Total No. of Questions—8] [Total No. of Printed Pages—4+1

Seat No.	

[5152]-537

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

CONTROL SYSTEM

(2015 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) Obtain the transfer function of system representd by the signal flow graph shown in figure no. 1. [6]

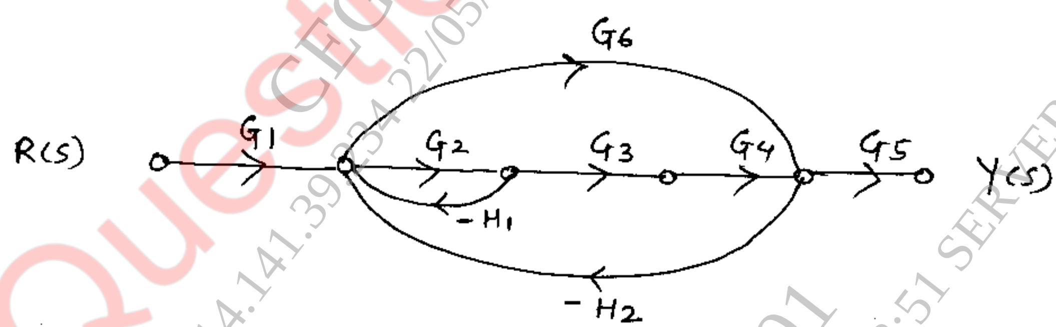

Fig. 1

(B) For the system with closed loop transfer function

$$G(s) = \frac{25}{s^2 + 8s + 25}$$

determine damping factor, undamped natural frequency, rise time, peak time, peak overshoot and settling time with 2% tolerance band. [6]

P.T.O.

Or

2. (A) Obtain the transfer function of system represented by the block diagram shown in Figure No. 2. [6]

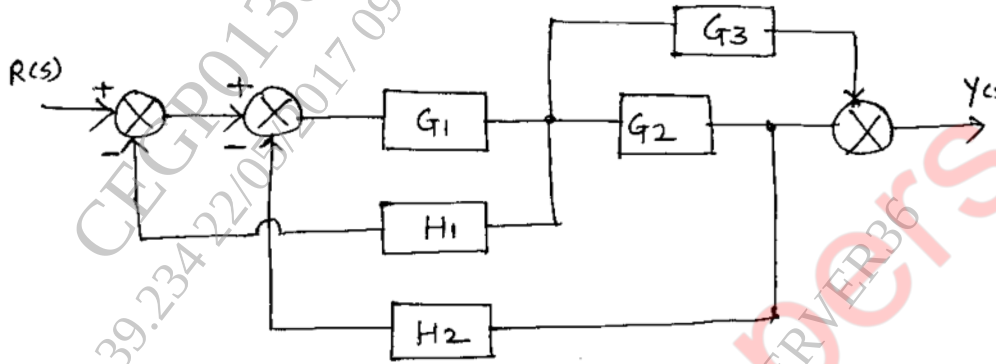

Fig. 2

(B) For the unity beedback system with open loop transfer function

$$G(s) = \frac{100(s+2)}{s(s+5)(s+10)},$$

determine static error constants and steady state error if input is $r(t) = 1 + t$. [6]

3. (A) Investigate the stability of a system having closed loop characteristic equation : [4]

$$Q(s) = s^3 + 7s^2 + 10s + k = 0 \text{ and}$$

find K_{mar} and W_{mar}.

(B) For the unity feedback system with open loop transfer function

$$G(s) = \frac{20}{s(s+1)(s+10)},$$

sketch Nyquist plot and investigate stability. [8]

Or

4. (A) Determine damping factor, undamped natural frequency, resonant peak and resonant frequency for the system with closed loop transfer function : [4]

$$G(s) = \frac{100}{s^2 + 10s + 100}.$$

(B) Sketch root locus of a system with open loop transfer function

$$G(s)\ H(s) = \frac{K}{s(s+4)(s+6)}.$$ [8]

5. (A) Obtain controllable canonical and observable canonical state models for the system with transfer function :

$$G(s) = \frac{s^2 + 3s + 5}{s^3 + 5s^2 + 2s + 9}.$$ [6]

(B) Investigate for complete state controllability and state observability of system with state space model matrices :

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -1 & -2 \end{bmatrix},\ B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix},\ C = \begin{bmatrix} 1 & 0 & 2 \end{bmatrix}$$ [7]

Or

6. (A) Derive formula of state transition matrix and state any *four* properties. [7]

(B) Obtain physical variable state model of the system shown in Figure No. 3. [6]

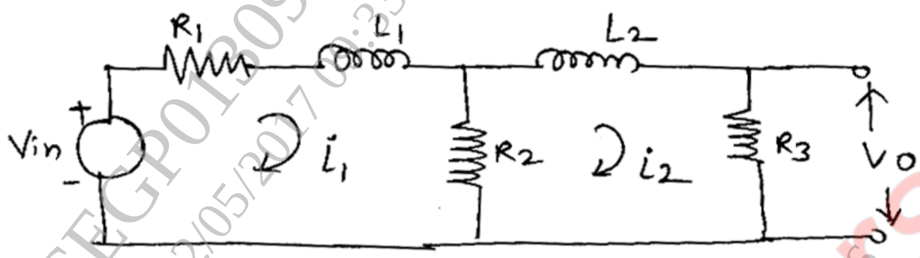

Fig. 3

7. (A) Determine pulse transfer function of a system shown in Figure No. 4, using first principle (starred Laplace transform) [7]

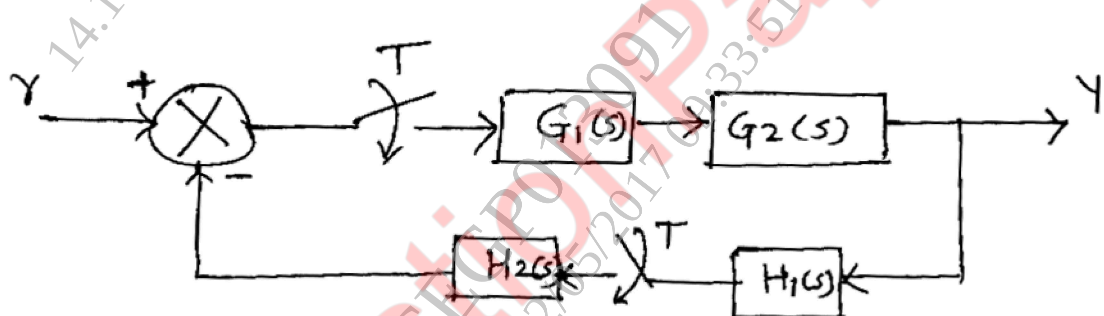

Fig. 4

(B) Sketch step and ramp responses of P, PI & PID control actions. [6]

Or

8. (A) Determine pulse transfer function of a system shown in Figure No. 5. .[7]

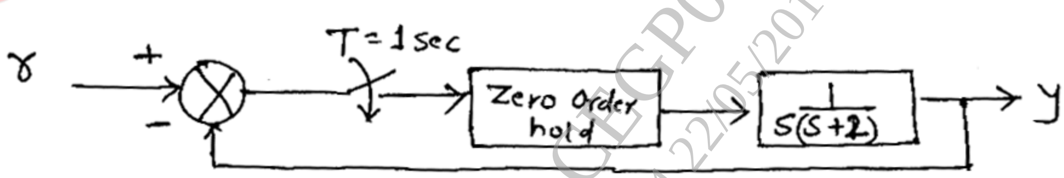

Fig. 5

(B) Obtain ladder diagram for a 3-input two output system with boolean expressions : [6]

$$Y_1 = A\bar{B}C + AB\bar{C}$$

$$Y_2 = \bar{A}\bar{B}\bar{C} + AB.$$