

C 58320

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Name

Reg. No.

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2009**

EC 2K 601—CONTROL SYSTEMS

Time : Three Hours

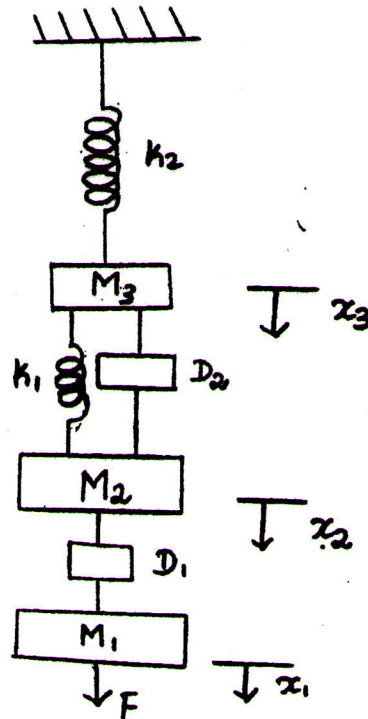
Maximum : 100 Marks

Answer all questions.

- I. (a) What is an error detector in a control system ?
(b) Differentiate between positional servomechanism and rate servomechanism.
(c) A second order system shows a resonance peak of 2 at a resonant frequency of 3 rad/sec. Calculate damping coefficient.
(d) List out the drawbacks of a lag compensator.
(e) A tachometer has a gain of 0.05 V/Crad/sec). Determine the output voltage when the shaft speed is 20 rad/sec.
(f) Define gain cross over frequency.
(g) What are the properties of state transition matrix ?
(h) Discuss the relation between poles and Eigenvalues.

(8 × 5 = 40 marks)

- II. (a) Obtain the analogues electrical network for the system given below :



Or

(15 marks)

Turn over

- (b) Derive the steady-state error for a rate servomechanism. Draw and explain the block diagram of the servo.

(15 marks)

- III. (a) (i) Using Routh-Hurwitz criterion determine the relation between K and T so that unity feedback control system whose open loop transfer function given below is stable

$$G(s) = \frac{K}{S[s(s+10) + T]}$$

(10 marks)

- (ii) Determine the modified relation between K and T if all the roots of characteristic equation as determined in (i) are to lie to the left of the line $S = -1$ in S-plane.

(5 marks)

Or

- (b) Sketch the root locus diagram of the following open-loop transfer function :

$$G(s) H(s) = \frac{K}{s(s+2)(s+5)}$$

(15 marks)

- IV. (a) Draw the Bode plot for the open loop transfer function $G(s) H(s) = \frac{20(0.2s+1)}{s(0.5s+1)}$. Find gain margin and phase margin of the system.

(15 marks)

Or

- (b) A unit step input is applied to a unity feedback control system whose open loop transfer function is given by $G(s) = \frac{K}{s(1+ST)}$. Determine the values of 'K' and 'T' to have a peak overshoot of 20% and resonant frequency of 6 rad/sec. Calculate resonant peak.

(15 marks)

- V. (a) (i) Prove that the spectrum of a discrete-time signal is periodic.

(7 marks)

- (ii) How do you get fourier transform from Z-transform ? Explain in detail.

(8 marks)

Or

- (b) For a system represented by the state equation :

$$\dot{X}(t) = A X(t)$$

$$\text{the Response is } X(t) = \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \end{bmatrix} \text{ when } X(0) = \begin{bmatrix} +1 \\ -2 \end{bmatrix}$$

$$X(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix} \text{ when } X(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

Determine the system matrix A and the state transition matrix.

(15 marks)

[4 × 15 = 60 marks]