B.Tech. SEM -VI Electrical 2014 Course (CBCS) : WINTER - 2017

SUBJECT: MODERN CONTROL SYSTEMS

Day: Wednesday **Time:** 10.00 AM TO 01.00 PM
Date: 22/11/2017 **Max. Marks: 60**

W-2017-2203

N.B:

1) All question are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.
4) Use of non-programmable **CALCULATOR** is allowed.

Q.1 **a)** Write state equations and represent them with the help of a state model. **(04)**

b) State and explain with an example various ways of decomposition of transfer function. **(06)**

OR

Q.1 **a)** Give classification of canonical forms. **(04)**

b) Draw state diagram for given transfer function using appropriate decomposition method. Also, obtain state equations. **(06)**

i) $Y(s)/U(s)=1/(s+2)(s+3)$

ii) $Y(s)/U(s) = s+5/s^2+10s+9$

Q.2 **a)** How do you compute STM using: **(04)**

i) Laplace Transform ii) Infinite/power series method

b) An LTI system is characterized by the state equation: **(06)**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where u is 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.

OR

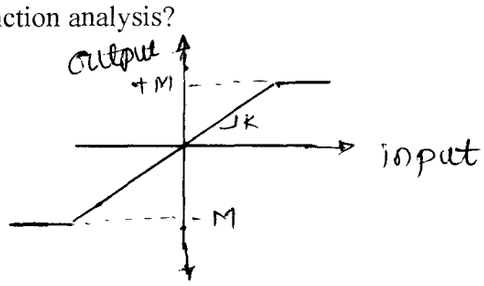
Q.2 **a)** State Caley-Hamiltion Theorem. **(04)**

b) Determine the STM for state model whose matrix A is given by, **(06)**

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

Q.3 **a)** Define Describing function of nonlinear element. What are the assumptions made while using describing function analysis? **(05)**

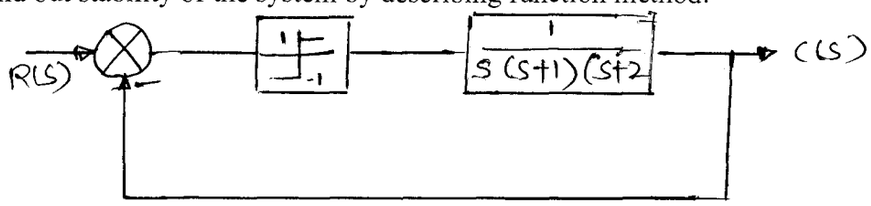
b) Derive describing function of: **(05)**



P.T.O.

OR

Q.3 Find out stability of the system by describing function method. **(10)**



Q.4 a) State sampling Theorem and explain with the help of Fourier spectra of input signal and sampled signal. **(05)**

b) A 4 bit ADC is used to sample 5V signal of 50Hz frequency. What is the minimum step of output signal? What should be the sampling frequency? **(05)**

OR

Q.4 a) Find f (k) for **(05)**

F (z) = $F(z)=\dfrac{4z^3-21z^2+29z}{(z-2)(z-3)^2}$

b) State initial value and final value theorem of Z transform. Hence find final value of f (t) = t for t ≥ 0 **(05)**

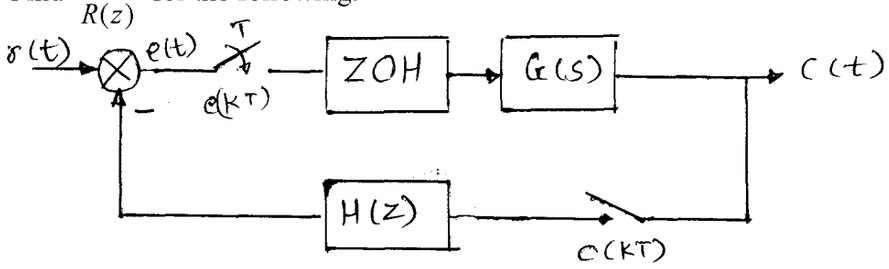
Q.5 a) Consider the discrete time unity feedback control system (T = 1sec) whose open loop transfer function is given by: $G(z)=\dfrac{k(0.3679z+0.2642)}{(z-0.3679)(z-1)}$ **(06)**

Determine the range of k for stability using Jury's test.

b) What is bilinear transformation? Describe how it can be used to determine stability of discrete system. **(04)**

OR

Q.5 a) Find $\dfrac{C(z)}{R(z)}$ for the following: **(06)**



b) Write down state variable equations for discrete time system and describe elements in the equation. **(04)**

Q.6 What are the advantages of robust control over classical control? Explain the terms used in robust control by block diagram with one example. **(10)**

OR

Describe membership functions for fuzzy logic and rules of fuzzy logic. **(10)**

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