Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:141701 **Date: 10/12/2018**

Subject Name: Control Theory

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)** State and explain Open loop and Closed loop control systems. Also, compare their merits and demerits. **07**

(b) Using block diagram reduction technique find the closed loop transfer function of the system whose block diagram is given in figure 1. **07**

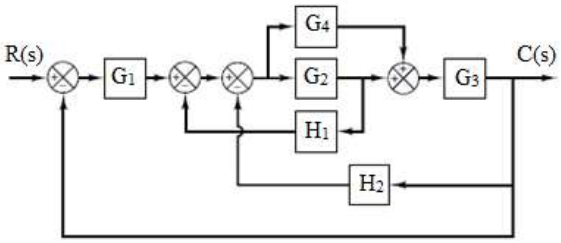

Figure 1

Q.2 **(a)** Define Following Terms: **07**
(I) Transfer Function (II) State (III) Self Loop (IV) Source Node (V) Rise Time (VI) Delay Time (VII) Peak Time

(b) A unity feedback system is characterized by open loop transfer function $G(s) = K/s(s+8)$. Determine gain K so that system will have damping ration of 0.7. **07**

OR

(b) A system has transfer Function $C(s)/R(s) = 10 / s+2$. Determine its unit impulse, step and ramp response with zero initial conditions. Sketch the response. **07**

Q.3 **(a)** What is analogous system? Explain Force-Voltage and Force-Current Analogy with suitable example. **07**

(b) A coupled spring-mass system is shown in the figure 2. Obtain the differential equations describing the system. **07**

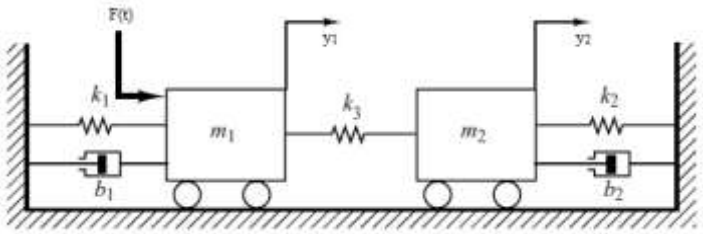

Figure 2

OR

Q.3 **(a)** Describe Correlation between transfer function and state-space equations with suitable example. **07**

(b) Obtain a state-space representation of the system shown in figure 3. **07**

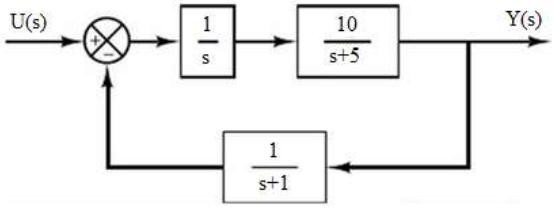

Figure 3

Q.4	**(a)**	Explain two position ON-OFF control action with example.	**07**
	(b)	Determine range of K for system stability for the characteristic equation of feedback system is $S^4 + 20S^2 + 15S^2 + 2S + K = 0$.	**07**
		OR	
Q.4	**(a)**	State and explain the Nyquist stability criterion use to determine system stability.	**07**
	(b)	Sketch the Bode plot for the transfer function $G(s) = 10/s(1 + 0.5s)(1 + 0.01s)$. Also, determine Gain margin, Phase margin and comment on system stability.	**07**
Q.5	**(a)**	Define: Root locus, Frequency response, Gain margin, Phase margin, Polar plot, Bode plot, Break-in point.	**07**
	(b)	Draw the Nyquist plot for $G(s) = 1/s(s - 1)$ and comment on system stability.	**07**
		OR	
Q.5	**(a)**	State and explain the Nyquist stability criterion use to determine system stability.	**07**
	(b)	Sketch the Root locus plot for the unity feedback system having $G(s) = K/s(s + 2)(s + 4)$.	**07**

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