Ref. No. : Ex/PROD/PE/B/T/421C/2024

B.E. PRODUCTION ENGINEERING 4TH YR 2ND SEMESTER EXAMINATION 2024

Subject : ROBOTIC ENGINEERING (ELECTIVE II)

Time: 3 hours **Full Marks: 100**

Answer any ten questions

1. Show the basic components of a robot using a neat sketch of an industrial robot, indicating the locations of actuators and internal sensors for the various joints and the electrical interface between them & the various components of the robot controller. 10

2. Which specifications are important when buying an industrial robot? Explain any three of them. 4+6

3. 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

4. Explain the working principle of the vacuum gripper. State the applications of vacuum grippers in industry. 9+1

5. 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

6. 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

7. A cylindrical work-piece of weight 20 kgf 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, u = 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

8. State the advantages and limitations of different drive systems used for industrial robots. 10

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9. Write a robot program in VAL-II language for a de-palletizing operation. The robot has to pick up 24 objects from a pallet, and to place them in a fixed location. The objects, to be picked up, are arranged in an array of 4 rows and 6 columns, where the rows and columns are parallel to x and y axes respectively, and are 300 mm & 200 mm apart respectively. 10

10. A robot has to pick up three different types of parts in a repeated fashion from a fixed location whenever any part is present there, and to place them in three different locations depending on the types of the parts. The presence of a particular type of part is indicated to the robot controller by a vision system (that recognizes the parts) which sends a binary value '1' ('ON') to any one of three binary input channels (numbered 2, 3 & 4). Write a robot program in VAL-II for performing the operation. 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 the following:
    (i) an inductive proximity sensor
    (ii) an optical proximity sensor 6+4

13.a) What is 'segmentation' in vision processing? Discuss edge detection technique. 2+5

b) What do you mean by direct and inverse kinematics in robotics? 3