B.Tech Sem – VI (2007 Course) (Electrical Engg.) : WINTER - 2018

SUBJECT: MODERN CONTROL SYSTEMS

Day: Friday
Date: 16/11/2018

W-2018-2855

Time: 10.00 AM TO 01.00 PM
Max Marks: 80

N.B:

1) Q. No. 1 and Q. No. 5 are **COMPULSORY.** Out of the remaining attempt any **TWO** questions from each section.
2) Both the sections should be written in **SEPARATE** answer books.
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)** Give classification of canonical forms. **(04)**

b) Define controllability and observability. **(04)**

c) Draw three types of nonlinearity and draw its input and output waveforms. **(06)**

Q.2 **a)** Draw the state block diagram for the transfer function **(07)**

$$\frac{Y(s)}{U(s)}=\frac{1}{(s^2+5s+6)}.$$

b) What is diagonalization? How eigen values and eigen vectors are obtained? **(06)**

Q.3 **a)** Obtain the phase variable state model for a system described by the differential equation: **(06)**

$$\frac{d^3y}{dt^3}+\frac{5d^2y}{dt^2}+\frac{dy}{dt}+2y=u \text{ . Draw state diagram.}$$

b) Find controllability and observability of the system described by state equation. **(07)**

$$\dot{X}=\begin{bmatrix}3 & 0\\ 2 & 4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}\text{u and } y=\begin{bmatrix}1 & 0\end{bmatrix}X \text{ .}$$

Q.4 **a)** Show different types of singular points and phase plane trajectory. **(06)**

b) Describe limit cycle phenomenon in phase plane method. **(07)**

SECTION-II

Q.5 **a)** Find z transform for T = 1 sec. for **(06)**

(i) $G(S)=\frac{1}{(s+2)(s+5)}$ (ii) $F(S)=\frac{a}{(s+a)^2}$

b) Define and explain **(04)**

(i) Jump resonance (ii) limit cycle

c) How Routh-Hrurwitz criteria Is useful to find stability of discrete time system? **(04)**

Q.6 Investigate the stability of a unity feedback control system having transfer function of: **(13)**

$G(s)=\frac{2}{s(s+1)(2s+4)}$ in cascade with relay type nonlinearity with relay output as ±2.

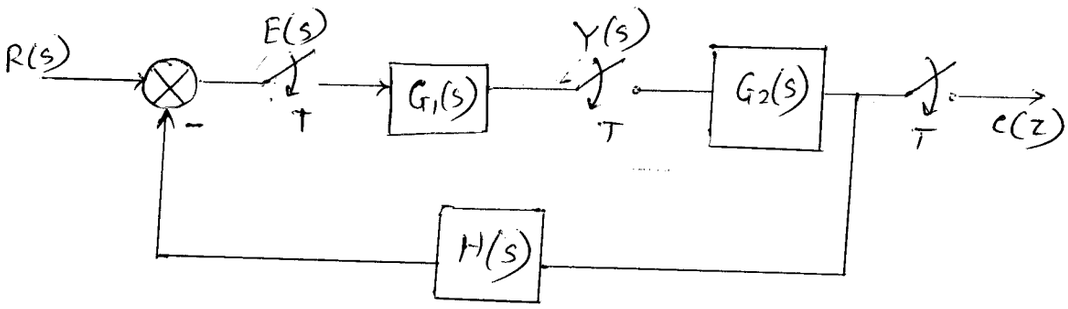
P.T.O.

Q.7 **a)** Solve the following difference equation: **(07)**
$y(k+2) + 5y(k+1) + 6y(k) = u(k)$ for step input. The initial conditions are:
$y(0) = 0$
$y(1) = 1$

b) Explain "Zero order Hold" with the help of mathematical equation and waveform. **(06)**

Q.8 **a)** Determine the stability of the system open loop transfer function is given by **(07)**
$G(s)=\frac{1-e^{-s}}{s}\frac{1}{s(s+1)}$.

b) Determine the pulse transfer function for the following system: **(06)**



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