GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV (Old) EXAMINATION – WINTER 2019

Subject Code: 141701   **Date: 14/12/2019**

Subject Name: Control Theory

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)**	Write short notes on open loop control systems and closed loop control systems. Discuss their advantages and disadvantages.	**07**
	(b)	Explain Standard Test signals & derive equation of steady state error. Discuss steady state error constants also.	**07**
Q.2	**(a)**	Explain Rules for block diagram reduction technique.	**07**
	(b)	Explain constant-M circles and constant-N circles by deriving related expressions. Explain how resonant peak can be obtained.	**07**
		OR	
	(b)	State and explain Nyquist Stability criteria. Explain about phase margin and gain margin using Nyquist plot.	**07**
Q.3	**(a)**	Derive expressions of (i) Rise time, tr (ii) Peak time, tp and (iii) Peak overshoot, Mp	**07**
	(b)	Draw the approximate root-locus diagram for close loop system whose transfer function is given by G(S)H(S) = K/ S (S+2) (S+5)	**07**
		OR	
Q.3	**(a)**	Briefly explain the first order system and its time response to a unit ramp input.	**07**
	(b)	Derive the transfer function for armature controlled DC motor.	**07**
Q.4	**(a)**	By means of Routh criterion, determine the stability of the system described by characteristic equations. (1) $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$ (2) $3S^4 + 10S^3 + 5S^2 + 5S + 2 = 0$	**07**
	(b)	Explain force current and force voltage analogy with suitable example.	**07**
		OR	
Q.4	**(a)**	Explain Mason's Gain Formula for signal flow Graph with a simple example.	**07**
	(b)	Draw the Polar Plot for the open loop transfer function G(S) = 100/ (S+2) (S+4) (s+8).	**07**
Q.5	**(a)**	Define the following terms:- (1) Gain Margin (2) Phase margin (3) Gain cross over frequency (4) phase cross over frequency (5) Band Width (6) Corner frequency (7) Transfer function.	**07**
	(b)	Draw the Bode Plot for the system having the following transfer function G(S)= 10/ S (S+1) (S+10) and determine stability of the system.	**07**
		OR	
Q.5	**(a)**	Explain the various rules for construction of root locus.	**07**
	(b)	Write definitions of state and state variables. Derive expression of transfer function of the system which is represented in the following standard state space form: $\dot{X} = AX + BU$ And $Y = CX + DU$	**07**

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