

BE / ETRX / VIII CREV 1315/2013.
Robotics & Automation.

ws-Com-2013-1
Con. 8256-13.

(REVISED COURSE)
(3 Hours)

GS-3187
[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
(2) Solve any **four** questions out of the remaining **six** questions.
(3) Assume suitable data where **necessary** and justify the **same**.

- Q.1 a) Define hard/fixed, soft/ flexible automation and hence the relative Cost effectiveness of different types of automation with a neat sketch. 05 marks
b) What is the different between Path & Trajectory and What is Trajectory planning? 05 marks
c) Define Pixel function, Shrink Operator and Swell operator. 06 marks
d) What are the advantages & disadvantages of PLC system. 04 marks
- Q2. a) Compute the joint variable vector $q = \{q_1, q_2, q_3, q_4\}^T$ for the following tool configuration vector of the given SCARA robot, where $w = \{203.4, 662.7, 557.0, 0, 0, -1.649\}^T$. 10 marks
b) Find the joint position of the tool tip of the Adept One robot when the joint variables are $q = [\pi/4, -\pi/3, 120, \pi/2]^T$ Where $d = [877, 0.0, d_3, 200]^T$ $a = [425, 375, 0.0, 0.0]^T$ 10 marks
- Q3. a) Consider the Stanford manipulator, Derive the complete set of forward kinematic equations, by establishing appropriate D-H coordinate frames, constructing a table of link parameters. 15 marks
b) With neat sketch write basic four steps for transferring frame k-1 to frame k. 05 marks
- Q4. a) What are the important edge detection methods for polygonal objects? Explain one of the edge detection technique? 10 marks
b) What are area descriptors? What are its advantages over line descriptors? Explain the different moments to characterizing shape? 10 marks
- Q5. a) Explain how the chain code of a boundary is constructed? 05 marks
b) Consider the 8 x 10 binary image shown in Figure 1 compute the zeroth, first and second order moments, Central moments, Normalised second order moments and the principal angle of the foreground region R. 15 marks

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	1	1	0	0	0	0	0	0
0	0	0	1	1	1	0	0	0	0
0	0	0	0	0	1	1	1	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Figure 1 : A region R in 8 x 10 binary image

- Q 6. a) Explain the equivalent Ladder Diagram to demonstrate De Morgan's theorem. 10 Marks.
b) Draw a ladder diagram for two motor system having the following conditions:
The start switch start motor 1; and 15 second later motor 2 starts ; the stop switch stops motor 1 and 20 seconds later motor 2 stops. 10 Marks
- Q7. write short note on :
- Classification of robots.
 - Properties of Inverse Kinematics solutions
 - Bounded Deviation Algorithm for straight line motion planning
 - Template matching technique for part recognition.