Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: INTRODUCTION TO ROBOTICS [MTE-3283]

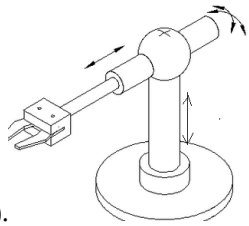
REVISED CREDIT SYSTEM
(OPEN ELECTIVE)

Time: 3 Hours MAX. MARKS: 50

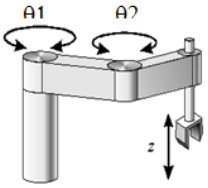
Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Draw the work volume diagram and joint notation scheme for the following Robotic Arm systems. **3**



Q1A(a).



Q1A(b).

1B. List any three difference between forward and inverse kinematics in brief. **3**

1C. Elaborate on PUMA robot anatomy with neat sketch. **4**

2A. Define the following terms in brief : **4**

i) MTTR & MTBF

ii) Control resolution & spatial resolution

2B. Explain the working principle of Hall Effect sensor with required diagram. **4**

2C. Consider a vision system uses a vidicon tube. An analogue video signal is Generated for each line of the 1024 lines comprising the faceplate. The sampling Capability of the A-D converter is 100 Nano seconds. This is the Cycle time Required to complete the A-D conversion process for 2 pixel. Using the American standard of 33.33 milliseconds (1/30 sec) to scan the entire faceplate Consisting of 1024 lines, determine the number of pixels that can be processed per line. **2**

3A. Demonstrate the working principle of capacitive proximity sensor with its Circuit diagram. **4**

3B. Determine the homogeneous transformation matrix to represent the following Sequence of operation with the graphical representation of the co-ordinates. **6**

i) Translation of Point from P_{xyz} $(1,4,2)^T$ to a length of $(5,2,1)^T$ to reach $P_{ABC.}$

ii) Rotation about B axis by an angle of 60° and Translation of -3 units along Q axis

4A. Consider 6 objects which are placed in a row of tray A with a distance of 50mm between each other. Write a program in RAPID such that robot should pick the objects one by one from tray A, and place it into tray B in row wise, which is kept 2500mm away from the tray A in y axis direction. **5**

4B. The telescopic arm of an industrial robot obtains total range of rotation of 120^0. The robot has a 12bit storage capacity for the axis. The arm fully extends to 1500mm and fully retracts to 750mm from the pivot point. Determine the robots control resolution for the axis. (i). in degrees of rotation (ii). On linear scale in fully extended and retracted position **2**

4C. Define seebeck effect. Explain about Cold junction compensation. **3**

5A. The mechanism connecting the wrist assembly is a twisting joint which can be rotated through 9.5 revolution from the start to end position. It is desired to have control resolution of rotation of $\pm 0.28^{o}$ at least. What is the number of bit storage capacity to achieve this resolution? **2**

5B. Derive an expression for the frictional force analysis of two fingered mechanical gripper mechanism with suitable sketch. **5**

5C. Discuss on Edge detection (vertical & horizontal) with reference to image Processing with suitable example. **3**