### III SEMESTER

**SCHEME OF TEACHING AND EXAMINATION**

**M.TECH. INDUSTRIAL AUTOMATION AND ROBOTICS**

#### 10MAR31 Automation in Manufacturing

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Teaching Hours / Week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10MAR31</td>
<td>Automation in Manufacturing</td>
<td>4</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>2</td>
<td>10MAR32</td>
<td>Elective – III</td>
<td>4</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>3</td>
<td>10MAR33</td>
<td>Elective – IV</td>
<td>4</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>4</td>
<td></td>
<td>Project Phase – II (5 week Duration)</td>
<td></td>
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<tr>
<td>5</td>
<td>10MAR34</td>
<td>Evaluation of Project Phase – I</td>
<td>-</td>
<td>3</td>
<td>50 - 50</td>
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</tbody>
</table>

**TOTAL**

12 3 9 200 300 500

* 3 Days Course and 3 Days of Project Work.

#### Elective – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
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<tbody>
<tr>
<td>10MAR321</td>
<td>Dynamics &amp; Mechanism Design</td>
</tr>
<tr>
<td>10MAR322</td>
<td>Mathematical approach to Robotic Manipulations</td>
</tr>
<tr>
<td>10MAR323</td>
<td>DFM Techniques and Product Design</td>
</tr>
<tr>
<td>10MAR331</td>
<td>Computer Control of Manufacturing Systems</td>
</tr>
<tr>
<td>10MAR332</td>
<td>Knowledge Base Design</td>
</tr>
<tr>
<td>10MAR333</td>
<td>Modeling of Management Information Systems</td>
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#### III SEMESTER

**AUTOMATION IN MANUFACTURING SYSTEMS**

<table>
<thead>
<tr>
<th>Sub Code</th>
<th>IA Marks</th>
<th>Hrs/ Week</th>
<th>Exam Hours</th>
<th>Total Hrs.</th>
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</thead>
<tbody>
<tr>
<td>10MAR31</td>
<td>50</td>
<td>04</td>
<td>03</td>
<td>52</td>
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</tbody>
</table>


8. **PLC**: Introduction, Micro PLC, Programing a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Comparison & Data Handling Instructions, Sequencing Instructions, Mask Data Representation, Typical PLC Programming Exercises for Industrial Applications.

10 Hours
Text Books:
1. Automation Production Systems and CIM - Mikell P Groover, Pearson Education, Asia

Reference Books:
1. Principles of CIM - Vajpayee, PHI.

DYNAMICS AND MECHANISM DESIGN

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<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>Total Hrs.</td>
<td>52</td>
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5. Autonomous Systems with Hologomic and Non Holonomic Constraints, Application to Systems with very small Displacements and to Impulsive Motion.


Text Books:

Reference Books:

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**MATHEMATICAL APPROACH TO ROBOTIC MANIPULATIONS**

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<th>Exam Hours</th>
<th>Exam Marks</th>
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</thead>
<tbody>
<tr>
<td>10MAR322</td>
<td>50</td>
<td>04</td>
<td>03</td>
<td>100</td>
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1. **Introduction**: Brief History, Multi-fingered Hands and Dexterous Manipulation.  
   *3 Hours*

2. **Rigid Body Motion**: Rigid Body Transformations, Rotational Motion in $\mathbb{R}^3$, Rigid Motion in $\mathbb{R}^3$, and Velocity of a Rigid Body, Wrenches and Reciprocal Screws.  
   *8 Hours*

3. **Manipulator Kinematics**: Introduction, Forward Kinematics, Inverse Kinematics, the Manipulator Jacobian, Redundant and Parallel Manipulators.  
   *8 Hours*

4. **Robot Dynamics and Control**: Introduction, Lagrange’s Equations, and Dynamics of Open-Chain Manipulators, Lyapunov Stability Theory, Position Control and Trajectory Tracking, Control of Constrained Manipulators.  
   *8 Hours*

5. **Multifingured Hand Kinematics**: Introduction to Grasping, Force-Closure, Grasp Planning, Grasp Constraints and Rolling Contact Kinematics.  
   *8 Hours*

   *6 Hours*

   *8 Hours*

   *7 Hours*

**Text Books:**

**Reference Books:**

**DFM TECHNIQUES AND PRODUCT DESIGN**

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<td>04</td>
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<td>100</td>
</tr>
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1. **Introduction**: General principles for manufacturability, Basic Principles of designing for economic production, Process capability, Feature tolerance and surface finish. 

2. **Designing for Machining**: Parts cut to length, Screw machine products, machined round holes, molded parts, parts produced by planning, shaping and slotting, broached parts, ground parts, rolled burnished parts, gears.

3. **Review of design consideration**: in formed metal components, non-metallic parts, design for heat treatment and economical deburring.

4. **Mechanical Assembly**: Application of selective assembly, deciding the number of groups – examples, design recommendations for different fastening arrangements, automatic assembly control of axial play in assemblies.

5. **Introduction to Product Design**: Definition of Product Design; design by evolution, design of innovation; essential factors of product design; production consumption cycles; the morphology of design (The seven Phases).

6. **Design of Production Metal Parts**: Produce ability requirements in the design of machine components; forging design; pressed component design; casting design; design for machining case; design powder metallurgical parts; expanded metals and wire forms.

7. **Optimization in Design and Human Engineering Considerations in Product Design**: Introduction; Siddal classification of product design approaches; optimization by differential calculus; Langrange multipliers; linear programming; geometric programming; Johson’s method of optimization; Human Engineering- Introduction; the design of controls; the design of displays; man/machine information exchange.

8. **Value Engineering and Product Design**: Introduction; Historical perspective; Nature and measurement of value; Importance of value; the value analysis plan.

**Text Books:**

**Reference Books:**
COMPUTER CONTROL OF MANUFACTURING SYSTEMS


2. **Interpolators for manufacturing systems**  DDA Integrator, DDA Hardware Interpolator, CNC software Interpolators, Reference word CNC interpolators, The concept of reference word interpolators, Tustin Method.  

3. **Control Loops of NC Systems**  Introduction, Control of Point-to-point Systems, Control loops in Contouring Systems, Mathematical Analysis, operation of a two axis system.  


5. **Manufacturing system simulation**  Introduction, Types of simulation, Need and elements of simulation, Simulation methodology.  

6. **Computerized Numerical Control:** CNC Concepts, Advantages, The Digital Computer, Reference Pulse Technique, Sampled-Data Technique, Design Principles, Optimization for Circular Motion, summary of design considerations, micro computers in CNC.  

7. **Computer integrated Manufacturing systems**  Introduction, Modern manufacturing, Sequence of functions in CIM, Elements of CIM system, CIM data base management system, CIM related standards, Guide lines for CIM development Benefits of CIM.  

8. **Flexible manufacturing systems**  Introduction, Elements of FMS, Classification and Types of FMS, FMS work stations, Lay out configurations, Petrinets, modeling with Petrinets.  

Text Books:

Reference Books:
1. **Computer Aided Design and Manufacturing** - Dr.Sadhusingh, Khanna Publishers, 2002
2. **Simulation modeling and Analysis** - Avverill M Law, TMH,2008.

KNOWLEDGE BASED DESIGN

Acquisition, Components of Knowledge, Knowledge Representation, Production Systems, Decision Tables, Frame Systems, Graphs and Semantic Networks.


Text Books:
2. Principles of Artificial Intelligence - Springer-Verlag, Berlin

Reference Books:
4. Introduction to Artificial Intelligence and expert systems -DAN.W. Patterson, PHI.

MODELING OF MANAGEMENT INFORMATION SYSTEMS

<table>
<thead>
<tr>
<th>Sub Code</th>
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<tbody>
<tr>
<td>10MAR333</td>
<td>50</td>
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<tr>
<td>Hrs/ Week</td>
<td>04</td>
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<tr>
<td>Exam Hours</td>
<td>03</td>
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</tbody>
</table>
Total Hrs. : 52  
Exam Marks : 100

1. **Information Basics**: Definition of information system, classification of IS, Need for Information system, Contemporary approaches to information system, Key system applications in the organization, Challenges of information systems. Impact of IT, IS for Knowledge work.  

7 Hours

2 **Managing with Information and its Resources**: Managing in 21st Century, Strategic planning and IS, Information needs for strategic planning, IS for decision support, Quality and privacy issues. Information resource management, strategic planning for IS function, justification for IS, IT/IS facilities and operations, security control and Audit.

7 Hours

3 **Information systems and Organizations**: Relationship between organizations and information systems, feature of organizations, effect of organizations on information systems, effect of information systems on organizations.

6 Hours

4 **Information, Management and Decision-making**: Role of managers, Decision making, Individual models of decision-making, Organizational models of decision-making.

7 Hours

5 **Information System Development**: System development life cycle and methodologies, principles of system design. System analysis- Definition, Strategies and Phases.

7 Hours

6 **Object Oriented Technology**: Object orientation, object oriented analysis (OOA), system development through OOT, Object Oriented Languages. OOT and MIS.

6 Hours

7 **System modeling**: Introduction to system modeling, system concepts for data modeling, logical data modeling, and construction of data model. Process modeling: Introduction to process modeling, system concepts for process modeling, data flow diagram, logical process modeling, construction of process model.

7 Hours

8 **Decision Support Systems**: DSS issues, Structure Constructions-approaches, generators, tools, software and cost benefits and simple examples of applications.

6 Hours

Text Books:


Reference Books:


4. Management Information systems - W.S Jawadekar, TMH

5. Information System for modern management - Murdick Ross & Claggett , PHI.

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