C 80758 (Pages : 3)

Name.....................................

Reg. No.................................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE [09 SCHEME] EXAMINATION, APRIL 2015

EC/PTEC 09 604—CONTROL SYSTEMS

Time : Three Hours   Maximum : 70 Marks

Part A

Answer **all** *question.*

1. Define transfer function.
2. Draw the step response of a second order undamped system.
3. State angle and magnitude condition of root locus.
4. Draw the magnitude and phase curves of a zero order hold.
5. Write down the necessary and sufficient condition for the system to be completely controllable.

(4 × 5 = 20 marks)

Part B

Answer any **four** *questions.*

6. List out the advantages of automatic control systems.
7. Derive the step response of a first order system.
8. Find the position, velocity and acceleration error coefficients for the open-loop transfer function

   $G(s)\,H(s) = \dfrac{100}{(1+0.5s)(1+2s)}$.
9. Check for stability of the sampled data control system represented by the characteristic equation $5z^2 - 2z + 2 = 0$.
10. List out the properties of a state transition matrix.
11. Obtain the state model of the electrical network shown is Figure (1) using minimal number of state variables.

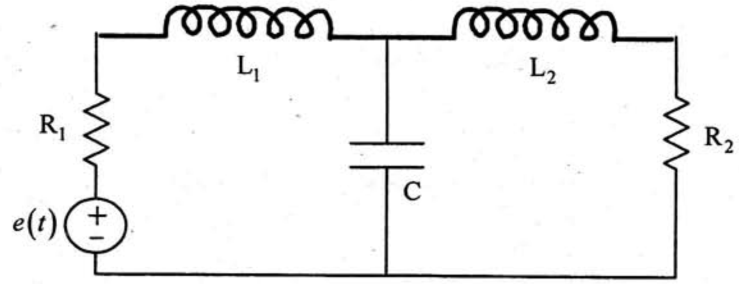

Fig. 1

(4 × 10 = 40 marks)

Turn over

Part C

Answer **all** *questions.*

Module I

12. (a) Obtain the overall transfer function $\frac{C}{R}$ for the signal flow graph shown in Figure 2.

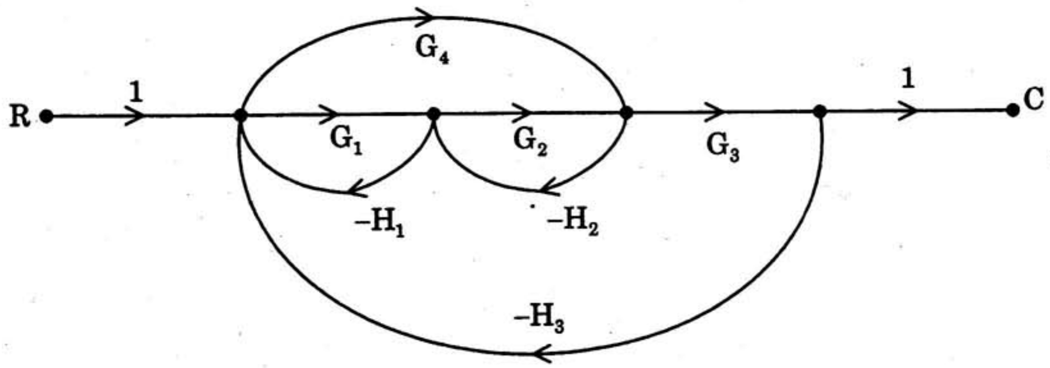

Fig. 2

Or

(b) Explain the various block diagram reduction rules.

Module II

13. (a) Draw the Nyquist plot and assess the stability of the closed loop system whose open loop transfer function is $G(s)\,H(s) = \frac{(s+4)}{(s+1)(s-1)}$.

Or

(b) Derive the time domain specifications of a second order underdamped system when subjected to unit step input.

Module III

14. (a) State and prove the properties of z-transform.

Or

(b) Obtain the pulse transfer function for the system shown in Figure 3 ZOH stands for zero order hold.

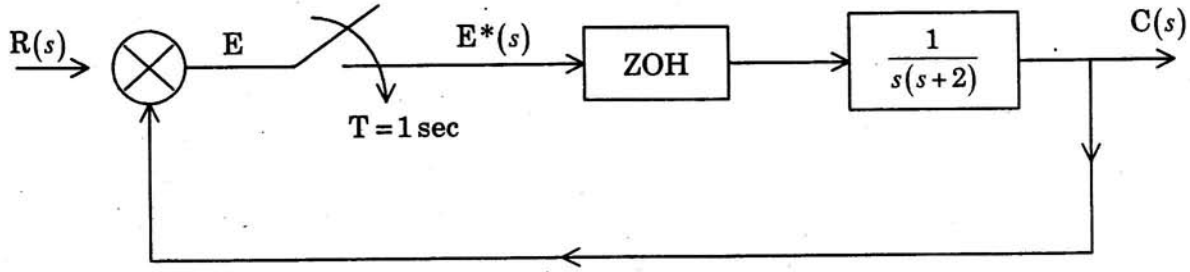

Fig. 3

Module IV

15. (a) Determine the transfer function for the state model given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \text{ and } y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

Or

(b) A linear time invariant system is represented by the homogeneous state equation $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. compute the solution of the homogeneous equation assuming the initial state vector as $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$.

(4 × 10 = 40 marks)