Total No. of Questions – [8] Total No. of Printed Pages - 3

G.R. No.	

paper code: U228-131 (RE-FF)

MAY 2019/ENDSEM RE-EXAM

S. Y. B. TECH. (E&TC) (SEMESTER - I)

COURSE NAME: CONTROL SYSTEMS

COURSE CODE: ETUA22171

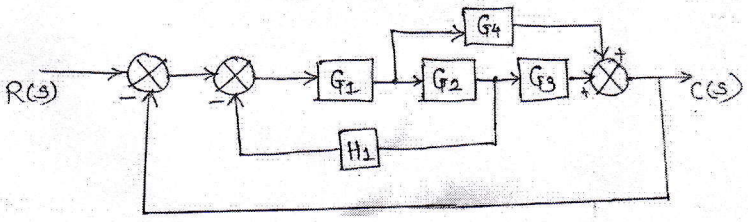
(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

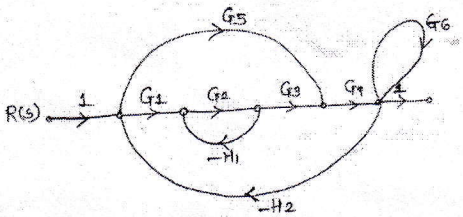
1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) Find closed loop transfer function of the given system, if $G_1=G_2=\frac{1}{s+1}$ and $G_3=G_4=s+1$, $H1=1$ [6 marks]



OR

b) Using Mason's Gain formula, calculate transfer function of the given system. [6 marks]



Q.2) a) Derive and sketch the response of first order system for i) unit step ii) unit impulse excitation. [6 marks]

OR

b) For the unity feedback system with open loop transfer function $G(s)=\frac{K}{s(s+1)(1+0.4s)}$. i) Find type and order of the given system.

ii) if r(t) = 4t and K = 2, determine steady state error.

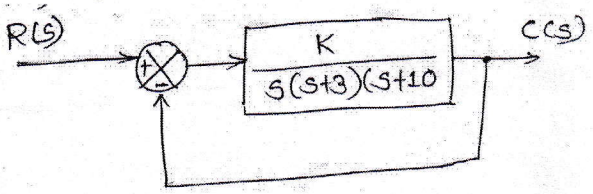
iii) If the desired value of steady state error is to be 0.2, find corresponding K. [6 marks]

Q.3) a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{80}{s\,(s+2)(s+20)}$. Draw bode plot. Show ω_{gc}, ω_{pc}. [6 marks]

OR

b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{40}{(s^2+2s+1)(s+4)}$. Draw Nyquist plot. Find gain margin and comment on stability. [6 marks]

Q.4) a) For the system shown, determine – [4 marks]



i. Range of K for stability
ii. Marginal value of K
iii. Frequency of Sustained oscillations

OR

b) Sketch the root locus for a unity feedback system whose open loop transfer function is $G(s)=\frac{k}{s(s+2)(s+10)}$. (Detailed calculations not required) [4 marks]

Q. 5) a) Obtain state space representation of the given system using controllable canonical form. Write state space equation for Observable canonical form.

$T(s) = \frac{2}{s^3+2s^2+4s+8}$ [6 marks]

b) Investigate for complete state controllability and complete state observability for the system [4 marks]

$$\dot{x}(t) = \begin{bmatrix} -2 & -2 \\ 0 & -1 \end{bmatrix} x(t) + \begin{bmatrix} 3 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = [1 \quad -1]x(t)$$

c) Find the transfer function of the system with state space model matrices,

$A = \begin{bmatrix} -2 & -2 \\ 0 & -1 \end{bmatrix}$ $B = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$ $C = [1 \quad 0]$ [4 marks]

OR

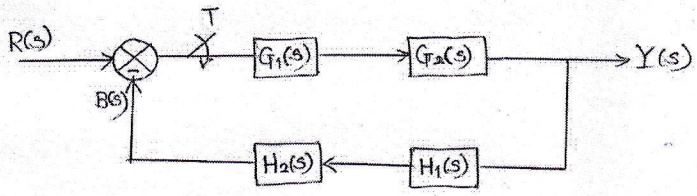
Q.6) a) Find state transition matrix if $A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$ in $\dot{x}(t) = Ax(t)$. Also find x(t), if $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ [6 marks]

b) Draw state space diagram of the given system using parallel form realization. $T(s) = \frac{s(s+2)}{s^3+8s^2+19s+12}$ [4 marks]

c) What is state transition matrix? Write any four properties of S. T. M. [4 marks]

Q.7) a) Explain block diagram of Digital control system. Draw its mathematical model. [6 marks]

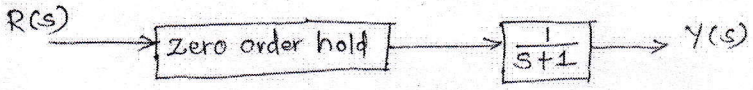
b) Obtain Pulse transfer function of following system using starred Laplace transform. [4 marks]



c) Write a short note on Programmable Logic Controller [4 marks]

OR

Q.8) a) Find pulse transfer function and impulse response of following system. [6 marks]



b) Explain advantages of Digital control system over analog control system. [4 marks]

c) Write a short note on PID system. [4 marks]