23MTOE321

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
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Model Question Paper

Sixth Semester BE Degree Examination

Robotics and Automation

Time: 3 Hours (180 Minutes) **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

		Module -1	M	L	C
Q1	a.	Define robotics and explain its origin and evolution through various generations of robots.	10	L2	CO1
	b.	Explain the classification of robots based on application, control and configuration.	10	L2	CO1
		OR			
Q2	a.	Describe the basic components and specifications of an industrial robot with suitable examples.	10	L2	CO1
	b.	Discuss Asimov's laws of robotics and their relevance, including the social impact and future prospects of robotics.	10	L2	CO1
		Module- 2			
Q3	a.	Explain the anatomy of a robot, including links, joints and degrees of freedom.	10	L2	CO2
	b.	Describe various robot configurations and compare their work volumes.	10	L2	CO2
		OR			
Q4	a.	Explain the various types of motions in robotic systems.	10	L2	CO2
	b.	Describe the working principles and applications of machine vision and ranging sensors in robotics.	10	L2	CO2
		Module – 3			
Q5	a.	A manufacturing plant needs a drive system for a machine that requires precise speed control and moderate load handling, identify the most suitable drive for this application with reasons.	10	L3	CO3
	b.	A manufacturing company uses an industrial robot to pick and place components of different shapes, materials and weights on an automated assembly line under continuous shop-floor conditions. Select appropriate end effectors for the task and justify.	10	L3	CO3
		OR			
Q6	a.	A flexible robotic cell in an electronics automotive mixed manufacturing line is required to handle components ranging from lightweight plastic housings to heavier metal brackets with irregular geometries. The cell operates continuously for long shifts and frequent tool changes are not feasible due to cycle-time constraints. Given these operating conditions, select an appropriate mechanical gripper type and justify your selection.	10	L3	CO3
	b.	A manufacturing unit is integrating robots for automated operations that require different levels of speed, accuracy and flexibility. Apply appropriate types of robot control for the given application and justify the selection	10	L3	CO3
		Module – 4			
Q7	a.	An average of 20 new orders is started through a certain factory each month. On average, an order consists of 50 parts to be processed through 10 machines in the	10	L3	CO4

<table>
<tr><td></td><td></td><td>factory. The operation time per machine for each part = 15 min. The nonoperation time per order at each machine averages 8 hr and the required setup time per order = 4 hr. There are 25 machines in the factory, 80% of which are operational at any time. The plant operates 160 hr/month. Determine a) Manufacturing Lead Time b) Production Rate c) Plant Capacity and d) Plant Utilization.</td><td></td><td></td><td></td></tr>
<tr><td></td><td>b.</td><td>An industrial plant currently operating with manual processes is transitioning to an automated system to meet increasing demands for higher productivity, consistent quality and operational flexibility. The plant handles multiple product variants and requires reliable, continuous operation with minimal human intervention. Given these requirements, apply the advanced functions of automation and justify its role.</td><td>10</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">Q8</td><td>a.</td><td>A certain part is routed through six machines in a batch production plant. The setup and operation time for each machine are given in the table below. The batch size is 100 and the average nonoperation time per machine is 12 hr. Determine a) Manufacturing Lead Time b) Production Rate for operation.
<table>
<tr><th>Machine</th><th>Setup Time (hrs)</th><th>Operation Time (min)</th></tr>
<tr><td>1</td><td>4</td><td>5</td></tr>
<tr><td>2</td><td>2</td><td>3.5</td></tr>
<tr><td>3</td><td>8</td><td>10</td></tr>
</table></td><td>10</td><td>L3</td><td>CO4</td></tr>
<tr><td>b.</td><td>A production facility is evaluating the introduction of automation across different stages of its manufacturing process to achieve higher output and consistent quality while controlling costs. Integration with existing equipment is a key requirement. Apply the concept of levels of automation and explain how varying automation levels influence productivity, quality, and operational efficiency.</td><td>10</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td rowspan="2">Q9</td><td>a.</td><td>A manufacturing plant operating under continuous production schedules must transport raw materials, work-in-process, and finished goods efficiently between multiple workstations and storage areas. The materials vary in size, weight and manual handling leads to delays and congestion on the shop floor. Given these operating conditions, select an appropriate material handling equipment for the plant and justify your selection.</td><td>10</td><td>L3</td><td>CO5</td></tr>
<tr><td>b.</td><td>A manufacturing factory wants to streamline material movement and reduce manual handling errors in its production process. Apply the concept of Automated Guided Vehicle (AGV) systems to the given production process and justify how it enhances operational efficiency.</td><td>10</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">Q10</td><td>a.</td><td>A manufacturing plant is experiencing delays and inefficiencies due to poor material movement and storage. Suggest the suitable types of material handling and storage systems to improve workflow.</td><td>10</td><td>L3</td><td>CO5</td></tr>
<tr><td>b.</td><td>An automated production line is required to identify and track components accurately as they move through different processing and assembly stages. The system operates at high speed with minimal manual intervention and reliable data capture is essential for maintaining workflow efficiency, traceability and quality control. Given these operating conditions, select suitable automatic identification methods for the application and justify your selection.</td><td>10</td><td>L3</td><td>CO5</td></tr>
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