Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 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. Discuss the working of a CCD camera with suitable diagram. Give any two comparisons between CCD camera and Videcon camera. **6**

1B. Define the following : **4**

i. Seebeck effect
ii. FIXED automation
iii. Compliance
iv. Accuracy

2A. A stepper motor actuates a arm of pick and place robot. The step angle of the motor is 3.2^0. For each pulse received from the pulse train source, the motor rotates through a distance of one step angle. **4**

i) How many pulses are required to rotate the motor through four complete revolution?
ii) What is the resolution of stepper motor?
iii) What is the control resolution and accuracy of rotation?
iv) If it is desired to rotate the motor at a speed of 48 rpm, what must be the pulse rate generated by the controller?

2B. Determine the homogeneous transformation matrix to represent a rotation of robot wrist about OP-axis of fixed frame by $45^0$and a translation of -11 units along OB – axis of the mobile frame. **4**

2C. Vision system uses a Vidicon tube. An analogue video signal is generated for each line of the 512 lines comprising the faceplate. The sampling capability of the A-D converter is 120 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 512 lines, determine the number of pixels that can be processed per line. **2**

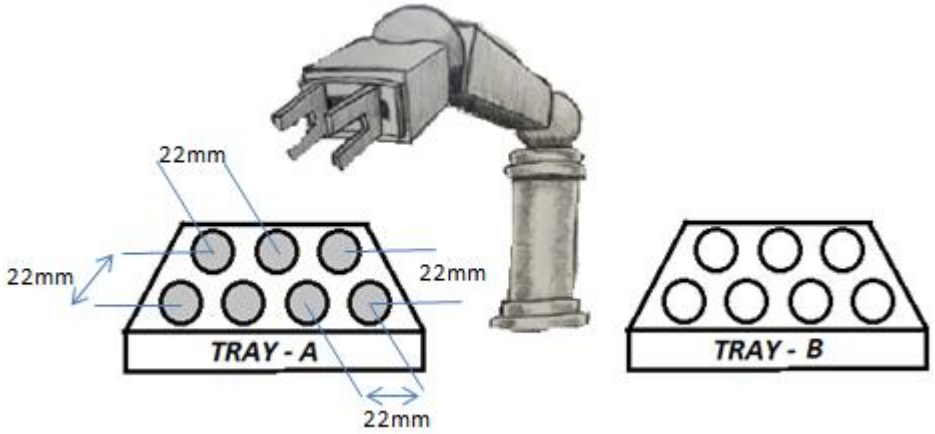
3A. The telescopic arm of an industrial robot obtains total range of rotation of 133^0. The robot has a 8bit storage capacity for the axis. The arm fully extends to 1800mm and fully retracts to 630mm from the pivot point. Determine the robots control resolution for the axis. (i). in degrees of rotation (ii). On linear scale in fully extended and retracted position **2**

3B. Elaborate on Harmonic drives with a suitable diagram by stating its application in robotics. **4**

3C. Draw a neat sketch of Polar Configuration Robot and indicate its work volume with joint notation scheme. **4**

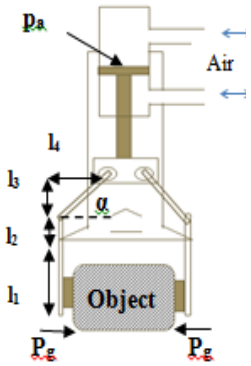
4A. A gear box has an input speed of 2300 rev/min clockwise and an output speed of 400 rev/min anticlock wise. The input power is 19KW and efficiency is 83%. Determine gear ratio, input torque , output power, & output torque. **4**

4B. Consider Tray – A and Tray – B as shown below, where Tray-A consists 7 objects in it which should be transferred to tray-B of same size. Write a RAPID program to do pick and place action of the objects by a robot arm from Tray-A to Tray-B. **6**



5A. The mechanical gripper uses friction to grasp a part weighing 18N. the co-efficient of friction between the part and the gripper pad shown in fig. is 0.17. the gripper is accelerating down with a acceleration =9.81m/s^3. The diameter of the piston of pneumatic cylinder is 58mm. assume a factor of safety=0.8 and lengths L1=71mm, L2=42mm, L3=19mm, L4=38mm.Calculate : **6**

i) Gripping force ,
ii) Actuation force,
iii) Power required,
iv) Air Pressure needed
v) Hinge force
vi) Linkage force



5B. List any two advantages and disadvantages of the Grounded and Isolated Junction Thermocouples with its neat sketch. **4**