A – 2340

Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, April 2016
(2008 Scheme)
08.801 : ADVANCED CONTROL THEORY (E)

Time : 3 Hours

Max. Marks : 100

***Instruction** : Answer **all** questions from Part **A** and **any one** question from **each** Module in Part **B**.*

PART – A

1. What is a phase variable ? What are the main advantages of state space representation in physical variable form ?
2. What is the need of similarity transformation ? Discuss the different methods for obtaining model matrix.
3. What is resolvant matrix ? List out main properties of state transition matrix.
4. With the help of neat block diagram explain the need of state feedback controller in design of modern control theory.
5. Explain Shannon's sampling theorem.
6. Obtain the pulse transfer function of the system described by differential equation $C(k) - 0.5\,C(k-1) = r(k)$. Hence find the impulse response.
7. Differentiate between the two popular theories used in analysis of non-linear system.
8. How non-linearities are classified ?
9. Explain the term "Frequency entrainments" related to a non-linear system.
10. Differentiate between asymptotic stability and globally asymptotically stable.

(10×4=40 Marks)

PART – B

Module – I

11. a) Derive the state space model of armature controlled dc motor and hence draw the block diagram. 8

b) A feedback system has closed loop transfer function

$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$. Construct state model in

i) Observable canonical form ii) Diagonal form (canonical). 12

12. a) An LTI system is characterized by the state equation $\dot{X} = AX$ given

$$\phi(t) = \begin{bmatrix} e^{-t} + te^{-t} & te^{-t} \\ -te^{-t} & e^{-t} - te^{-t} \end{bmatrix}.$$

i) Find resolvant matrix and state matrix.

ii) Find the set of states such that $X_1(2) = 2$; $X_2(2) = 1$. 12

b) Examine controllability and observability of the given system

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u$$

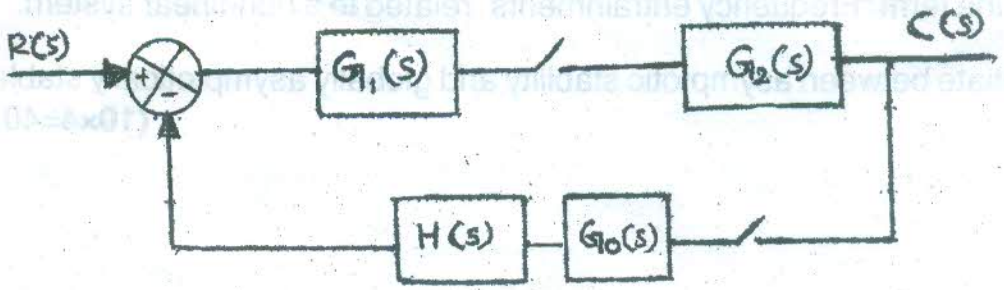
$Y = [10 \quad 5 \quad 1] X$. 8

Module – II

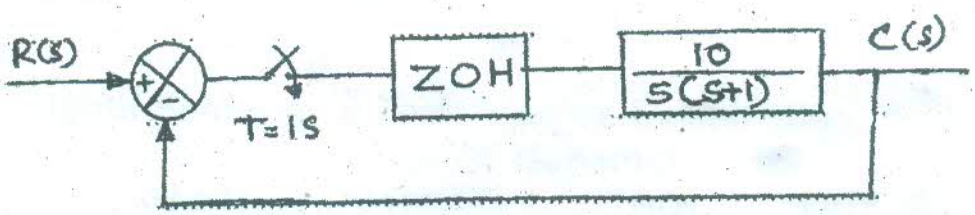
13. a) Solve the difference equation.

$4x(k+2) + 5x(k+1) + 6x(k) = 0$ with $x(0) = 1$; $x(1) = -1$. 10

b) Obtain the expression for C(z). 10

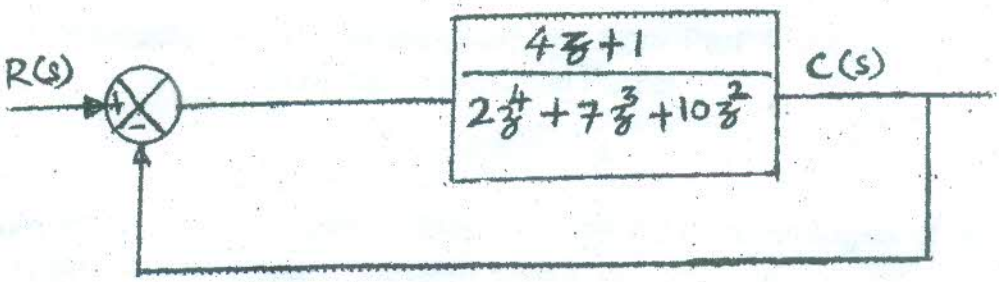


14. a) Obtain unit step response for given system.



10

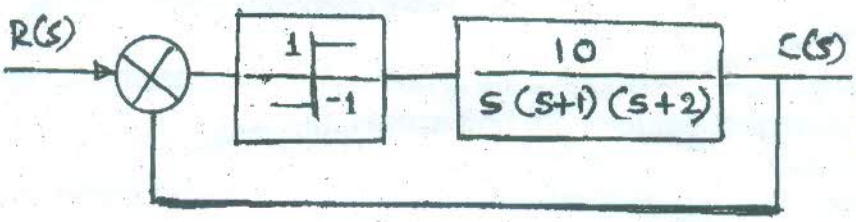
b) Examine stability of the given system using Jury's test. 10



Module – III

15. a) Briefly explain different physical non-linearities. 8

b) Derive the describing function for an ideal relay. Discuss the possibility of limit cycle for the given system. If limit cycle exists determine amplitude and frequency of limit cycle. 12



16. a) Investigate stability of system $\dot{X} = AX$ using 2nd method of Liapunov where

$A = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix}$. Also find Liapunov function. 10

b) Explain Liapunov's theorems. 5

c) Explain how phase trajectories are constructed by analytical method. 5