Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5252]-137

S.E. (Electronics/E&TC) (Second Semester) EXAMINATION, 2017

CONTROL SYSTEM

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Derive the force to voltage and force to current analogy between mechanical and electrical systems. [6]

(*b*) For unity feedback system with open loop transfer function $G(s) = \frac{36}{s(s+6)}$ determine rise time, peak time, peak overshoot and setting time with 2% criterion. [6]

P.T.O.

Or

2. (*a*) Determine C(*s*)/R(*s*) for the block diagram shown in Figure No. 1 using block diagram reduction. [6]

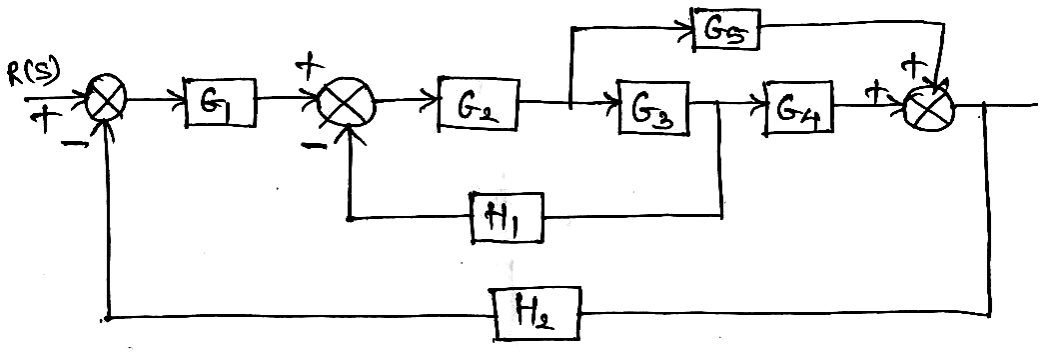

Fig. 1

(*b*) A second order system has peak time of 2 sec and peak overshoot of 10%. Find its damping factor, undamped natural frequency, setting time with 2% criterion and closed loop transfer function if its gain at steady state is unity. [6]

3. (*a*) Investigate the stability of system with characteristic equation :

$$Q(s) = s^4 + s^3 + 2s^2 + 2s + 1 = 0$$ [4]

(*b*) Sketch Nyquist plot and investigate the stability of a system with open loop transfer function :

$$G(s)H(s) = \frac{50}{(s+1)(s+2)(s+5)}.$$ [8]

Or

4. (*a*) Explain how stability analysis is done using Bode Plot. [4]

(*b*) For unity feedback system with open loop transfer function :

$$G(s) = \frac{K}{s(s+1)(s+5)},$$ sketch root locus. [8]

5. (*a*) Determine state transition matrix of : [7]

$$A = \begin{bmatrix} 0 & 1 \\ -5 & -6 \end{bmatrix}.$$

(*b*) Define the following : [6]

(*i*) State

(*ii*) State variables

(*iii*) State vector,

(*iv*) State space,

(*v*) State controllability,

(*vi*) State observability.

Or

6. (*a*) Investigate state controllability and state observability if

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -3 & -4 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 2 & 1 \end{bmatrix}.$$ [6]

(*b*) Determine the state model of the system shown in Figure No. 2. [7]

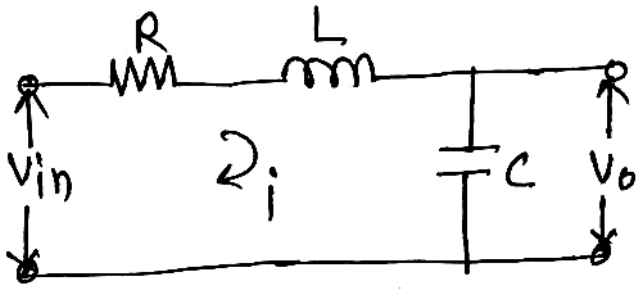

Fig. 2

7. (*a*) List different control actions and control modes of PID controller and explain all control actions. [7]

(*b*) Explain the operation of digital control system with the help of block diagram. [6]

Or

8. (*a*) Determine Pulse transfer function and impulse response of the system shown in Figure No. 3 [7]

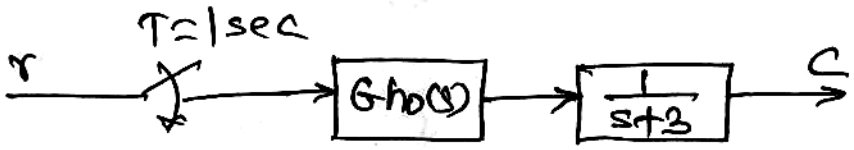

Fig. 3

(*b*) Explain PLC with the help of its block diagram. [6]