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**B.E / B.Tech (Full Time ) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014**

**ELECTRICAL AND ELECTRONICS ENGINEERING**

Third Semester

**EE9201 CONTROL SYSTEMS**

(Regulation 2008)

Time: 3 Hours

Answer ALL Questions

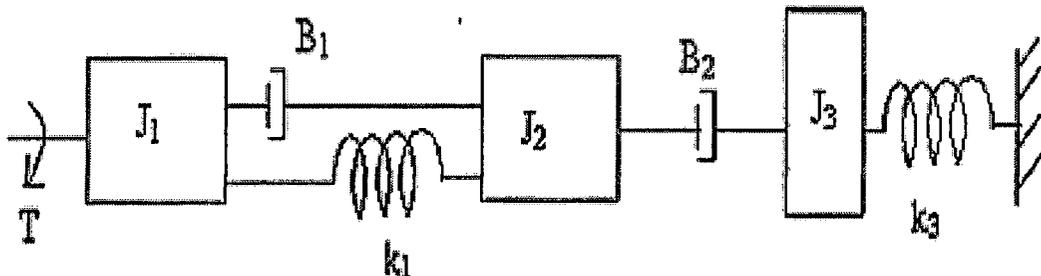
Max. Marks 100

**PART-A (10 x 2 = 20 Marks)**

1. What is control system? Mention the various elements of it in general.
2. What are the basic elements used for modeling mechanical rotational system?
3. Define Damping ratio. Give the expression for damping ratio of mechanical and electrical system.
4. What is resonant frequency?
5. What are the advantages of Bode Plot?
6. How the roots of characteristic equation are related to stability?
7. Define BIBO Stability.
8. What is the relation between stability and coefficient of characteristic polynomial?
9. What are state variables?
10. What is meant by Eigen value and state transition matrix?

**Part – B ( 5 x 16 = 80 marks)**

11. Write the differential equations governing the Mechanical system shown in figure and determine the transfer function.



- 12 a) i) Derive the expressions and draw the response of first order system for unit step input. (8)  
ii) Write and explain the rules for sketching root loci. (8)

**OR**

- b) i) Draw the response of second order system for critically damped case and when input is unit step. (8)  
ii) Derive the expressions for Rise time, Peak time, and Peak overshoot. (8)

13. a) Plot the Bode plot for the following transfer function  $G(s)$  and obtain the gain and phase cross over frequencies.

$$G(s) = 10 / s(1+0.4s) (1+0.1s)$$

**OR**

- b) Construct the polar plot for the following transfer function and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin.

$$G(s) = 10(s+2)(s+4) / s (s^2-3s+10)$$

14. a) Construct Nyquist Plot for a system with the open loop transfer function  $G(s) H(s) = 5 / s(1-s)$ .

Comment on the stability of open loop and closed loop system.

**OR**

- b) i) Construct Routh array and determine the stability of the system represented by the characteristics equation  $s^5+s^4+2s^3+2s^2+3s+5=0$ . Comment on the location of the roots of characteristic equation. (8)

ii) Write a detailed technical note on finding the stability from Bode plot with relevant expressions. (8)

15. a) Discuss in detail about the solution of state model and state variable analysis for linear continuous time systems with relevant expressions. Give the properties of state transition matrix.

**OR**

- b) Describe the concept of controllability and observability.

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