Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (OLD) EXAMINATION – WINTER 2018

Subject Code: 171701 **Date: 03/12/2018**

Subject Name: Control System Design

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.**

			MARKS
Q.1	**(a)**	Compare merits and demerits of Conventional control approach over modern Control approach.	**07**
	(b)	Derive the state space model for a series RLC circuit having the values of component as under: R= 10K ohm, L= 10mH, C=10 uF.	**07**
Q.2	**(a)**	Design a suitable compensator in time domain for a transfer function G(s) = $\frac{K}{(s^2)}$ for specification as under. Peak overshoot Mp ≤ 20 % , Settling time ts ≤ 4 sec.	**10**
	(b)	Explain the design steps of Lag compensator in time domain.	**04**
		OR	
	(b)	Explain the dynamics of standard second order step response of the system like peak overshoot, rise time etc.	**04**
Q.3	**(a)**	Design a suitable compensator using Bode plot for unity feedback system to meet following performance specifications. Acceleration error constant Ka=10 and Phase Margin ≥35. $$G(s) = \frac{K}{s^2(0.2s+1)}$$	**10**
	(b)	Derive the state space model from a SISO Transfer function given as under. G(s) = 1/s(s+1)	**04**
		OR	
Q.3	**(a)**	Explain with suitable example Contrability and observability.	**07**
	(b)	Draw the bode plot of G(s)= $\frac{K}{s(s+1)(s+4)}$ for Kv=5 and find out gain margin and phase margin.	**07**
Q.4	**(a)**	State and prove linearity and time reversal properties of z transform.	**06**
	(b)	Find out the z transform for 1. Unit step 2. X(n) =(coswn) * u(n)	**08**
		OR	
Q.4	**(a)**	State and prove time scaling and differentiation properties of z transform.	**06**
	(b)	Find the inverse z transform for x(z)=$\frac{1}{1-1.5z^{-1}+0.5z^{-2}}$	**08**
Q.5	**(a)**	Check the controllability and observability of the system given with state matrices as $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -2 & -3 & -5\end{bmatrix}$, $B=\begin{bmatrix}0\\0\\1\end{bmatrix}$, $C=\begin{bmatrix}1 & 0 & 0\end{bmatrix}$	**10**
	(b)	State and prove the properties of state transition matrix.	**04**

OR

Q.5	**(a)**	Explain robust PID controller.	**07**
	(b)	Explain optimal control system.	**07**

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