

B.E. PRODUCTION ENGINEERING 4TH YR 2ND SEMESTER EXAMINATION 2025
Subject : ROBOTIC ENGINEERING (ELECTIVE II)

Time: 3 hours

Full Marks: 100

Answer any ten questions

1. Which specifications are important when buying an industrial robot? Explain any three of them. 4+6
2. Discuss with a neat sketch, about the function and the working principle of a RCC device, that can be employed at the robot wrist for rectification of misalignment in peg and hole assembly. 10
3. Explain the working principle of the vacuum gripper. State the applications of vacuum grippers in industry. 9+1
4. Show two different types of mechanism of two fingered parallel jaw type robot grippers with revolute & prismatic joints and compare the advantages & limitations of using these two types of robot gripper? . 8+2
5. What is the basic difference between Polar & SCARA Configurations of Robot where both are R-R-P (Revolute-Revolute-Prismatic) configurations? Discuss with suitable figures. Can a revolute joint of a robot be actuated using a piston & cylinder type prismatic actuator? Show necessary figure for that. 6+4
6. A cylindrical work-piece of weight 8kgf with its axis vertical is to be picked up by a robot gripper with three fingers, using friction between the object and the fingers. The co-efficient of friction, $\mu = 0.2$. The gripper is attached to a SCARA type robot. Calculate the minimum gripping force, to be exerted by each finger when the work piece is being picked up vertically upwards with an acceleration, $g/2$. (g =acceleration due to gravity) 10
7. Can a revolute joint of a robot be actuated using a piston & cylinder type prismatic actuator? If answer is 'yes' show a figure for that. Compare the advantages & disadvantages of different drive systems used for robots. 4+6
8. How many degrees of freedom (minimum) are required to position the end-effector at any point within the working envelope of a robot? How many additional degrees of freedom are required at the robot wrist & for what purpose? Show how this can be achieved, using a neat sketch of a robot wrist. 1+3+6

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- 9.a) What do you mean by 'location variable' in a robot language? Explain the world coordinate and joint coordinate systems for defining a location variable in a robot language. 2+4
- b) What do you mean by direct and inverse kinematics in robotics? 4
10. Write a robot program in VAL-II for a palletizing operation, in which a robot has to pick up 20 objects from a fixed location, and to place them in a pallet in the form of an array of 4 rows and 5 columns. The rows and columns are parallel to x-axis and y-axis respectively, and are 200 mm & 150 mm apart respectively. 10
11. What are the reasons for employing sensors in robots? Distinguish between internal and external robot sensors with suitable examples. 5+5
12. Explain the working principles of:
- (i) an inductive proximity sensor
 - (ii) an optical proximity sensor
- 6+4
- 13.a) Explain 'edge detection' technique of segmentation in vision processing? 5
- b) What are the major applications of vision system in robotics? 5