BE, Comp. - VIII, Electronics, CBGS, SH2016
02/12/16

Robotics

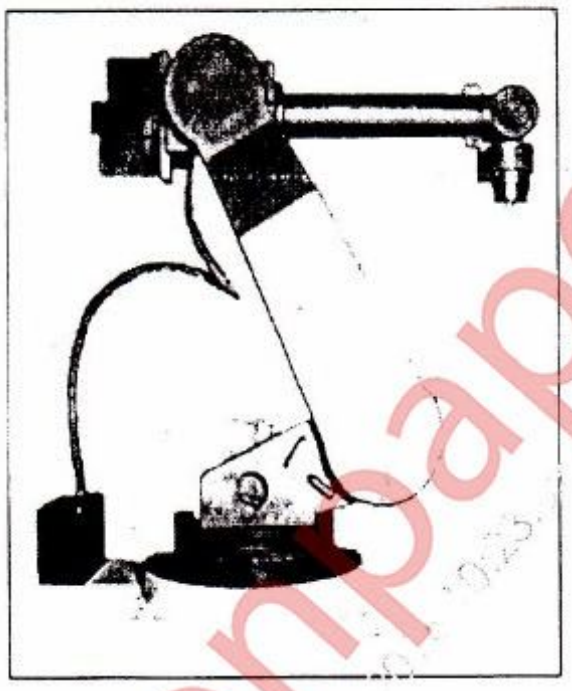
QP CODE : 732401

(3 Hours) [Total Marks: 80]

N. B.:
1. Question No. 1 is compulsory.
2. Attempt any three questions from the remaining five questions.
3. Assume suitable data if necessary.
4. Figures to the right indicate full marks.

Q.1. Answer following questions in brief.

a Draw the approximate workspace for the following robot. Assume the dimensions of the base and other parts of the structure of the robot are as shown below. (05)

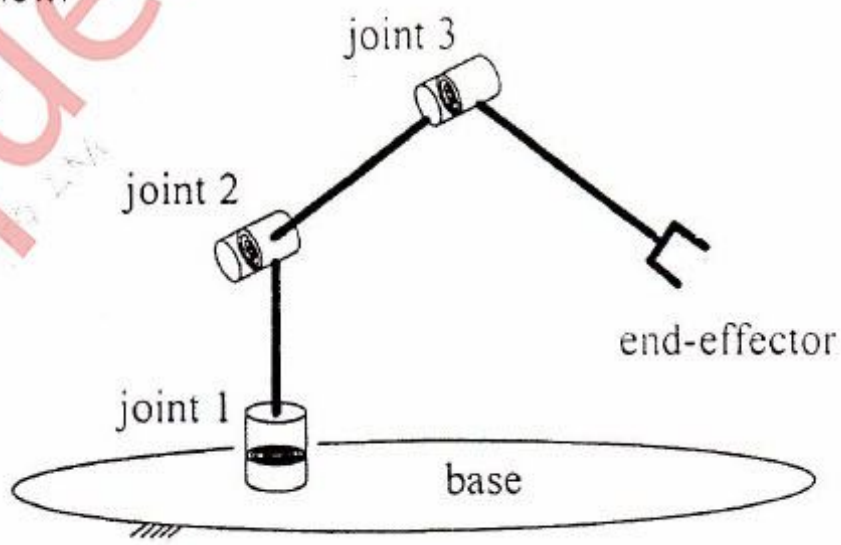


b What is a homogeneous transformation matrix? Give the transformation matrix for pure translation and rotation matrix about y-axis. (05)

c Discuss wave-front planner in brief. (05)

d What is Histogram? Explain the use of Histogram in image processing. (05)

Q.2. a A 3-DOF robot arm has been designed for applying paint on flat walls, as shown below. (12)



- Assign coordinate frame as necessary based on the D-H representation
- Write parameter table
- Find the ${}^{U}T_{H}$ matrix.

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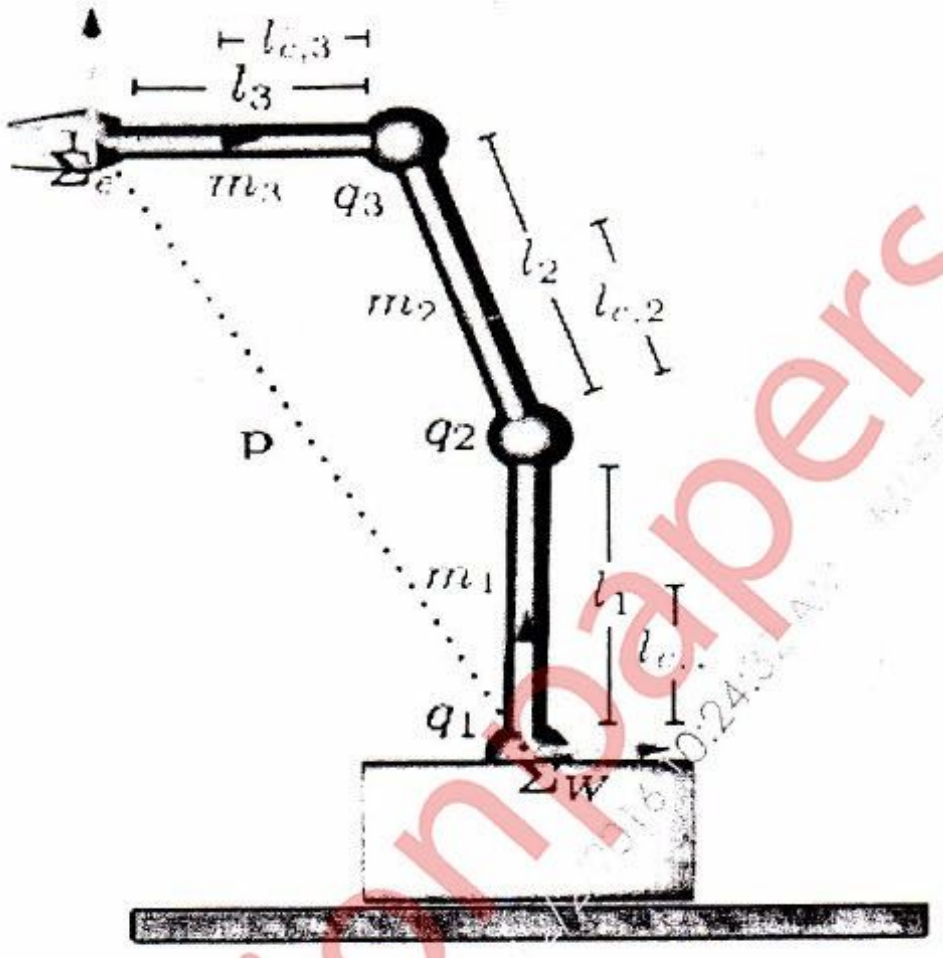
b Define the following terms . (08)
- Roll, Pitch and Yaw angles
- Euler angles
- Articulated joints

Q.3. a Discuss differential rotation about reference axes. (08)
b Derive the equations of motion for the system shown below: (12)



Q.4. a Explain Bug1 algorithm and compare it with Bug2 algorithm. (10)
b Explain how you will use attractive/repulsive potential function method to handle moving objects. (10)

Q.5. a What is visibility graph? Explain algorithm to construct visibility graph. (10)
b Differentiate between (10)
I. Path versus trajectory
II. Joint space versus Cartesian space

Q.6. Write short notes on
a Trajectory planning (05)
b Robot applications (05)
c Potential function in non-Euclidean spaces (05)
d Construction of GVD (05)

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