BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VI/ADD**
BRANCH: EEE/ECE **SESSION : SP/19**

SUBJECT: EE6201 CONTROL THEORY

TIME: 3.00 Hrs. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

Q.1(a) Identify an input and an output for an electric automatic coffee-maker. Is this system open-loop or closed-loop? [2]

Q.1(b) What are the effects of negative feedback on an open loop system? Explain. [4]

Q.1(c) What is meant by sensitivity of a system? Show that the feedback can increase or decrease sensitivity of a system. [6]

Q.2(a) What is signal flow graph (SFG)? Explain the Mason's gain formula. [2]

Q.2(b) Obtain the overall transfer function of the system shown in Fig. 1 by Mason's gain formula. [4]

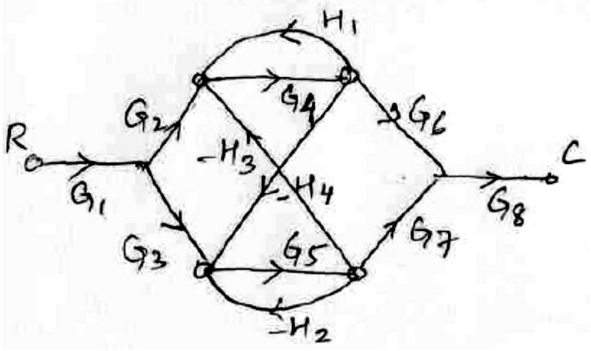

FIG. 1

Q.2(c) Draw the block diagram representation of the circuit given in Fig. 2, where x and y are the input and output variables respectively. Determine the transfer function by block diagram reduction technique. [6]

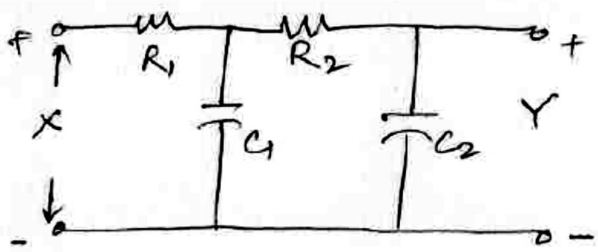

FIG. 2

Q.3(a) Differentiate between (i) type and order of a system (ii) natural and forced response. [2]
What is the type and order of a system, whose open-loop transfer function is given by

$$G(s)H(s)=\frac{10s}{s(1+s)(1+10s)}$$

Q.3(b) Derive the expression for time response for a second order system for unit step input. [4]

Q.3(c) Explain Evan's conditions. [6]
Obtain the Breakaway point, centroid, asymptotes, angle of asymptotes for the system whose open loop transfer function is given by

$$G(s)=\frac{k(s+1)}{s(s+5)(s+10)}.$$

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Q.4(a) Define the following terms (i) gain margin (ii) phase margin (iii) resonant peak (iv) phase crossover frequency. [2]

Q.4(b) Differentiate between absolute stability and relative stability of a system? [4]

Q.4(c) Find the Bode plot of the system whose open loop transfer function is given by $G(s)H(s) = \frac{10(s+5)}{s(s^2+5s+50)}$. Also comment on stability of the system. [6]

Q.5(a) What is Nyquist contour? Explain the Nyquist stability criteria. [2]

Q.5(b) Mention the advantages of frequency response analysis over time domain analysis? [4]

Q.5(c) Consider a unity feedback system has open loop transfer function $G(s) = \frac{10}{(s+1)(s-3)}$. Investigate about the stability of the system using Nyquist plot. [6]

Q.6(a) Why derivative controller is not used alone in control systems? Explain. [2]

Q.6(b) Explain the importance of encoders in control system? What are the different types of encoders used in control systems? Explain any one. [4]

Q.6(c) What is the effect of PI controller on the system performance? Explain. [6]

Q.7(a) Mention the advantages of diagonal form over other forms of state model. [2]

Q.7(b) Define state transition matrix. [4]
Obtain the state transition matrix for the system given by

$$\dot{X} = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} X$$

Q.7(c) Obtain the three different forms of state model for the system given by [6]

$$\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = \dddot{u} + 8\ddot{u} + 17\dot{u} + 8u$$

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