

Day: Wednesday
Date: 29/05/2019

Time: 02.30 PM TO 05.30 PM
Max Marks: 80

S-2019-3120

N.B:

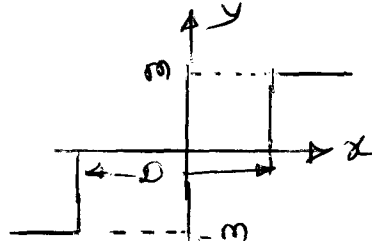
- 1) Q. No. 1 and Q. No. 5 are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each section.
- 2) Answer to both the sections should be written in **SAME** Answer book.
- 3) Draw neat labeled diagrams **WHEREVER** necessary.
- 4) Figures to the **RIGHT** indicate full marks.
- 5) Assume suitable data, if necessary.

SECTION-I

- Q.1** a) Obtain state equations of RLC series network (05)
b) Define State Transition Matrix (STM) .State properties of STM (05)
c) Describe salient phenomenon observed in nonlinear system (04)
- Q.2** a) Draw state diagram for given transfer function using appropriate decomposition method. Also obtain state equations. (07)
- $$\frac{Y(s)}{U(s)} = \frac{s+5}{s^2+10s+9}$$
- b) Compare state variable analysis with classical approach of transfer function (06)
- Q.3** a) An LTI system is characterized by the state equation (08)
- $$\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$
- Where u is the unit step function.
- The initial condition is $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$.
- Using inverse Laplace Transform method, obtain the solution of the state equation
- b) State Kalman's test for Controllability and Observability (05)
- Q4** a) Define Phase plane, phase trajectory, phase portrait for second order system. (06)
What is singular point?
b) Describe isoclines method of drawing phase plane trajectory. How stability analysis is done from this method. (07)

SECTION-II

- Q5** a) What are the assumptions made while defining describing function of nonlinear element? Write mathematical expression for describing function. (05)
b) Define Z transform. Calculate Z transform of (i) $f(t) = \cos \omega t$ (05)
(ii) $f(t) = e^{-at} \sin \omega t$
c) State advantages and limitations of discrete time system over continuous time system (04)
- Q.6** a) Derive Describing Function for the following nonlinearity. Also show input output waveforms. (07)

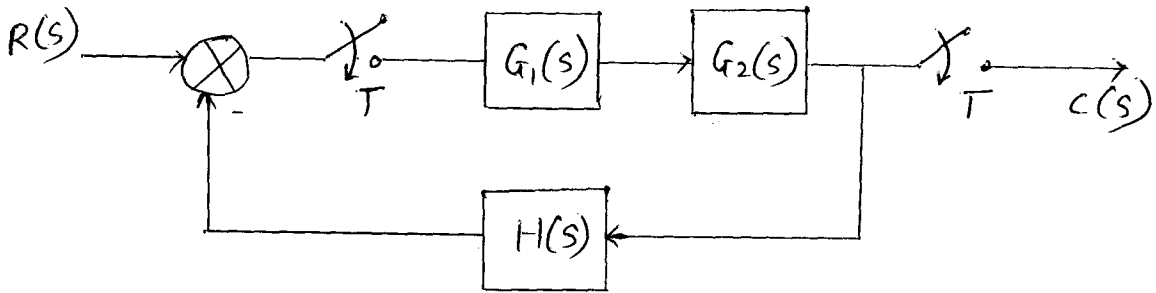


b) How describing function is used for stability analysis of nonlinear system. Show existence of limit cycle with diagram and its significance. (06)

Q.7 a) State Sampling Theorem and explain "Aliasing" and "Folding" phenomenon with diagram (06)

b) Draw sample and hold circuit .Show its input and output waveforms .write down transfer function of sample and hold circuit. (07)

Q.8 a) Determine pulse transfer function of the following (07)



b) Draw mapping of s plane to z plane and hence state stability criteria in z domain (06)

* * * *