Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER IV (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2740502 **Date:04/05/2016**

Subject Name: Robotics and Intelligent Systems

Time:10:30 am to 01:00 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)**	With necessary details, derive an equation of obstacle range calculation of mobile robot sighting necessary steps. Clearly mention assumptions to be made.	**07**
	(b)	Define a) Response time and b) Accuracy c) Sensitivity d) Linearity, in context of sensors used for robots.	**07**
Q.2	**(a)**	Explain Road map/ potential field approach in case of mobile robot path planning. Compare both approaches in terms of accuracy, complexities.	**07**
	(b)	In intelligent system, Compare following neural network training approaches in terms of computational complexities, accuracy and other related parameters. I. Heuristic training II. Discrete sample based training	**07**
		OR	
	(b)	In intelligent system, critically evaluate following concepts in terms of computational complexities, speed, accuracy and other related parameters. I. Concept of sensors grouping II. Quantization of sensor values	**07**
Q.3	**(a)**	Draw and explain architecture diagram for i) MAP based and ii) behavior based navigation of mobile robot.	**07**
	(b)	Enlist objectives of fuzzy based car parking system. Explain in brief following: a) forward /reverse car parking system and b) algorithm steps (rough) for car parking system	**07**
		OR	
Q.3	**(a)**	In context of optimization on robotics answer following: a) Challenges for optimization in real robotics application b) List three examples of use of optimization in Robotics, mentioning respective objective functions, variables and constraints	**07**
	(b)	Explain hybrid systems, in general. In context of autonomous mobile robot navigation, explain clearly (with rough graph if required) advantage of Neuro-fuzzy system compared to i) Single stage neural system ii) Single stage fuzzy system.	**07**
Q.4	**(a)**	Differentiate between active and passive transducers. Name three active and three passive transducers used for robotics. What are their merits and demerits?	**07**
	(b)	Describe different types of locomotion used for robots. Compare and contrast with each other.	**07**
		OR	
Q.4	**(a)**	Describe closed loop controller action for controlling speed of a DC motor, using neat block diagram and strategies. Explain clearly interfacing of sensors used in it.	**07**
Q.4	**(b)**	Differentiate concept of kinematics and dynamics in context of robotics. Explain its significance in robotics design.	**07**
Q.5	**(a)**	Draw rotary 4 bit grey encoder disk, for position/angular velocity measurements for motor used for robots. Is 4 bit grey encoder is better than one bit encoder? Justify answer.	**07**

	(b)	Explain Electric actuators and Hydraulic Actuators for robots. Compare them based on their basic principles of working. Describe their relative merits and demerits.	**07**

OR

Q.5	**(a)**	What is homogeneous matrix in context of robot motion planning? Derive it for translation in XY plane, followed by a rotation around Z axis by theta. Compute coordinates reference to original axis, if translation is done by (6,5) and rotated around Z axis by 45°.	**07**
	(b)	1) Explain working principal of Air muscle actuator, with neat diagram. 2) Describe advantages of stepper motors compared to other electric actuators.	**07**

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