Reg. No. : | | | | | | | | | | |

Question Paper Code: 31451

B.E. / B.Tech. DEGREE EXAMINATION, NOVEMBER 2015

Fourth Semester

Electronics and Instrumentation Engineering

01UEI401 – CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Distinguish open loop and closed loop control system with an example.

2. List the steps involved to obtain the mathematical model for a physical system.

3. Calculate the value of damping ratio for a unity feedback system with open loop transfer function $G(s) = \frac{9}{s(s+2)}$

4. Identify the position error coefficient of a unity feedback system with $(s) = \frac{25}{s+6}$.

5. Calculate the frequency domain specification of a second order system whose closed loop transfer function is given by $\frac{C(s)}{R(s)} = \frac{64}{(s^2+10s+64)}$.

6. Discuss the effect of adding zero to open loop transfer function of a system.

7. Relate the roots of the characteristic equation with stability.

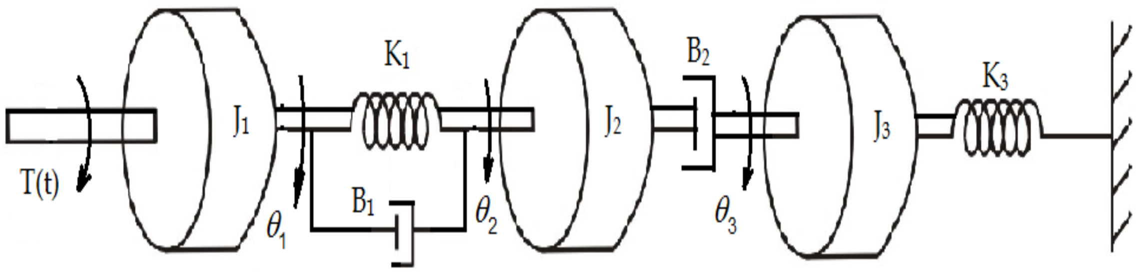
8. State Nyquist stability criterion.

9. Give any four advantages of state space analysis.

10. List the properties of state transition matrix.

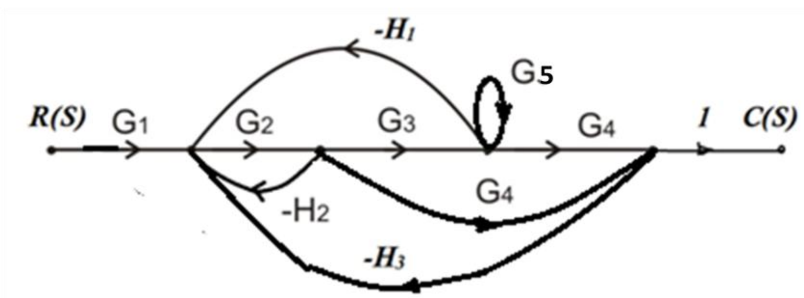
PART - B (5 x 16 = 80 Marks)

11. (a) Give the differential equation governing the mechanical rotational system for the figure shown below. Draw the torque-voltage and torque-current electrical analogous circuits and verify the same by writing mesh equations. (16)



Or

(b) Identify the overall gain for the signal flow graph shown in the below figure. (16)



12. (a) (i) Consider $G(s) = \frac{1}{s(1+0.5s)(1+0.2s)}$ in a control system having unity feedback. Calculate the values of ω_n , ξ, M_p, t_s and ω_d for unit step input. (8)

(ii) Derive the time response relation for a under damped second order system. (8)

Or

(b) Input to a unity feedback control system is $r(t) = (3 + 5t + t^2)$. Here $G(s) = \frac{1}{s(s+4)}$

Estimate various generalized error coefficients and steady state error. (16)

13. (a) Given $G(s) = \frac{Ke^{-0.2s}}{s(s+2)(s+8)}$ calculate the 'K' so that the system is stable with gain margin equal to 6 *db* and phase margin equal to 45^o . (16)

Or

(b) Explain the various types of compensation required in control system. For a control system $G(s) = \frac{5(1+0.3s)}{(1+0.1s)}$ find the type of network and maximum phase shift that will be provided by compensator. (16)

14. (a) (i) Explain the importance of routh array for carrying out the stability analysis and find the range of 'K' for stability of unity feedback system whose open loop transfer is $G(s) = \frac{K}{s(s+1)(s+2)}$. (10)

(ii) Discuss BIBO stability of a linear system with examples. (6)

Or

(b) Sketch the root locus of the system whose open loop transfer function is $G(s) = \frac{K}{s(s+4)(s+2)}$ Identify the value of 'K' so that the damping ratio of the closed loop system is 0.5. (16)

15. (a) Formulate the state model and draw the state diagram for the system represented by the transfer function using cascade decomposition $\frac{Y(s)}{U(s)} = \frac{s^2+5s+6}{s^3+3s^2+4s+2}$. (16)

Or

(b) Evaluate the transfer function of the control system represented by the following state space model. (16)

$$\dot{x} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & 4 & 6 \end{pmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix} x + u$$