INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – May 2021

IV SEMESTER - INDUSTRIAL ROBOTICS [IMET 244]

(Branch: Mechatronics)

Time: 3 Hours **Date: 24 May 2021** **Max. Marks: 50**

- ✓ **Answer ALL the questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. **(5)**

Identify the joint notations for the following robots. Draw the work envelops and give an example for each of the configurations shown below.

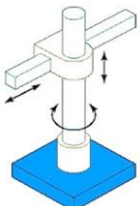

Figure Q1A- 1

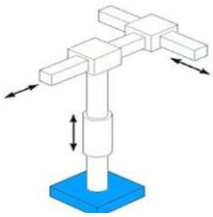

Figure Q1A- 2

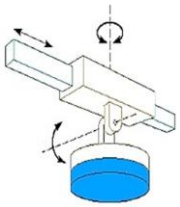

Figure Q1A- 3

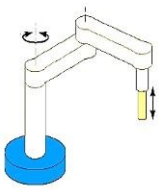

Figure Q1A- 4

1B. Describe features and capabilities of future industrial robots. **(5)**
Write a short note on flexible manufacturing system associated with the capabilities of future robots.

2A. Describe magnetic grippers. Explain different types of magnetic grippers. **(5)**

2B. Discuss the working of hybrid stepper motor used as robotic actuator. **(5)**
Differentiate between unipolar and bipolar types of stepper motors.

3A. What is the need of sensors in a Robot? Describe on the working principle of three motion sensors which we use in a Mobile robots. **(5)**

3B. Consider a robot arm initially its end effector is located at the OPQR plane. **(5)**
Determine the homogeneous transformation matrix after the following sequence of operations to reach OABC

i) Rotation of 60° about OR-axis.

ii) Translation of -22° units along OX-axis.

iii) Rotation of 55° about OZ axis.

iv) Translation of -9 units along OC-axis.

4A. The coordinates of point P in frame {1} are $[3 \quad 2 \quad 1]^T$. The position vector P is rotated about the z-axes by 45°. Find the coordinates of point Q, the new position of point P. **(5)**

4B. If there are two reference frame {A} and {B} and ${}^A_B X$, ${}^A_B Y$, ${}^A_B Z$ represents the X,Y and Z axis respectively for frame {A} represented in reference frame {B},Find out the rotation matrix between {A} and {B}. **(5)**

5A. Derive the DH Parameters of a Three-link Planar Arm. Write down the representation of a, α, d, θ in DH parameters. **(7)**

Neatly sketch and describe

(i) DH parameters of a Revolute-Prismatic Planar Arm

(ii) DH Parameters of a Prismatic-Revolute Planar Arm

5B. Describe on the essential characteristics which a robot should possess with the help of a neat block diagram. **(3)**

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