COLLEGE OF ENGINEERING, PUNE – 5.

End Semester Examination

ILE 301 Robotics (Institute Level Elective)

Programme : **TYB Tech** Date : 24th April 2013

Specialisation : Institute Level Elective Max. Marks : 50

Year : 2012 – 13 Duration : 03 hrs.

Instructions :- 1) Figures to the right indicate full marks.

2) Assume suitable data if required.

Q.1 a) Discuss the salient features of Hard (Fixed) and Soft (Flexible) automation with the help of suitable graphical sketch and also discuss their advantages and disadvantages. Explain the relative significance of robotisation for these automation types. **[05]**

b) Discuss the term "Dexterity and Redundancy". How it is concerned with the robotics as a remedy to rigid end effectors problems? Explain RCC device with neat sketch. **[05]**

OR

b) State the meaning of the terms & explain their significance w.r.t. the robotics **(any two)** **[05]**

i) Generations of Robot ii) Accuracy, Precision & Resolution of Robot

iii) D.O.F. and D.O.M.

Q.2 a) Explain in detail **any two** sensors from the following given types.

i) Tactile Sensors iii) Proximity Sensors

iii) Force and Torque Sensors iv) Velocity sensors **[05]**

OR

a) What is a working principal of Rotary Optical Encoder Disc? Give the types of such disc. Draw a sketch of disc that can provide

i) 4 - bit binary code and ii) 4 – bit gray code. **[05]**

b) Explain the role of PID controller in the robot control systems ? Describe the working principal of this system with the help of circuit diagram and performance characteristic curve. **[05]**

OR

b) Write a detail note with figures on 'Estimation of force' for various types of Robot grippers. **[05]**

Q.3 a) The Link parameter table for Robot System is as given below,

Link	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	12	10	0
2	90^0	0	0	θ_1
3	0	9	0	θ_2

1) Obtain the transform matrices $[{}^1_2T]$, $[{}^2_3T]$ and $[{}^1_3T]$

2) Find the joint variables θ_1 , θ_2 using Forward Kinematics Approach, when coordinates of tip of the tool wrt mounting plate for performance of certain task are (2 , 6 , -9) **[05]**

b) Explain the principal of working , speed torque characteristics and peculiar feature of **any one** types of electric drives which are to be used for small capacity Industrial Robot. **[05]**

Q.4 a) A 10 X 10 image has intensity values as given below. **[05]**

33	34	32	37	41	33	32	41	36	33
41	36	40	36	34	36	34	40	34	32
33	39	32	39	37	32	39	33	40	33
35	37	40	35	40	40	34	40	34	41
41	36	34	41	39	42	40	32	34	35
41	41	32	39	39	39	33	37	35	41
33	34	40	35	40	40	36	40	33	34
32	39	34	42	32	33	39	34	41	35
35	35	40	34	39	40	36	39	33	34
42	33	35	41	39	40	34	33	33	36

i) Construct a histogram and obtain the threshold value

ii) Convert the picture into black and white image after smoothening binary images

iii) Find the outlines of the picture expressed as an image in this array.

b) Compare the terms "Walk Through and Lead Through Programming" for Robotic Manipulators in brief and explain the advantage of alternative solutions for inverse kinematics programming. **[05]**

OR

b) Give the details of Artificial Intelligence techniques for Robots with elaborations. **[05]**

Q. 5. Write a note with neat sketches, specific points & equations. (**any two**) **[10]**

i) Dynamics of Robots for better control

ii) Significance of Inverse Kinematics for Robotics

iii) Robot programming languages.

iv) Types of Preprocessing techniques for Image processing.

v) Trajectory Generations for robotics.

########## ********** ##########