EE502

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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JANUARY 2016

Course & Branch	:	**B.E.- Electrical &Electronics Engg.**	**Semester**	:	**V**
Subject	:	**Control Systems**	**Max. Marks**	:	**100**
Subject Code	:	**EE502**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

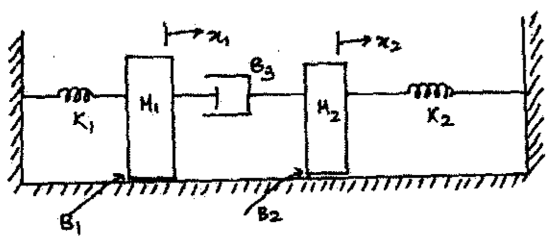
- Answer one full question from each unit.
- Assume any missing data appropriately

UNIT – I

1. a) Define closed and open loop system. List at least 3 disadvantages of Open loop systems over closed loop systems. CO1 (08)

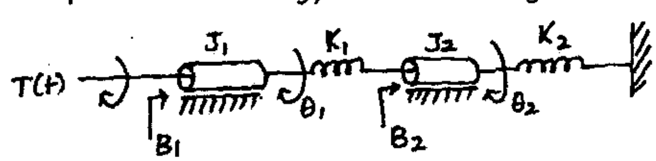
b) Briefly explain the need for mathematical modeling of a system. CO1 (04)

c) Obtain the transfer function $\dfrac{X_1(s)}{F(s)}$ of the following system CO1 (08)



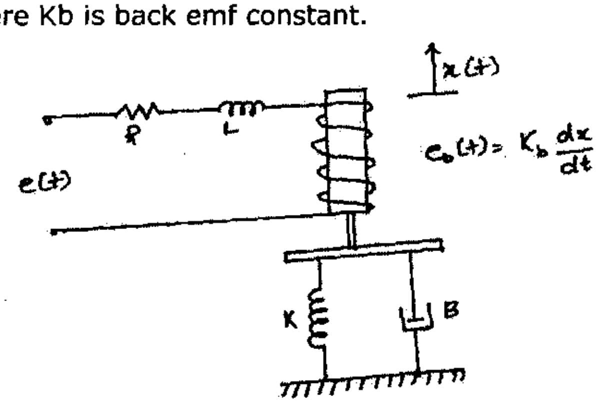
Q 1. c.

2 a) Obtain the torque current analogy of the following rotational system. CO1 (08)



Q2. a.

b) Obtain the transfer function of following electromechanical system. Where Kb is back emf constant. CO1 (12)



Q 2. b.

UNIT – II

3\. a) Illustrate how to perform the following connection with block diagram reduction techniques: CO1 (08)

i) Moving a summing point behind a block and ahead a block.

ii) Moving a take-off point behind a block and ahead a block.

b) A second order system is represented by the transfer function, $\frac{Y(s)}{U(s)} = \frac{1}{Js^2 + Bs + K}$. A step input of 10Nm is applied to system and results are, CO3 (12)

i) $\% \ M_p = 6\%$

ii) $t_p = 1\sec$

iii) The steady state value of output is 0.5 radians.

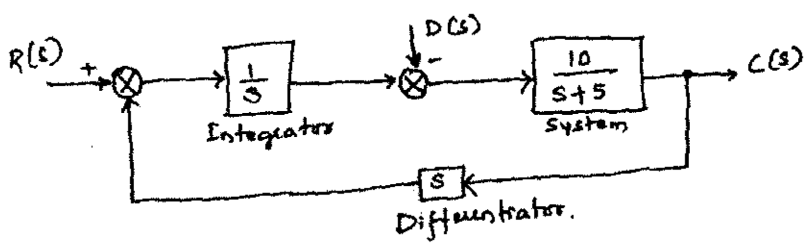
Find the values of J,B and K.

4\. a) For the following closed loop system, CO1 (12)

i) Draw SFG

ii) Find the TF $\frac{C(s)}{R(s)}$

iii) Find the settling time for system response to be within 2% of the final value when unit step disturbance D(s) occurs.



Q4. a.

b) Define steady state error? With usual notations, derive the expression for steady state error of a negative feedback system. CO3 (08)

UNIT – III

5\. a) A negative unity feedback system is having OLTF $G(s)H(s) = \frac{K(s+4)(s+20)}{s^3(s+100)(s+500)}$. Find the range of K from RH criterion for which system stable. CO2 (08)

b) State the steps of construction of root-locus from OLTF. CO2 (12)

6\. a) A system having OLTF $G(s)H(s) = \frac{K(s+1)}{s^3 + ps^2 + 2s + 1}$, oscillates with frequency 2 rad/sec. Find values of 'K_{mar}' and 'p' if system is stable. CO2 (10)

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b) Plot the root locus of the system with OLTF $G(s)H(s) = \dfrac{K(s^2-2s+5)}{(s+2)(s-0.5)}$. CO2 (10)

Comment on stability of the system.

UNIT – IV

7. a) Using Nyquist stability criterion, investigate the stability of closed loop system whose OLTF is $G(s)H(s) = \dfrac{100}{(s+1)(s+2)(s+3)}$. CO2 (10)

b) A unit step input is applied to unity negative feedback system having OLTF $G(s)H(s) = \dfrac{K}{s(1+sT)}$. CO2 (10)

Determine K and T to have peak overshoot $M_p = 20\%$ and resonant frequency $\omega_r = 6\ rad/\sec$. Also find resonant peak M_r .

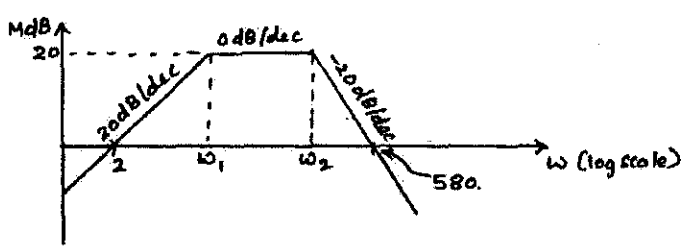
8. a) Using standard notations of a typical second order system, derive the expression for i) Resonant Peak ii) and Bandwidth. Hence mention the relation between time domain and frequency domain specifications. CO2 (10)

b) Given that $M_r = 2$ and $\omega_r = 5\ rad/\sec$, determine steady state error for a unit ramp input, for a unity feedback system with a closed loop transfer function of standard second order function. CO2 (10)

UNIT – V

9. a) Obtain the transfer function of lead compensator, for $\phi_m = 40^o$ and $f_m = 3kHz$. Assume $C = 10nF$. Also find the corner frequencies. CO3 (10)

b) Obtain the transfer function of the system whose Bode plot is as shown below. CO2 (10)



Q 9. b.

10. a) Obtain the Bode plot of unity negative feedback system, whose OLTF is $G(s)H(s) = \dfrac{K(s+0.2)}{s(s+0.01)(s+10)(s+2)}$. Determine marginal value of K. CO2 (12)

b) Explain the need for designing of a compensator with one practical example. CO2 (08)

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