Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER III (NEW) – EXAMINATION – WINTER-2016

Subject Code: 2730808 **Date:25/10/2016**

Subject Name: Robotics Engineering

Time:02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Enlist the different types of joint commonly use in robots. Sketch any two of them.	**07**
	(b)	Discuss the direct kinematics with example.	**07**
Q.2	**(a)**	Explain reciprocal condition number and manipubality index.	**07**
	(b)	The following forces (**F**) and moment (**T**) are experienced at the base of a robot in static equilibrium. What is the equivalent force and moment at the gripper if it is located in frame **A** such that (see right side) $F = 5i + 6j + 7k$, $T = 10i + 20j + 30k$, $A=\begin{bmatrix} 0 & 0 & 1 & 20 \\ 1 & 0 & 0 & 30 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$	**07**
		OR	
	(b)	For simple pendulum derive the governing equations for dynamic equilibrium using the principle of virtual work along with the D'Alembert principle.	**07**
Q.3	**(a)**	Discuss the properties of dynamic equations in brief.	**07**
	(b)	Write the algorithm for lagrange-Euler dynamic formulation of an n-DOF manipulator that satisfies the condition for existence of closed-form geometric solutions.	**07**
		OR	
Q.3	**(a)**	Compare the Lagrange-Euler with Newton-Euler formulations.	**07**
	(b)	Explain the Joint space Cartesian trajectory planning.	**07**
Q.4	**(a)**	Write the short note on forth-order polynomial trajectory planning.	**07**
	(b)	Enlist the types of grippers and sketch any two of them.	**07**
		OR	
Q.4	**(a)**	Enlist the different type of sensors and explain any two of them.	**07**
	(b)	What do you mean by actuators? Explain working principle of any two.	**07**
Q.5	**(a)**	Explain the generalized motion control laws for robotic manipulators.	**07**
	(b)	Write the difference between robot open and closed loop control system.	**07**
		OR	
Q.5	**(a)**	Discuss about the independent joint PID control with effective joint inertia.	**07**
	(b)	Briefly explain the constant and variable speed controller.	**07**

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