

**End Semester Examination – April/May – 2017**

**Code : 14EI2005**  
**Sub. Name : Control Systems**

**Duration : 3hrs**  
**Max. marks : 100**

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	<p>Convert the following block diagram into signal flow graph</p> <p>A. Find out the overall transfer function.</p> <p>B. Verify the the same using block diagram reduction rules.</p>	CO1	15+5
(OR)				
2.	a.	<p>Write the differential equations governing the mechanical rotational system shown below and determine the transfer function <math>\theta(s)/T(s)</math></p>	CO1	20
3.	a.	<p>A unity feedback system is characterized by open loop transfer function</p> $G(s) = \frac{15}{(s+1)(s+3)}$ <p>Find the Delay time, Rise time, Peak time, Peak overshoot, Settling time for a unit step input.</p>	CO2	20
(OR)				
4.	a.	<p>Find <math>K_p</math>, <math>K_v</math>, <math>K_a</math> and steady state error for a systems with open loop transfer function as: <math>G(s) = \frac{100}{s^2(s+2)(s+5)}</math> where the input is unit ramp</p>	CO2	14

	b.	A unity feedback system is characterized by open loop transfer function $G(s) = \frac{20}{(s+1)(s+4)}$ Obtain the damping ratio, damped frequency and natural frequency.	CO2	6
5.	a.	Sketch the Bode plots of the following transfer function. $G(s) = \frac{5}{s(1 + 0.2s)(1 + 0.02s)}$ Determine the gain cross over frequency, phase cross over frequency, Phase Margin and Gain margin.	CO3	20
(OR)				
6.	a.	Draw the polar plot for the following open loop transfer function and determine Gain Margin and phase margin. $G(s) = \frac{1}{s(s + 0.1)(s + 0.2)}$	CO3	20
7.	a.	Find the range of K such that the closed loop system is stable whose characteristic equation is $S^4 + 22S^3 + 10S^2 + 12S + K = 0$	CO3	8
	b.	The open loop transfer function of a unity feedback control system is given by $G(S) = \frac{K}{(S + 2)(S + 4)(S^2 + S + 7)}$ By applying Routh criterion, determine marginal value of K and frequency of sustained oscillations.	CO3	12
(OR)				
8.	a.	Sketch the root locus for the open loop transfer function of unity feedback control system given below $G(S)H(S) = \frac{K}{S(S + 2)(S + 4)}$	CO3	20
<u>Compulsory:</u>				
9.	a.	State model of system is given by $\dot{X} = \begin{pmatrix} 0 & 1 \\ -3 & -4 \end{pmatrix} \begin{pmatrix} X1 \\ X2 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} U \quad \text{and} \quad Y = \begin{pmatrix} 1 & 0 \end{pmatrix} \begin{pmatrix} X1 \\ X2 \end{pmatrix}$ Find the transfer function.	CO3	20

ALL THE BEST

**Course Outcomes:**

- CO1. Represent the mathematical model of a system.
- CO2. Determine the response of different order systems for various test inputs.
- CO3. Analyse the stability of the system.