Total No. of Questions : 8]

SEAT No. :

P1023

[Total No. of Pages : 3

[5870] - 1214
T.E. (Electronic and Telecommunication)
ROBOTICS
Principles of Robotics (Honors)
(2019 Pattern) (Semester - I) (304181 HR)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory. i.e. Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) What are the different types of Grippers? Explain Mechanical Grippers with specification. **[6]**

b) Enlist what are the various process tools which can be used as a end effectors. Explain any one in detail. **[6]**

c) A block of weight having 1400N is to be gripped as shown. Find the clamping force. Assuming safety factor = 2, Coefficient of friction $\mu = 0.2$. Center of gripping does not coincide with center of gravity. (Refer fig.1). **[5]**

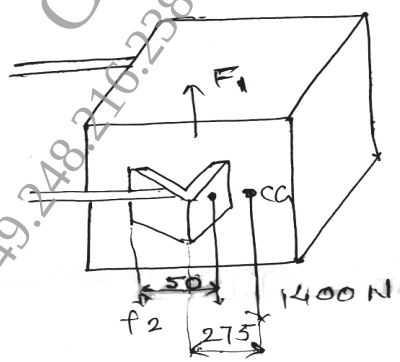

Fig. 1. Gripper Force Analysis

OR

Q2) a) Compare pneumatic & Hydraulic grippers. **[6]**

b) Which devices can be used as end effector in robotics? How to achieve end effector interface? **[6]**

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c) A 5kg rectangular block is to be gripped in the middle & lifted vertically at a velocity 1m/s. If it accelerates to this velocity at 27.5 m/s^2 & the coefficient of friction between gripping Pads & block is 0.48, Calculate the minimum force that would prevent slippage (Refer fig.2) **[5]**

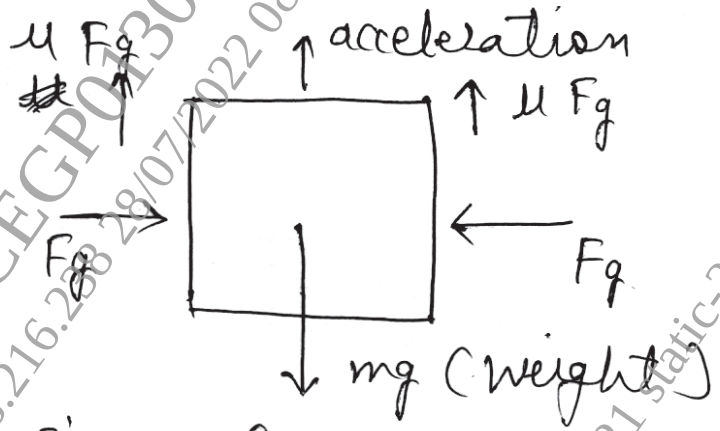

Fig-2. Gripper force

Q3) a) What are different types of Safety sensor used in Robotics? Explain any one of them with the help of neat sketch. **[6]**

b) With the help of neat diagram explain the operation of Ultrasonic range finder. **[6]**

c) What are the different position sensors used in robotic applications? Explain any one in detail. **[6]**

OR

Q4) a) Write short note on : **[8]**

i) Thermocouple

ii) Piezoelectric transducer

iii) Incremental encoder

iv) Photovoltaic transducer

b) What are the different types of proximity sensors used in robotics applications? Explain capacitive proximity sensor in detail. **[5]**

c) Explain working principal of piezoelectric sensor. How to use it in Robotic applications? **[5]**

Q5) a) Explain how to use Joint Co-ordinate system for Robotic Manipulator. **[6]**

b) What is the difference between forward & reverse Kinematics? Explain in detail. **[6]**

c) Explain forward & reverse transformation of 4 DOF Manipulator. **[5]**

OR

Q6) a) Explain with the block diagram different parameters involved in Trajectory planning problem? Explain different steps in Trajectory planning? **[6]**

b) What is the importance of transformation matrix in cordinate transformation. **[6]**

c) How do you find the Jacobian Matrix of Robotic Manipulator? **[5]**

Q7) a) Explain design of robot for object recognition & categorization using vision system. **[6]**

b) What are the various robotic applications? What is significance of Microcontroller while designing these applications? **[6]**

c) Explain designing of material handling robot for industrial application with suitable diagram. **[6]**

OR

Q8) a) Explain the different safety considerations for robot based manufacturing system. **[6]**

b) Explain how to use robot for defence & surveillance industry application. **[6]**

c) Write a short note on robotics applications like arc welding, spot welding, spray painting, assembly operation. **[6]**