CBCS SCHEME

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21MT734

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Control System and Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the following :
i. Time response
ii. Transient response
iii. Steady state response
iv. Ramp signal
v. Parabolic signal. **(10 Marks)**

b. Derive an expression for unit step response of a 1st order system. **(10 Marks)**

OR

2 a. Derive an expression for rise time (T_R) of an under damped 2nd order system. **(10 Marks)**

b. With the help of block diagram explain :
i) PI controller ii) PD controller. **(10 Marks)**

Module-2

3 a. Briefly explain the steady state response of sinusoidal input. **(10 Marks)**

b. For a unity feedback system $G(s) = \frac{K}{s(1+sz)}$. Determine the values of K and 'τ', so that $M_r = 1.06$ and $w_n = 12$ rad/s. **(10 Marks)**

OR

4 a. i. Define the term stability and hence define stable, unstable, marginally stable and conditionally stable systems.
ii. Explain the necessary conditions for stability. **(10 Marks)**

b. Construct Routh array and determine the stability of the system whose characteristics equation is : $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. **(10 Marks)**

Module-3

5 a. Define root locus. Explain the basic concepts of root locus with a suitable example. **(06 Marks)**

b. Define : i) Breakaway point
ii) Angle of asymptotes. **(04 Marks)**

c. Consider the system with $G(s) = \frac{K}{s(s+5)(s+10)}$. Find whether $s = -2$ lies on the root locus and also find the value of K using angle condition and magnitude condition. **(10 Marks)**

OR

6 a. Sketch root locus plot for the unity feedback system whose open loop transfer function is given by $G(s) = \frac{K(s+1)}{s^2}$. Discuss on stability of system. **(14 Marks)**

b. Discuss the effect of addition of poles and zero's to the system. **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

7 a. Explain the general steps to solve problems by Nyquist criterion. **(06 Marks)**

b. For a certain control system . $G(s)H(s) = \dfrac{K}{s(s+2)(s+10)}$ sketch the Nyquist plot and hence calculate the range of values of K for stability. **(14 Marks)**

OR

8 a. Sketch the Bode plot for the transfer function $G(s) = \dfrac{Ks^2}{(1+0.2s)(1+0.02s)}$. Determine the value of K of the gain cross-over frequency to be 5 rad/s. **(14 Marks)**

b. What are the advantages of bode plot? **(06 Marks)**

Module-5

9 a. i. Define the following terms :
i) State ii) State variables iii) State vector iv) State trajectory v) State space.
ii. State the advantages and disadvantages of state variable analysis. **(10 Marks)**

b. Obtain the state model of the given electrical system.

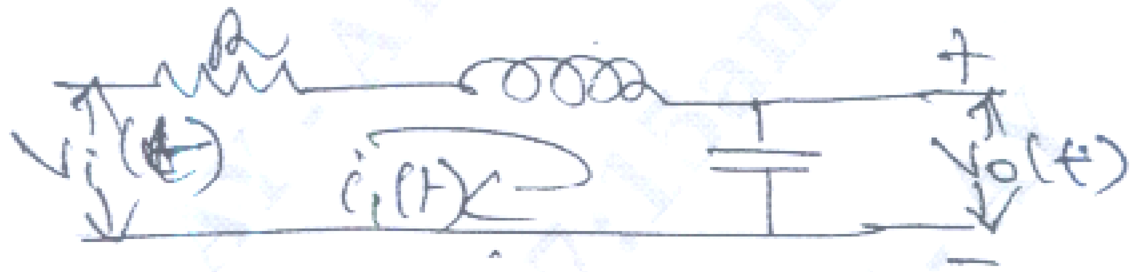

Fig.Q9 **(10 Marks)**

OR

10 a. Obtain the state model for the mechanical system shown in Fig.Q10(a).

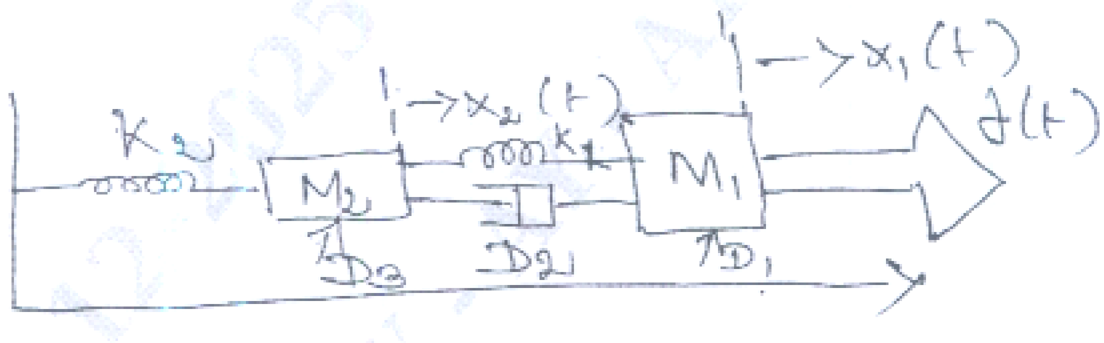

Fig.Q10(a) **(12 Marks)**

b. Obtain the transfer function of the system :

$$\begin{bmatrix} \dot{\alpha}_1 \\ \dot{\alpha}_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} u \text{ and } y = \{1 \;\; 2\} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix}.$$ **(08 Marks)**

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