COLLEGE OF ENGINEERING, PUNE
(An Autonomous Institute of Government of Maharashtra)
End Sem Examination
(PE 451) Robotics (Departmental Elective)
Programme: Final Year B.Tech (Production S/w)

Year: 2013-14 | Semester: I
Duration: 3 Hr | Max. Marks: 60

Instructions:
1. **Attempt any Five questions.**
2. Figures to right shows marks assigned to questions.
3. Non-programmable calculator is allowed
4. Assume suitable data if required.

Q.1 a) Define work volume and explain with sketch vertical and horizontal stroke and respective reach of robot manipulator. (4)

b) Explain with sketch the Joint motions in Robots. (4)

c) A robot having one sliding joint with a full range of 2 meter and robots control memory has a 12 bit storage capacity. Determine the control resolution and accuracy of robot. (4)

Q.2 a) Discuss servo-controlled and non servo-controlled robots. (4)

b) Explain Control resolution, Spatial resolution, Accuracy & Repeatability (4)

c) Describe the effectiveness of vacuum and magnetic grippers. Also state the limitations of each. (4)

Q.3 a) Explain Thresholding & Region growing in data analysis of machine vision system. (4)

b) Classify sensors. Explain slip sensor with suitable figure. (4)

c) Discuss the characteristics Stepper motors. (4)

Q.4 a) Explain direct and inverse kinematics. (4)

b) Explain D-H principle of link transformation. The link parameters are given in table. Obtain the transformation for a Yasukawa L-3 Motoman robot for origin of gripper w.r.t. base frame indicating all the intermediate steps. (8)

i	α_{i-1}	a_{i-1}	di	θi
1	0	0	0	90
2	90	0	5	0
3	0	3	0	45
4	0	0	2	60

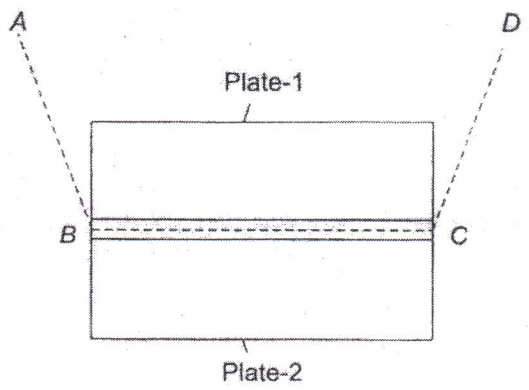
Q.5 a) Find the output voltage and the value of Kp of a potentiometer with following characteristics. Excitation Voltage = 6V, Total Wiper Travel=180^0, Initial wiper position= 60^0. (4)

b) An array of 8x8 pixels of an image with intensity values is shown in Fig. Construct a histogram and obtain the threshold value and convert the picture into Black and white image. (8)

11	12	13	11	12	13	11	12
12	13	13	12	15	16	14	18
16	23	64	65	65	68	23	16
20	24	54	75	75	55	24	20
22	26	55	75	75	54	26	22
24	44	46	48	49	46	45	24
12	42	41	46	46	55	55	12
9	10	12	13	8	10	12	14

Q.6 a) Discuss Direct costs and operating costs associated with Robot Analysis. (6)

b) Two plates of 10 mm thickness are to be welded with square butt joint as shown in Fig. The welding is straight weld with triangular weave pattern with cycle distance 5mm and amplitude 5mm. The welding torch should start from position A, move to B, continue with continuous arc welding along BC in a straight line and then move to position D. Write a VAL program in world coordinates. The speed of welding is 12 mm/s , welding voltage is 50v and welding current 65 Amp. (6)



Q.7 Write Short note on following.(Any 3) (12)

i) Remote Centered Compliance unit

ii) SCARA Robot

iii) Safety considerations in workspace design for Robot application

iv) Powered Lead Through Programming

v) Tele-operated Robots