

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1410
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (ETC) (Sem-V)
Control System
(Revised)

[Time: Three Hours]

[Max.Marks:80]

- N.B
- Please check whether you have got the right question paper.
- 1) Q. No. 1 and Q. No.6 are compulsory.
 - 2) Attempt any two questions from the remaining Questions in each section.
 - 3) Figures to the right indicates full marks.

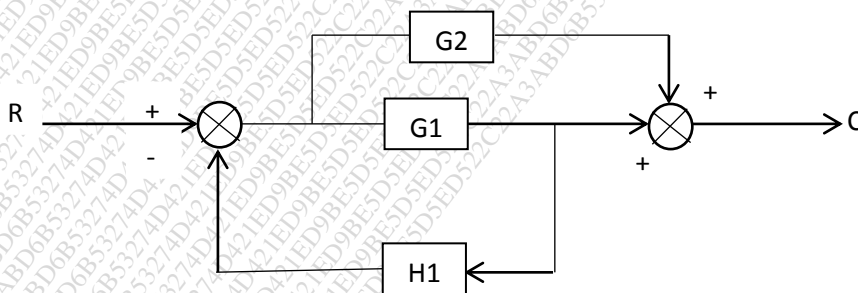
Section A

Q.1 Answer any five (05) of the following in Brief. 10

- a) Differentiate between open loop control system & close loop control system?
- b) What is signal flow graph?
- c) Define non-touching loop?
- d) For the transfer Function

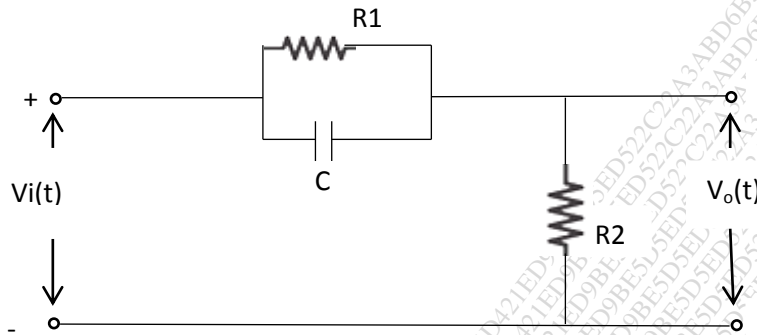
$$G(S) = \frac{K(S + 1)(S + 2)}{S(S^3 + 2S^2 + 2S)}$$
 What is the order & type of system?
- e) How the system is classified depending on the value of damping?
- f) Define steady state error, also enlist the error coefficients?
- g) Give the procedure to find stability of a system using Routh's –Hurwitz criteria?

Q.2 a) Draw a signal flow graph for the block diagram below, Determine the overall transmittance? 08



- b) Determine the rang of 'K' SO that the system is marginally stable and find the frequency of sustained oscillations. For the equation $S^4 + 25S^3 + 15S^2 + 20S + K = 0$ 07

Q.3 a) Find out the transfer function of given electrical network $V_o(S) / V_i(S)$: 08



b) Draw the approximate root locus diagram for a system having open loop transfer function. 07

$$G(S)H(S) = \frac{K}{S(S + 5)(S + 10)}$$

Q.4 a) What is position error coefficient (K_p), velocity error coefficient (K_v), acceleration error coefficient (K_a) and Steady state error (e_{SS}). Derive the expressions for these for type-2 system? 08

b) Derive the expression for underdamped response of the system of second order subjected to unit step input, i.e. 07

$$c(t) = 1 - \frac{e^{-\xi\omega_n t}}{\sqrt{1 - \xi^2}} \sin \left(\omega_n \sqrt{1 - \xi^2} t + \tan^{-1} \frac{\sqrt{1 - \xi^2}}{\xi} \right)$$

Q.5 Write short notes on (any three) 15

- a) Characteristic equation
- b) Block diagram reduction rules.
- c) Routh – Hurwitz stability criteria.
- d) R.L.C. Network analysis

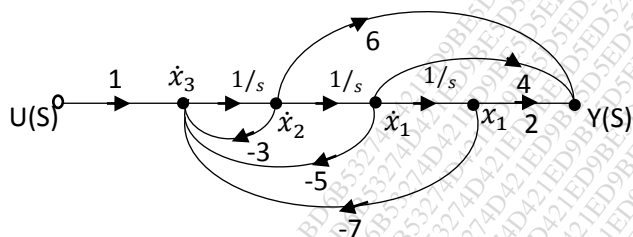
Section - B

Q.6 Answer any Five (05) of the following in brief. 10

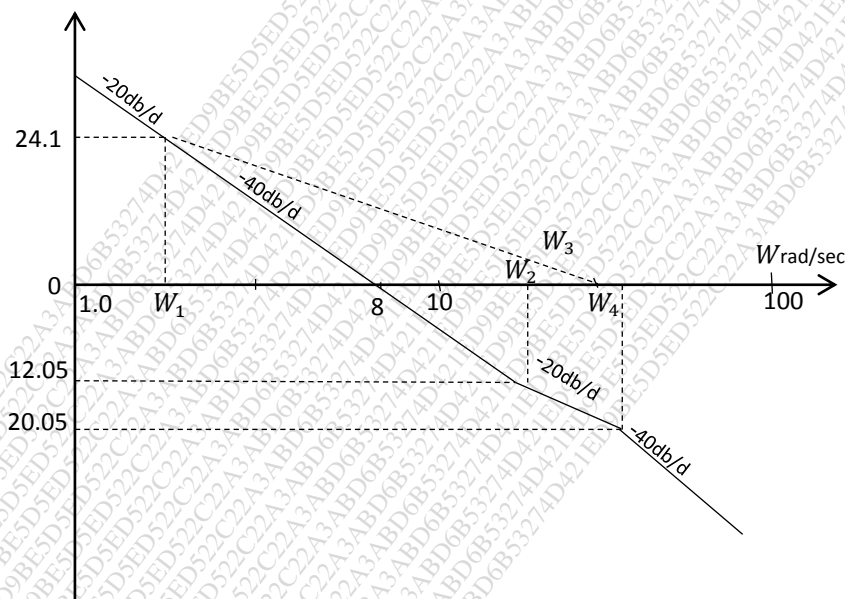
- a) What is Nyquist Stability Criteria?
- b) How stability is defined based on information of gain & phase margin?
- c) What is state variable & standard form of state model?
- d) Using Bode plot, how stability can be determined?
- e) Draw the state diagram for MIMO system?
- f) What is PID Controller
- g) What are the characteristics of ON/OFF Controller?

Q.7 a) For the transfer function $\frac{Y(S)}{U(S)} = \frac{2S + 3}{S^2 + 5S + 6}$ Write the state model matrix equation? 08

b) For the signal flow graph below write the state model matrix equation. 07



Q.8 Determine the open – loop transfer function from the Bode plot shown? 15



Q.9 a) A unity feedback control system has $G(S) = \frac{10}{s(s+1)(s+2)}$ Draw the Nyquist plot & comment on closed loop stability. 08

b) Obtain the solution for state equation (refer Q.9a) Transfer function) 07

Q.10 Write short notes on (any three) 15

- a) Proportional controller
- b) PID controller
- c) Digital Control System
- d) Polar Plot.