CLASS: BTECH   **SEMESTER : V/ADD**
BRANCH: EEE   **SESSION : MO/2024**

SUBJECT: EE351 CONTROL THEORY

TIME: 3 Hours   **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL

Q.1(a)   i. Define transfer function of a system. State whether transfer function technique is   [5]   1   1,2,3
         applicable to non-linear system and whether the transfer function is independent
         of the input of a system.
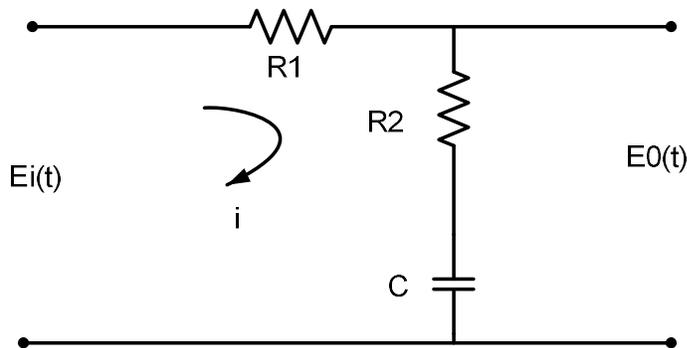   ii. Obtain transfer function of the electrical network shown in Fig. 1.

Fig. 1

Q.1(b)   i. Determine C/R for the system using block diagram reduction technique.   [5]   1   2,3
         ii. Draw the signal flow graph of the system shown in Fig-2. Determine overall gain of
             the system using Mason's gain formula.
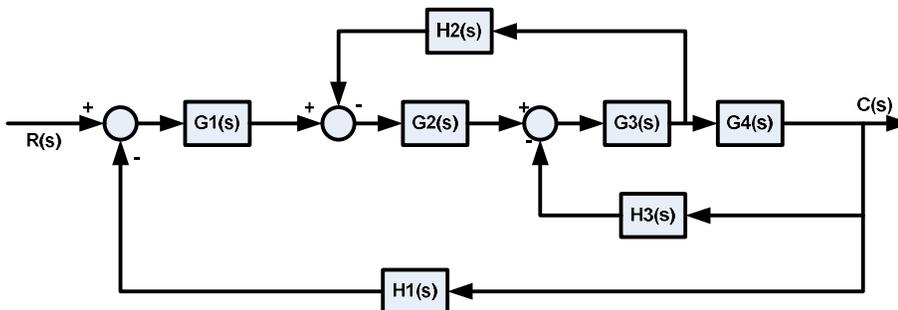   iii. Verify the results obtained in part (i) and (ii).

Fig. 2

PTO

Q.2(a) Differentiate between (i) type and order of a system (ii) natural and forced response.   [5]   1,3   1,3,4
Consider a unity feedback system, whose open-loop transfer function is given by

$$G(s)H(s) = \frac{10}{s(s+5)(s^2+2s+10)}$$

    i.   Determine the type and order of the system.
    ii.   Obtain the characteristic equation of the system.
    iii.   Using R-H criteria, comment on stability of the system.

Q.2(b) A unity feedback control system has an open-loop TF   [5]   2,3   3,4

$$G(s) = \frac{K}{s(s^2+4s+13)}$$

Sketch the root locus. Also examine the stability of the system.

Q.3(a) Draw the Bode plot of the system whose open loop transfer function is given by   [5]   2,3   3,4,5

$$G(s)H(s) = \frac{50}{s(1+0.25s)(1+0.1s)}$$. Determine GM and PM from the plot and also

comment on stability of the system.

Q.3(b) Consider a unity feedback system has open loop transfer function   [5]   2,3   3,4

$$G(s) = \frac{1}{s(1+2s)(1+s)}$$.

Investigate about the stability of the system. Also using Nyquist stability criteria, determine closed loop stability of the system.

Q.4(a) Discuss the effects of PD control action and PI control action.   [5]   3,4   4
Q.4(b) Compare the characteristics of phase lead and phase lag networks used for control   [5]   3,5   3,6
system compensation. Enumerate the design procedure for lead compensation in frequency domain.

Q.5(a) Define (i) State (ii) State Variables (iii) State Vector (iv) state transition matrix.   [5]   1   1,3
Obtain the state transition matrix for the system given by

$$\dot{X} = \begin{bmatrix} -1 & 1 \\ 0 & 2 \end{bmatrix} X$$

Q.5(b) Obtain the three different forms of state model for the system given by   [5]   1   2,3

$$\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = u$$

Also draw the block diagram in each case.

::::::21/11/2024::::::M