



**B.E DEGREE EXAMINATIONS: NOV/DEC 2023**

(Regulation 2018)

Fifth Semester

**ELECTRONICS AND COMMUNICATION ENGINEERING**

U18ECT5004: Control Systems

**COURSE OUTCOMES**

- CO1:** Apply techniques for system modelling.
- CO2:** Analyze the systems in time domain.
- CO3:** Demonstrate the frequency domain analysis of the system.
- CO4:** Discuss various stability analysis techniques.

**Time: Three Hours**

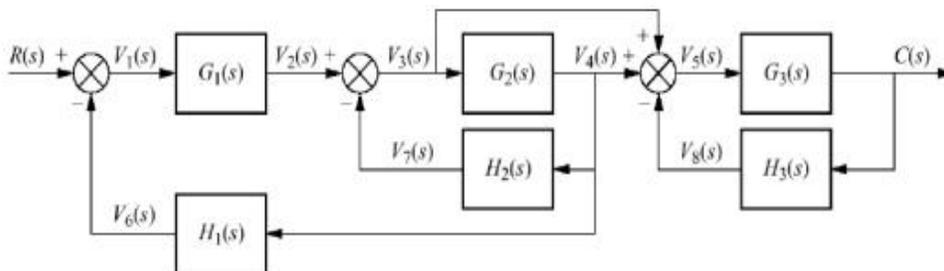
**Maximum Marks: 100**

**Answer all the Questions: -  
PART A (10 x 2 = 20 Marks)  
(Answer not more than 40 words)**

- |  |     |                   |
|--|-----|-------------------|
| 1. Differentiate open loop and closed loop control system.   | CO1 | [K <sub>3</sub> ] |
| 2. Why negative feedback is preferred in control systems?  | CO1 | [K <sub>2</sub> ] |
| 3. Name the test signals used in time response analysis.   | CO2 | [K <sub>1</sub> ] |
| 4. How is the system classified depending on the value of damping?   | CO2 | [K <sub>2</sub> ] |
| 5. How do you find the stability of the system by using polar plot?  | CO3 | [K <sub>2</sub> ] |
| 6. What are the advantages of Bode plot?   | CO3 | [K <sub>2</sub> ] |
| 7. State Nyquist stability criteria.   | CO4 | [K <sub>2</sub> ] |
| 8. What is root locus.   | CO4 | [K <sub>2</sub> ] |
| 9. The characteristic equation of a system is $5S^4 + 3S^3 + 10S + 2 = 0$ . Comment about the stability of the system. | CO4 | [K <sub>3</sub> ] |
| 10. Justify the role of compensators in control systems. Name the types of compensators and which one is best.         | CO4 | [K <sub>3</sub> ] |

**Answer any FIVE Questions: -  
PART B (5 x 16 = 80 Marks)  
(Answer not more than 400 words)**

- |  |    |     |                   |
|--|----|-----|-------------------|
| 11. Find the transfer function of this system. | 16 | CO1 | [K <sub>3</sub> ] |
|--|----|-----|-------------------|



- |  |    |     |                   |
|--|----|-----|-------------------|
| 12. a) Find the undamped natural frequency and damping ratio of a system when a unit step input is given to system represented by $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$ ? | 10 | CO2 | [K <sub>4</sub> ] |
| b) Write short notes on Steady state error.  | 6  | CO2 | [K <sub>2</sub> ] |

13. a) Sketch the polar plot for and determine the PM and GM . 8 CO2 [K<sub>2</sub>]  

$$G(s) = \frac{20}{s(s+1)(s+2)}$$

b) For the Transfer Function given in 13(a). sketch the Bode diagram which shows how the phase of the system is affected by changing input frequency. 8 CO3 [K<sub>3</sub>]

14. a) Find the angle of asymptotes and the centroid of a system whose characteristic equation for is. 8 CO3 [K<sub>3</sub>]  
 $s(s+4)(s^2+2s+1)+K(s+1)=0$  .

b) Suppose we have a stable transfer function as given below. To improve performance, we close the loop with a gain of 1000 i.e  $K(s) = 1000$ . Explain the system stability for closed loop. ( use Routh array) 8 CO3 [K<sub>3</sub>]  

$$\hat{G}(s) = \frac{1}{(s+2)(s+3)(s+5)}$$

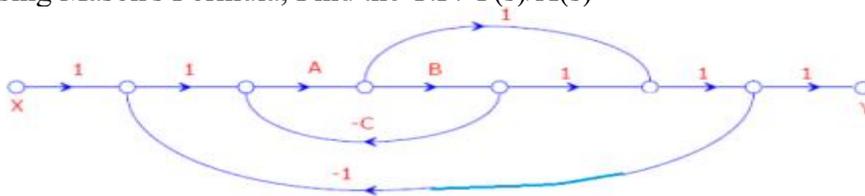
15. a) For a certain system, unity feedback with an OLTF given below, design Lead compensator to meet the following specification  $K_v = 12 \text{ Sec}^{-1}$ , and  $\Phi_{PM} = 40^\circ$ . From the bode plot ,  $PM = 15^\circ$  and the frequency at which the gain is  $-20 \log 1/\sqrt{\alpha}$  is  $\omega = 5.8 \text{ rad/sec}$  8 CO4 [K<sub>3</sub>]

$$G(s) = KG(s) = \frac{K}{s(1+s)}$$

b) For a unit feedback system with open loop transfer function given below, design Lag compensator to meet the following specification  $K_v = 20 \text{ Sec}^{-1}$ ,  $\Phi_{PM} = 55^\circ$ . From the Bode plot ,  $PM = 18^\circ$ , New gain cross over frequency  $\omega_{gc} = 0.9 \text{ rad/sec}$ , Amplitude at  $\omega_{gc} - 28\text{dB}$ . 8 CO4 [K<sub>3</sub>]

$$G(s) = \frac{5}{s(1+0.5s)}$$

16. a) Using Mason's Formula, Find the T.F.  $Y(s)/X(s)$  8 CO1 [K<sub>3</sub>]



b) Write the algorithm for designing Lead – Lag Compensator. 8 CO4 [K<sub>3</sub>]

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