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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B. E. - Mechanical Engineering

Semester End Examination; July - 2021

Industrial Robotics

Time: 3 hrs

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Define Industrial robot. Discuss about a brief history about robotics. 10
- b. With neat sketches, explain resolution, accuracy and repeatability with respect to robot. 10
- 2 a. Sketch and explain any two configurations of industrial robots with its merits. 10
- b. With a neat sketch, explain CAM actuated and screw actuated mechanical grippers. 10
- 3 a. Discuss hydraulic and electric drive systems of industrial robots with relative advantages and disadvantages. 10
- b. Explain the following feedback devices: 10
 - i) Potentiometers
 - ii) Encoders
- 4 a. Explain electric actuators used in industrial robots. 10
- b. Discuss the velocity sensors and proximity sensors used in industrial robots. 10
- 5 a. Describe the Euler angle representation of system-II and system-III. Also derive the Eulerian rotation matrix of system-I. 10
- b. Find the resultant rotation matrix that represents a rotation of ϕ angle about the OY axis followed by a rotation of θ angle about the OW axis followed by a rotation of α angle about the OU axis. 5
- c. If $a_{xyz} = (4, 3, 2)^T$ and $b_{xyz} = (6, 2, 4)^T$ are the coordinates with respect to the reference coordinate system, determine the corresponding points a_{uvw} , b_{uvw} with respect to the rotated OUVW coordinate system, if it has been rotated 60° about the OZ axis. 5
- 6 a. With a neat sketch, explain the steps involved in implementing DH convention. 10
- b. With a neat diagram, explain the application of DH method for 3-axis robot arm articulated robot and obtain the transformation matrices. 10
- 7 a. Explain the features and capabilities of first generation and second generation robot languages. 10
- b. Describe the motion commands used in robot programming languages. 10
- 8 a. Discuss the end effector and sensor commands in the robot programming languages. 10
- b. Discuss the program control and subroutines in robot programming. 10
- 9 a. Explain the applications of robot in die casting and plastic molding process. 10
- b. Discuss the technical considerations in arc-welding applications with respect to robots. 10
- 10 a. Explain the applications of robot in machining and stamping press operations. 10
- b. Discuss the requirements of the robot for spray coating applications 10