VALLIAMMAI ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SEMESTER: III-C&I (M.E)

SUBJECT CODE: CL7004

SUBJECT NAME: ROBOTICS AND CONTROL

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UNIT-1 & 2

PART-A

1. Define a Robot?

2. What is meant by automation?

3. What is manipulator?

4. What are the basic components of a robotic system?

5. List the characteristics of robot.

6. Define degrees of freedom?

7. State the advantages and limitation of a hydraulic drive?

8. What are the types of hydraulic actuator?

9. What is an encoder?

10. Classify different types of stepper motor?

11. Name the commonly used robot configuration system?

12. What are the types of automation?

13. Write are the Benefits of industrial automation?

14. List the different types of robots?

15. Write Asimov's laws of robotics?

16. What is a potentiometer?

17. How many DOFs are required to position an end effector at any point in 3-D space?

18. What are the principles of DC motor and AC motor?

19. List the advantages and limitation of a hydraulic drive?

20. List the types of actuators.

PART-B

1. What is the work envelope of a robot? Sketch and explain the following robots indicating the joints and degree of freedom.

 i) Cartesian robot.   ii) Polar robot.

2. Write short notes on the following:

 i) Dynamic stabilization of robots.

 ii) Degrees of freedom.

3. Discuss the origin and various generations of robots. Sketch and explain the work envelope of a cylindrical robot.

4. What is the work envelope of a robot? Sketch and explain the following robots indicating the joints and degree of freedom.

 i) Cylindrical robot. ii) Anthropomorphic robot.

5. Discuss the differences between servo controlled and non- servo controlled robots. Sketch and explain the servo control system for point to point positioning.

6. State the laws of robotics and discuss the various mechanical design considerations of robots. Write the significance of odds and uncertainties in measurement.

7. Sketch and explain the working of stepper motors.

8. Sketch and explain the working of DC motor.

9. What are the advantages of hydraulic actuator systems over electrical motors? Sketch and explain a hydraulic drive system used for robots.

10. Sketch and explain a pneumatic power drive used for robots.

11. What are the basic components of a robotic system? Explain the functions of each of the components with a neat sketch.

12. What is the work envelope of a robot? Sketch and explain the following robots indicating the joints and degree of freedom.

 i) Cylindrical robot. ii) Anthropomorphic robot.

13. What do you mean by robot motions? With the help of sketch describe pitch, yaw and roll motion of a robot wrist.

14. Discuss the origin and various generations of robots. Sketch and explain the work envelope of a cylindrical robot.

15. What are the various types of joints used in robots? Sketch and explain the following robots indicating the joints and degree of freedom.

 i) SCARA robot.   ii) Gantry robot.

16. Write short note on:(i) Types of automation.

(ii)Types of joints in robots.

17. Distinguish between shunt wound motor and series wound motor. Sketch and explain the principle of operation of stepper motor.

18. Compare stepper motor and D.C. motor drives for a robot. Sketch and explain a hydraulic drive system used for robots.

19. What are the advantages of hydraulic actuator systems over electrical motors? Sketch and explain a pneumatic power driveused for robots.

20. Sketch and explain the working of AC Servomotor.

UNIT-3&4

PART-A

1. What are the rules of robot?

2. Name the commonly used robot configuration system?

3. What is the tactile sensor?

4. What are the techniques used in object recognition?

5. Define End effector:

6. Draw the electronic PD controller.

7. Define manipulator kinematics.

8. What is teach pendent?

9. Write some industrial application of robot?

10. What is palletizing?

11. Write Asimov's laws of robotics?

12. What is meant by pay load capacity of robot?

13. State the advantages and limitation of a hydraulic drive?

14. What is segmentation?

15. What is meant by manipulator?

16. Draw the electronic PI controller.

17. What is kinematics?

18. What are the methods of robot programming?

19. What are the different types of material handling operation?

20. List the types of assembly operation.

PART-B

1. What are the basic components of a robotic system? Explain the functions of each of the components with a neat sketch.

2. With neat sketch explain different configuration of robots with DOF.

3. Sketch and explain the working of stepper motors in robot.

4. Sketch and explain a hydraulic drive system used for robots.

5. Sketch and explain a pneumatic manipulator control circuits used for robots.

6. Write short notes on any about the following

   a) Magnetic grippers.

   b) Vaccum Grippers.

7. Consider two frames {A} and {B}. The frame {B} is rotated with respect to frame {A} by 30o around Z-axis and the origin of {B} is shifted with respect to the origin of {A} by [5, 10, 15]. The ZA and ZB axes are parallel. A point P is described in {B} by [4, 2, 3]. Describe the same point with respect to {A} using the transformation matrix [ATB].

8. In a TL robot, assume that the coordinate system is defined at joints J2.

   i) Determine the coordinates of the end-effector point if joint J1

   twist by an angle of 30o and the variable link has a length of 1 m.

   ii) Determine variable link length and angle of twist at J1 if the end-

   effector is located at (0.7071, 0.7071).

9. Write detailed note on robot computer interface and robotcell design.

10. Discuss robots in manufacturing and non-manufacturingapplications.

11. Discuss the origin and various generations of robots.

12. Sketch and explain the servo controlled robot for point to point positioning.

13. Describe different stages of machine vision system with neat sketch.

14. Sketch and explain the working of a tactile sensor.

15. Explain the working of electronic manipulator control circuit with neat sketch.

16. Write short notes on any about the following

   a) Cam actuated gripper.

   b) Gripper based on slider crank mechanism.

17. A point P in space is defined as BP= [5, 3, 4]T relative to frame B, which is attached to the origin of the reference frame A and is parallel to it. Apply the following transformations to frame B and AP. using the three dimensional grid, plot the transformations and the result and verify it:

(i)Rotate 90o about the x-axis.

(ii)Then translate 3units about the y-axis, 6 units about the   z-axis, and the 5 units about the x-axis.

(iii) Then rotate 90o about the local z axis.

18.   An RR robot has two links of length 1 m. Assume that the originof the global coordinate system is at J1.

a) Determine the coordinate of the end-effector point if the joint rotations are 30o at both joints.

b) Determine joint rotations if the end-effector is located at (1, 0)

19.   What is meant by robot cell? Explain the different robotic cell layouts.

20.   Discuss robot application for assembly and inspection

UNIT- 5

Part A

1.   What is a sensor?

2.   What are the basic classifications of sensors in robotics?

3.   What are the desirable features of sensors in robotics?

4.   What is a tactile array sensor?

5.   What is a range sensor?

6.   What is meant by sampling?

7.   What is meant by quantisation?

8.   What is meant by encoding?

9.   What is thresholding?

10.   What are the phases of A/D conversion?

11.   What is region growing?

12.   List the various techniques in image processing & analysis.

13.   What are the techniques involved in segmentation?

14.   What are the functions of machine vision system?

15.   What is application of machine vision system?

16.   What is the frame of the vision data?

17.   Define End effector

18.   What is meant by manipulator?

19.   What is meant by gripper?

20.   How to select grippers?

21.   Draw the electronic I controller.

22.   Write different types of magnetic gripper?

23.   List the types of mechanism gripper.

24.   What is kinematics?

25.   What is forward kinematics?

26.   What is reverse kinematics?

PART-B

1.   (a) What is robot vision? Describe a vision sensor used to take the image of an object.

      (b) Discuss response, accuracy and sensitivity in relation to robot sensors. Explain the working of proximity and range sensors.

2.   Distinguish between tactile and non-tactile sensors. Sketch and explain the working of an acoustic sensor.

3.   What is pattern recognition? Briefly describe a sensing device to generate the contour picture of a work piece.

4.   What are the functions of sensors? How do you sense the positional accuracy of a robot? Describe the suitable type of sensor used to measure the position.

5.   With neat block diagram explain machine vision system in robotics.

6.   Classify the robot end-effector from the view point of control. Sketch and explain a cam actuated gripper used for robots.

7.   (a) How is a robot end-effector specified? Discuss the design considerations in the robot end-of-the-arm tooling.

      (b) What is the function of a manipulator? Discuss the working of a robotic manipulator arm with a sketch.

8.   Discuss the functions of gripper with the help of a sketch. Explain the working of magnet grippers used for robots.

9.   Compare and contrast the end-effectors from the view-point of their functions. Sketch and explain a gripper based on slider crank mechanism.

10.   Discuss the functions of manipulators. Sketch and explain a pneumatic manipulator control circuits used for robots.

11. Discuss the functions of manipulators. Sketch and explain a electronic manipulator control circuits used for robots.

12. Distinguish between two-point and three-point centering of robot gripper. Explain any two types of grippers used for robots.

13. Write short notes on any about the following

    a) Magnetic grippers.

    b) Vaccum Grippers.

14. A point P in space is defined as BP= [2, 3, 5]T relative to frame B, which is attached to the origin of the reference frame A and is parallel to it. Apply the following transformations to frame B and AP. Using the three dimensional grid, plot the transformations and the result and verify it:

    (i) Rotate 90o about the x-axis.

    (ii) Then rotate 90o about the local aaxis.

    (iii) Then translate 3units about the y-axis, 6 units about the z-axis, and the 5 units about the x-axis.

15. A point P in space is defined as BP= [5, 3, 4]T relative to frame B, which is attached to the origin of the reference frame A and is parallel to it. Apply the following transformations to frame B and AP. Using the three dimensional grid, plot the transformations and the result and verify it:

    (i) Rotate 90o about the x-axis.

    (ii) Then translate 3units about the y-axis, 6 units about the z-axis, and the 5 units about the x-axis.

    (iii) Then rotate 90o about the local z axis.