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

G.R. No.	

Paper Code - U228-131 (ESE)

MAY 2019/ENDSEM

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

COURSE NAME: CONTROL SYSTEMS

COURSE CODE: ETUA22171

(PATTERN 2017)

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

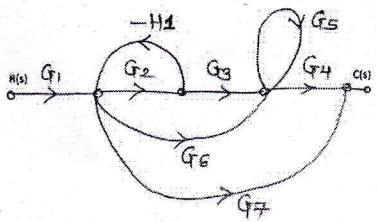
(*) Instructions to candidates:

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) Write any 8 rules for block diagram reduction. [6 marks]

OR

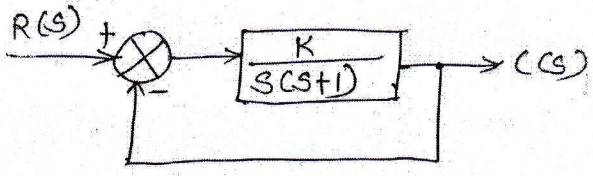
b) Using Mason's Gain formula, calculate transfer function of the given system. [6 marks]



Q.2) a) Define and derive following time domain specifications for second order under damped system. i) t_r ii) t_p iii) M_p [6 marks]

OR

b) For the unity feedback system shown , assume r(t)= 0.2t. It is desired that ess<=0.08, find range of K for steady state error to be within limit. What is the type and order of the system? [6 marks]



Q.3) a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{10(s+20)}{(s+1)(s+2)(s+10)}$. Draw bode plot. Show ω_{gc}, ω_{pc}. [6 marks]

OR

b) Explain Nyquist stability criteria using Principle of Argument. Draw Nyquist plot for UFCS with OLTF $G(s) = \frac{2}{(s+1)(s+5)(s+10)}$ [6 marks]

Q.4) a) Determine stability of the system whose characteristic equation of a system is given as $s^5+2s^4+3s^3+6s^2+2s+1=0$ [4 marks]

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 needed) [4 marks]

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

$T(s) = \frac{20}{s^3+4s^2+5s+10}$ [6 marks]

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

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

$$y(t) = [1 \quad 2]x(t)$$

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

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

OR

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

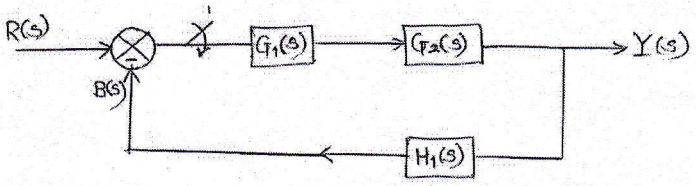
b) Obtain state model using controllable canonical form for

$T(s) = \frac{s^3+2s^2+5s+1)}{s^4+4s^3+4s^2+7s+2}$ [4 marks]

c) State and prove any four properties of S. T. M. [4 marks]

Q.7) a) Explain Ladder Diagram concept in PLC. Draw and explain different symbols used to construct ladder. [6 marks]

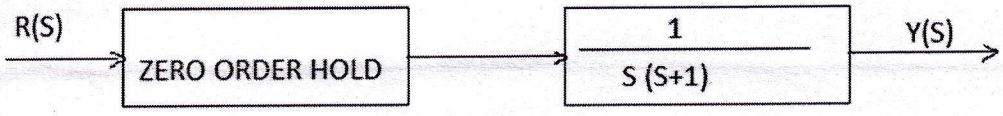
b) Obtain Pulse transfer function of following system using starred Laplace transform. [4 marks]



c) Write a short note on Digital control system. [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) Sketch the output of P, PI, PD and PID controller for step input. [4 marks]