



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

MKC

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

MECH

Must Know Concepts (MKC)

2021-22

Subject		19MEE07 & INDUSTRIAL AUTOMATION & ROBOTICS		
S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/Equation/Expression	Units
UNIT I: INTRODUCTION				
1.	Production system		collection of people, equipment, and procedures organized to perform the manufacturing operations of a company	
2.	Facilities.		the equipment, the way the equipment is laid out, and the factory in which the equipment is located.	
3.	Manufacturing support systems		the procedures used by the company to manage production and to solve the technical and logistics problems encountered in ordering materials, moving the work through the factory	
4.	Automated Systems		A process is performed by a machine without the direct participation of a human worker	
5.	Sequence of activities in Manufacturing support system		<ol style="list-style-type: none"> 1. business functions, 2. product design, 3. manufacturing planning, and 4. manufacturing control 	
6.	automated elements of the production system		<ul style="list-style-type: none"> • automation of the manufacturing systems • computerization of the manufacturing support systems 	
7.	Automated manufacturing systems classification		<ol style="list-style-type: none"> 1. fixed automation, 2. programmable automation, and 3. flexible automation. 	
8.	Automation Principles and Strategies		<ul style="list-style-type: none"> • the USA Principle, • Ten Strategies for Automation and Process Improvement, and • an Automation Migration Strategy 	
9.	USA stands for		<ol style="list-style-type: none"> (1) understand the existing process, (2) simplify the process, and (3) automate the process. 	

10.	Basic Elements of an Automated System		(1) power to accomplish the process and operate the system, (2) a program of instructions to direct the process, and (3) a control system to actuate the instructions.	
11.	Advanced automation functions		(1) safety monitoring, (2) maintenance and repair diagnostics, and (3) error detection and recovery.	
12.	Levels of Automation		<i>Device level.</i> <i>Machine level.</i> <i>Cell or system level</i> <i>Plant level.</i> <i>Enterprise level.</i>	
UNIT II: MATERIAL HANDLING				
13.	Material handling		the movement, protection, storage and control of materials and products throughout the process of manufacture and distribution, consumption and disposal	
14.	Material Handling Equipment		(4) transport equipment, (5) positioning equipment, (6) unit load formation equipment, (7) storage equipment, and (8) identification and control equipment.	
15.	Transport Equipment		industrial trucks, automated guided vehicles, rail-guided vehicles, conveyors, hoists and cranes.	
16.	unitizing equipment		(1) containers used to hold individual items during handling and (2) equipment used to load and package the containers.	
17.	Storage methods		(1) conventional storage methods and (2) Automated storage systems.	
18.	Design Considerations in Material Handling		Material Characteristics Flow Rate, Routing, and Scheduling Plant Layout Unit Load Principle	
19.	AGVS		automated guided vehicle system	
20.	automated guided vehicle system		a material handling system that uses independently operated, self-propelled vehicles guided along defined pathways	
21.	Types of AGVS		(1) towing vehicles for driverless trains, (2) pallet trucks, and (3) unit load carriers	

22.	AGVS Applications		(1) driverless train operations, (2) storage and distribution, (3) assembly line applications, and (4) flexible manufacturing systems.	
23.	Vehicle Guidance Technologies		(1) imbedded guide wires, (2) paint strips, (3) magnetic tape, (4) laser-guided vehicles (LGVs), and (5) inertial navigation	
24.	Rail-Guided Vehicles		material transport equipment consists of motorized vehicles that are guided by a fixed rail system.	
25.	Conveyors		A conveyor is a mechanical apparatus for moving items or bulk materials, usually inside a facility.	
26.	Types of Conveyors		Roller conveyors Skate-wheel conveyors Belt conveyors. Chain conveyors Overhead trolley conveyor	
27.	Automated storage systems types		1) fixed-aisle automated storage/retrieval systems and 2) Carousel storage systems.	
UNIT III: FUNDAMENTALS OF ROBOT				
28.	Industrial Robot		Reprogrammable, multifunctional mechanical device performing tasks.	
29.	Manipulator		Machine having same function as of human being	
30.	Work envelope		Space within the robot manipulates its wrist	
31.	Pitch		Up and down movement of wrist	
32.	Roll		Rotation of wrist	
33.	Yaw		Right and Left movement of wrist	
34.	Actuator		Devices used to convert hydraulic energy to Mechanical Energy	
35.	Automation		Automation is a technology that is concerned with the use of mechanical electronic and computer based system in the operation and control of production.	
36.	Types of Automation		Fixed automation, programmable automation, flexible automation	
37.	Rule of robot		Do not harm human being Obey human being Protects itself from harm	
38.	Robot anatomy		It means study of structure of Robots	

39.	Types of robot anatomy		Polar Cylindrical Cartesian Jointed arm	
40.	Robot joints		Linear Rotational Twisting Revolving	
41.	Wrist		It is the set of rotary joints to which a robots end effector is attached.	
42.	Major components of robots		Manipulator, end effector, power source, controller, sensors, actuator	
43.	General areas of robotics		Industrial, hobbyist, promotional, personal, military, educational, medical.	
44.	Work performed by the robot		Loading Unloading Palletizing Depalletizing	
45.	Advantages of robots		Greater Flexibility Reprogram Ability Adjustable Kinematics Greater Response Time Improved Product Quality	
46.	Disadvantages of robots		Replacement of Human Labour More Unemployment Significant Retraining Costs	
47.	Processing application of Robot		Welding Painting Assembly Inspection	
48.	Offset		Point of action for the tool mounted to the Robot tool plate	
49.	Types of Robot movements		Arm and Body Motion Wrist Motion	
50.	4D jobs		Dirty Dangerous Difficult Dull	
51.	RIA definition of robot		Reprogrammable, multifunction manipulator designed to move materials, parts, tools or special devices through variable programmed motions for the performance of the variety of tasks.	
52.	Robot control techniques		Non Servo Control Servo Control	
UNIT IV: ROBOT SENSORS AND END EFFECTORS				

53.	Sensors		Device that detects information about the surroundings	
54.	Accuracy		Defined target point within work volume.	
55.	Precision		Closeness to the true value	
56.	Repeatability		Ability of the robot to position itself again and again	
57.	Spatial Resolution		Control resolution combined with mechanical inaccuracy	
58.	Control Resolution		Capability of the robot's positioning system to divide the range of the joint into closed spaced points	
59.	Palletizing		Arranging materials on a pallet as per rules	
60.	Tactile Sensor		Indicates contact between themselves and some other solid objects	
61.	Proximity Sensor		Senses the presence or absence of the object without physical contact	
62.	Range sensor		Senses the distance of the object	
63.	Piezoelectric Materials		When stretched or compressed generates electric charges	
64.	End-effector		Attachments at the wrist arm perform a task.	
65.	Grippers		Device to grasp objects	
66.	Stripping Device		Used to remove work piece from magnetic gripper	
67.	Advantages of magnetic gripper		Pick up times are very fast To handle metal parts with holes Require only one surface gripping	
68.	Disadvantages of magnetic gripper		Residual magnetism Side slippage More than one sheet will be lifted by the magnet from a stack	
69.	Types of magnetic grippers		Electromagnetic grippers Permanent magnet grippers	
70.	Adhesive grippers		Which an adhesive substance performs the grasping action for handling fabrics and other lightweight material.	
71.	Limitations of adhesive grippers		Adhesive substance losses is tackiness on repeated usage Reliability is diminished with successive operations	

72.	Advantages of suction Cup grippers		Requires only one surface of the part for grasping Applies uniform pressure distribution Lightweight gripper	
UNIT V: ROBOT DRIVES				
73.	Types of Drive Systems		Electric: Servo motors, Stepper motors Hydraulic actuators Pneumatic actuators	
74.	Linear hydraulic actuator		Single Acting Cylinder Double Acting Cylinder Double Acting Double rod Cylinder	
75.	Hydraulic rotary actuator		Geared motor Vane motor Piston motor	
76.	Advantages of hydraulic actuator		Robust Self-Lubricating High Efficiency	
77.	Disadvantages of hydraulic actuator		Expensive Noisy High Maintenance	
78.	Advantages of pneumatic actuator		Compact Cheapest Compressed air can be stored and conveyed easily over long distance	
79.	Disadvantages of pneumatic actuator		More noise and vibration Not suitable for heavy load If mechanical stops are used resetting the system can be slow	
80.	Advantages of electrical actuator		Widespread availability of power supply No pollution of working environment High power conversion efficiency	
81.	Disadvantages of electrical actuator		Poor dynamic response Larger and heavier motors must be used which is costly Conventional gear driven create backlash	
82.	Drive system used in the robot		Gears Pulley Drive Rack and Pinion Recirculating Ball and Screw Rotary Drives	
83.	Advantages of open loop system		Simple Economical Easier to Construct	

84.	Advantages of closed loop system		The systems are accurate even in the presence of nonlinearities Less affected by noise	
85.	Uses of stepper motor		Used for measured rotation Can be held at a particular position of shaft	
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