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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech (Minor) Degree Examination December 2022 (2021 admn.)

Course Code: RAT281

Course Name: BASICS OF ROBOTICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1	Define the following terms in a robotic working contest - Repeatability, Precision and Accuracy	(3)
2	Describe the characteristics of spray painting robot?	(3)
3	Discuss upon the different stages involved in image acquisition	(3)
4	Summarize the working of a linear actuator.	(3)
5	Explain the features of a PUMA robot.	(3)
6	Illustrate upon the working of magnetic grippers.	(3)
7	A frame is rotated with respect to the initial frame about the x axis by an angle of 60°. The opposition of the new frame as seen from the initial frame is $D_2^1 = [7 \quad 5 \quad 7]^T$. Obtain the transformation matrix ${}^1T_2$ which describes second frame relative to the initial frame.	(3)
8	How will you compute end effector position and orientation of a robotic arm?	(3)
9	Comment upon the requirement of a nonlinear control techniques for robotic systems	(3)
10	Discuss upon the dynamic modelling of 1DOF robot.	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11a	What are the different types of joint normally used robot manipulators?	(9)
b	Write note on degree of freedom of a 3D body.	(5)
12a	Explain in detail any two robotic application in defence sector.	(10)
B	Differentiate between point to point and continuous path robotic motion	(4)

Module 2

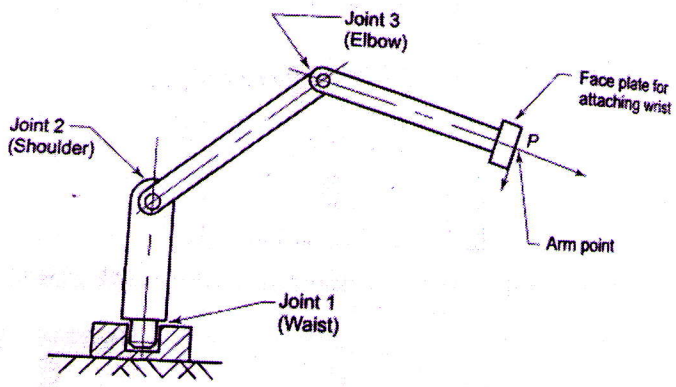
13a	Describe the working of a typical hydraulic actuator.	(8)
b	What are the different techniques involved in image processing	(6)
14a	Illustrate upon the working of a brushless DC motor.	(7)
b	Explain the working of any two commonly used non-contact type proximity sensors	(7)

Module 3

15	With the help of neat sketches explain different robotic configurations.	(14)
16	With supporting diagrams classify robotic end effectors and grippers based on the gripping technique used.	(14)

Module 4

17	Obtain the forward kinematics of the 3 DOF manipulator	(14)



18	Assume that a robot has to move from 0° to 90° in 5 second. The initial and final joint rates are respectively 25°/s and -25°/s. In the intermediate point of 45° at time t=3s, the joint rate is assumed to be -8°/s. obtain the cubic trajectory and the associated velocity and acceleration	(14)

Module 5

19a	Obtain the dynamic model of 1 DOF robot operated by gearbox.	(8)
b	Illustrate upon transfer function and state space representation of a system	(6)
20a	Describe the schematic of PID controlled robotic manipulator and derive the closed loop transfer function. Explain how gains are computed for the PID controller?	(10)
b	How will you build a servo controlled robotic arm?	(4)

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