Roll No. ☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 18

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B.Tech (EE)   (Sem.–5)
CONTROL SYSTEMS
Subject Code : BTEC-504-18
M.Code : 78300
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Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

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SECTION-A
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Answer briefly :

1)   Define transfer function for LTI systems.

2)   Write the formula for Mason's gain formula.

3)   What is the difference between steady-state and transient response?

4)   a) What is the difference between proportional and integral control?

     b) Draw the block diagram of feed forward and multi-loop control configurations.

5)   Explain the Routh Hurwitz criterion of stability.

6)   Draw the electrical circuits of lag and lead compensator.

7)   What is the significance of gain margin and phase margin in the estimation of relative stability?

8)   What is a characteristic equation? Give an example of it.

9)   How state variables are derived for a given system?

10) What are eigen values and eigen vectors?

SECTION-B

11) Using Mason's Gain formula, obtain the transfer function of the control system for the following block diagram, where R is the input signal and C is the output signal. G's and H's are path gains.
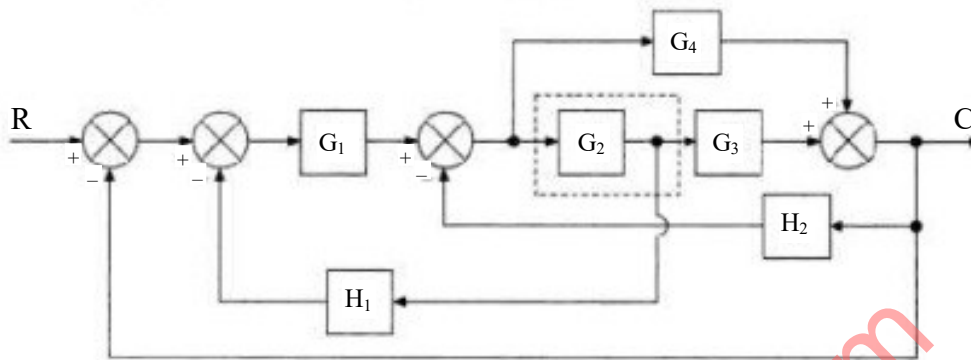
12) Using the Routh's Hurwitz criterion, evaluate and comment on the stability for the control system having the following characteristics equation :

$$s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$$

Also, determine the roots of the above system equation.

13) Using the final value theorem, derive the steady state error for unit step and unit ramp inputs.

14) Derive an equation for the magnitude and phase angle for a second order system in frequency domain. Also, estimate the resonant frequency and its bandwidth of system.

15) Derive the state transition equation in terms of state transition matrix and state variables.

SECTION-C

16) A unity feedback control system has an open-loop transfer function $G(s) = 5 / [s(s + 1)]$. Find the rise time, percentage overshoot, peak time, and settling time for a step input of 10 units. Also, determine the peak overshoot.

17) Obtain a state model of the system described by the transfer function. $Y(s)/U(s) = 5 / [s^3 + 6s + 7]$

18) Compare the P, I and D controllers in terms of time domain specifications. Hence, draw the overall response curve for PI and PID controller.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.