

Time: 3 Hours

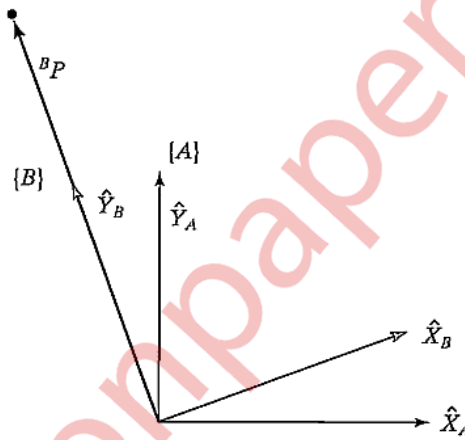
Marks: 80

- N.B.: (1) Question No. 1 is Compulsory.
 (2) Attempt any three questions out of the remaining four.
 (3) Each question carries 20 marks and sub-question carry equal marks.
 (4) Assume suitable data if required.

Q.1. 20

A Following figure shows a frame {B} that is rotated relative to frame {A} 5

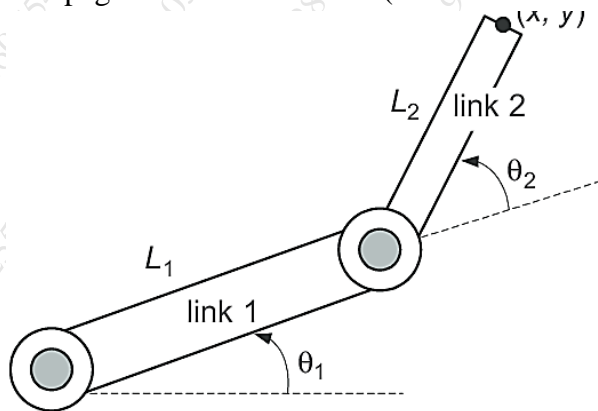
about Z by 30° . Given point ${}^B P = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$, find ${}^A P$.



- B Define following parameters using neat diagram: link length, link twist. 5
 C What is workspace? Define Dextrous workspace and Reachable workspace. 5
 D What are the challenges in localization? Explain, in brief, effector noise. 5

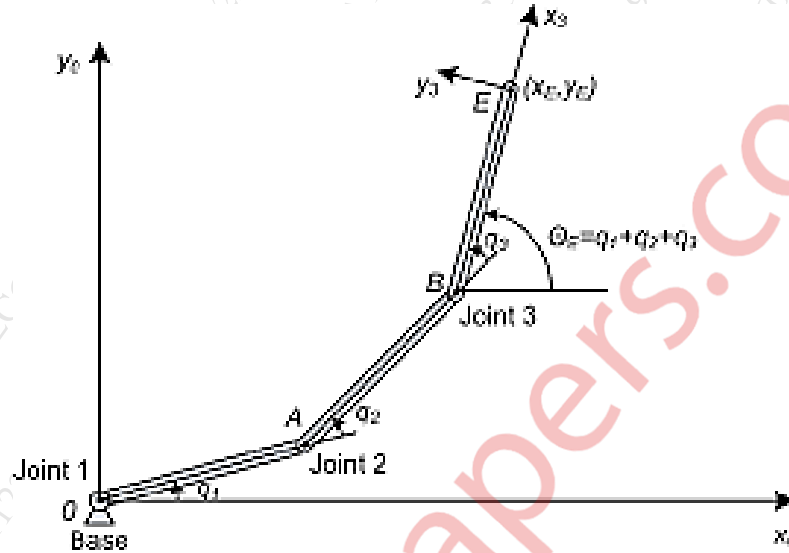
Q.2. 20

A Consider the two-link planar arm of Figure 2a. The joint axes z_0 and z_1 10
 are normal to the page. Derive T-matrices (transformation matrices).



B How potential field can be used for robot navigation? Also, explain use 10
 of potential field for obstacle avoidance.

- Q.3. 20
- A Write short note on application of mobile robot for military application. 5
- B Write short note on Humanoids. 5
- C Solve the inverse position kinematics for the manipulator of Figure 3B. 10



- Q.4. A Explain, in brief, an architecture for landmark based navigation. 10
- B Discuss forced control for robotics manipulator with neat diagram. 10
- Q.5. 20
- A Explain D-H algorithm in detail. 10
- B Describe position and orientation path panning for robotic manipulator. 10
- Q.6. 20
- A Explain, in brief, need for service robot. 5
- B Write short note on design and control issues of robotic manipulator. 5
- C Why we need transformation? Explain, in brief, homogeneous transformation. 5
- D Write short note on Monte Carlo navigation. 5
