYPING

Subject Code: MMEE3-259 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (08 Hrs.)

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems
Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details,

UNIT-II (11 Hrs.)

Selective Laser Sintering and Fusion Deposition Modeling: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Principle of Fusion deposition modeling, Process parameter.
Solid Ground Curing: Principle of operation, Machine details, Applications.

UNIT-III (09 Hrs.)

Laminated Object Manufacturing: Principle of operation. Process details, application.
Concepts Modelers: Principle, Thermal jet printer, Sander's model market. Genisys Xs printer HP system 5, object Quadra systems.

UNIT-IV (12 Hrs.)

Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy Tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc Direct Rapid Tooling., AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling.
RP Process Optimization: Factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing.

Recommended Books

1. Paul F. Jacobs, 'Stereo Lithography and other RP & M Technologie', SME, NY, **1996**.
2. D.T. Flham & S.S. Dinjoy, 'Rapid Manufacturing', Verlog London, **2001**.
3. 'Rapid Automated- Lament Wood', 1st Edn., Indus Press, New York, **1993**.

COMPUTER CONCEPT FOR AUTOMATION

Subject Code: MMEE3-260 **L T P C** **Duration: 39 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

Introduction to Big Data:
Big Data and its Importance – Four V's of Big Data – Drivers for Big Data –Introduction to Big Data Analytics – Big Data Analytics applications. Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans Firewall, Analytics - Information Management.

UNIT-II (09 Hrs.)

Processing Big Data:
Integrating disparate data stores - Mapping data to the programming framework Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

UNIT-III (11 Hrs.)

Hadoopmapreduce:
Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce Jobs Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT-IV (10 Hrs.)

Database Management System:
Comparison of File System, Database Management System, Characteristic Features of Database Management Systems, Relational Databases.
Data Base Models: DBMS Languages and Interfaces. Data Base Security and Authorization
Recommended Books

1. RamezElmasri and Navathe, 'Fundamentals of DBMS', Addison Wesley, 5th Edn., **2009**.
2. Michael Minelli, Michehe Chambers, 'Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business', 1st Edn., Ambiga Dhiraj, Wiley CIO Series, **2013**.
3. Arvind Sathi, 'Big Data Analytics: Disruptive Technologies for Changing the Game',1st Edn., IBM Corporation, **2012**.
4. Bill Franks, 'Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics', 1st Edn., Wiley and SAS Business Series, **2012**.

MICROPROCESSORS AND MICRO CONTROLLERS

Subject Code: MMEE3-261 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction to Microprocessors: Introduction to Microprocessors, Microprocessor Based Computer Systems, Architecture of 8085, 8086 and Segmentation.

Microprocessors Assembly Language Programming: Addressing Modes of 8086, Data Movement Instructions. Instruction Encoding, Arithmetic and Logic Instructions. Programming Examples. Machine Control and Miscellaneous Instructions.

UNIT-II (11 Hrs.)

Hardware Feature of 8086: Pin Outs and Pin Functions. Clock Generator, Bus Buffering, Latching and Timing Diagrams.

Interrupt Systems, Memory and I/O Interfacing In Microprocessors: Introduction to Interrupts, Interrupt related Instructions, Interrupt Processing, Memory Devices, Address Decoding, 8/16-Bit Memory Interfacing, DRAM Memory Systems. Introduction to I/O Interfacing. Memory Mapped and I/O Mapped I/O; Application examples related to Stepper Motor.

UNIT UNIT-III (10 Hrs.)

Introduction to Micro Controllers: Introduction, Comparing Microprocessors and Micro Controllers, Z-80, 8051, PIC Micro Controllers, PIC Development Tools. The Micro Controller Survey, 4Bit, 8Bit, 16Bit and 32 Bit Micro Controllers. Develop Systems for Micro Controllers.

Micro Controllers Architecture: 8051 Architecture, PIC Architecture, 8051 Micro Controller Hardware, Input/Output Pins, Ports and Circuits, External Memory, Counter and Timers, Serial Data Input/Output,

UNIT-IV (11 Hrs.)

Basic Assembly Language Programming Concepts in Micro Controllers: The Mechanics of Programming, The Assembly Language Programming Process, PAL Instructions, Programming Tools and Techniques. Addressing Modes, Data Exchanges, Code Memory Read-Only Data Moves, Push Pop Op Codes, Logical Operators, Arithmetic Operators, Jump and Call Instructions.

Micro Controller Applications: Introduction, Key Boards, Displays, Pulse Measurement, D/A and A/D Conversions, Multiple Interrupts.

Recommended Books

1. K. Udaya Kumar & B.S. Umashankar, 'Advanced Microprocessors and IBM PC', TMH, 1st Edn., **1996**.
2. John B. Peatman, 'Design with PIC and Micro Controllers', 1st Edn., Pearson Education, **2001**.

ARTIFICIAL INTELLIGENCE

Subject Code: MMEE3-311 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

INTRODUCTION: History, Definition of AI, Emulation of human cognitive process, intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

UNIT-II (12 Hrs.)

PROBLEM-SOLVING: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search. Informed (Heuristic) Search Strategies, Greedy best-first search, A* search, Heuristic Functions, The effect of heuristic accuracy on performance.

UNIT -III (11 Hrs.)

BEYOND CLASSICAL SEARCH: Local Search Algorithms and Optimization Problems, Hill climbing search, simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

UNIT-IV (10 Hrs.)

PROGRAMMING AND LOGICS IN ARTIFICIAL INTELLIGENCE: LISP and other programming languages – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non-deductive inference methods.

Recommended Books

1. Stuart Russell and Peter Nowig, 'Artificial Intelligence: A Modern Approach', 3rd Edn., PEARSON.
2. Donald A. Waterman, 'A Guide to Expert Systems', 2nd Edn., Addison Wesley, **1986**.
3. DAN.W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', 2nd Edn., PHI, **2009**.
4. George. F. Luger, 'Artificial Intelligence', 3rd Edn., Pearson Education, Asia, **2009**.
5. Robert J. Schalkeff, 'Artificial Intelligence: An Engineering Approach', 2nd Edn., PHI, **1990**.

ROBOT PROGRAMMING

Subject Code: MMEE3-312 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

BASICS OF ROBOT PROGRAMMING:

Robot Programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, Functions-Wrist Mechanism-Interpolation-Interlock Commands Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

UNIT II (13 Hrs.)

VAL LANGUAGE:

Robot Languages-Classifications, Structures- VAL language commands-motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications.

RAPID LANGUAGE:

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Movemaster command Language-Introduction, syntax, simple problems.

UNIT III (09 Hrs.)

PRACTICAL STUDY OF VIRTUAL ROBOT:

Robot cycle time Analysis-Multiple robot and machine Interference-Process Chart-Simple Problems-Virtual robotics, Robot studio online Software-Introduction, Jogging, components, work planning, program modules, input and output Signals-Singularities-Collision Detection-Repeatability measurement of Robot-Robot economics.

UNIT III (09 Hrs.)

VAL-II AND AML:

VAL-II programming-basic commands, applications- Simple problem using conditional Statements-Simple pick and place Applications-Production rate calculations using robot. AML Language-General description, elements and functions, Statements, constants and Variables-Program Control Statements-Operating systems, Motion, Sensor Commands-Data processing.

Recommended Books

1. S.R. Deb, 'Robotics Technology and Flexible Automation', Tata McGraw Hill Publishing Company Limited, **1994.**
2. Mikell. P. Groover, 'Industrial Robotics Technology, Programming and Applications', McGraw Hill Co, **1995**.
3. R.D. Klafter, T.A. Chmielewski, Noggin's, 'Robot Engineering: An Integrated Approach', Prentice Hall of India Pvt. Ltd., **1994**.
4. K.S. Fu., R.C. Gonzalez & C.S.G. Lee, 'Robotics Control, Sensing, Vision and Intelligence', McGraw Hill Book Co., **1987.**
5. J.J. Craig, 'Introduction to Robotics mechanics and Control', Addison-Wesley, **1999**.