



B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Fifth Semester

MECHATRONICS ENGINEERING

U18MCT5004: Control Engineering

COURSE OUTCOMES

- CO1:** Know the significance to control engineering and the basic construction of control systems.
- CO2:** Develop mathematical equations for model mechanical, electrical systems and can able to compute transfer function using block diagram and signal flow graph methods
- CO3:** Analyze the 1st and 2nd order systems in time domain for various test signals and Calculate steady state errors and derive generalized error series in the time domain analysis.
- CO4:** Analyze the 1st and 2nd order systems in frequency domain using Bode and Polar plots
- CO5:** Calculate the stability of the system using Routh Hurwitz, Nyquist and Root Locus techniques.
- CO6:** Explain about PID control and tuning, time delay responses and also discuss sequence control in process industry

Time: Three Hours

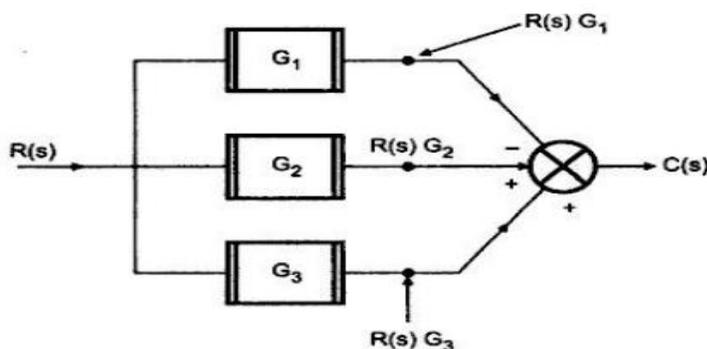
Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

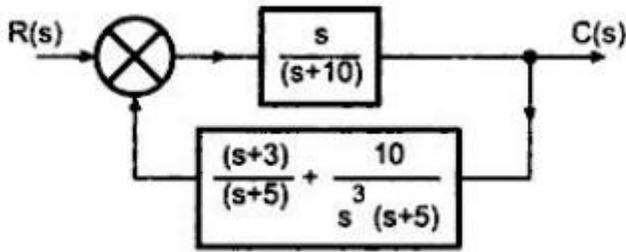
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|---|-----|-------------------|
| 1. List the components of feedback control system. | CO1 | [K ₂] |
| 2. Classify the control system based on time variant and linearity. | CO1 | [K ₂] |
| 3. Find out the transfer function of the given diagram. | CO2 | [K ₂] |



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|--|-----|-------------------|
| 4. Observer the given transfer function and determine the poles and number of poles. | CO2 | [K ₃] |
|--|-----|-------------------|

$$T(S) = \frac{K(S+6)}{S(S+2)(S+5)(S^2+7S+12)}$$

- | | | |
|---|-----|-------------------|
| 5. Find the K _p , K _v and K _a for the given transfer function. | CO3 | [K ₃] |
|---|-----|-------------------|



6. Give the suitable corner frequency for the given function.

CO4 [K₃]

$$G(S) = \frac{5(1 + 2S)}{(1 + 4S)(1 + 0.25s)}$$

7. Write the statement of Routh Hurwitz Criterion

CO5 [K₂]

8. Determine the range of K for stability of unity feedback system whose open loop transfer function is

CO5 [K₃]

$$G(S) = \frac{K}{S(S+1)(S+2)}$$

9. Define tuning of the controller.

CO6 [K₂]

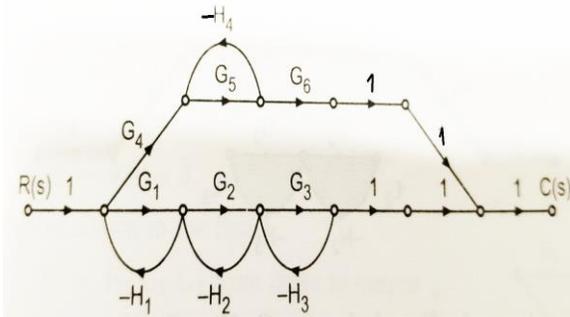
10. Justify why derivative controller is not used in control systems.

CO6 [K₂]

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

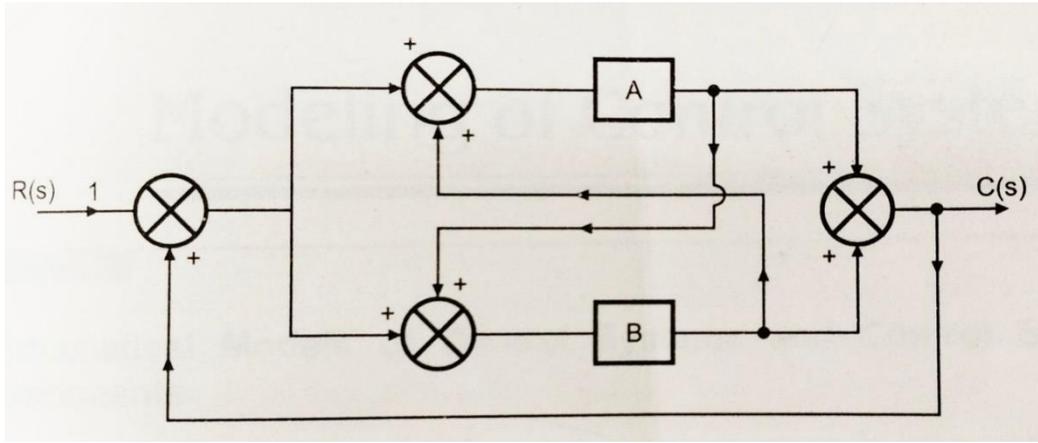
11. a) Find the overall gain of the system using signal flow graph.

8 CO2 [K₃]



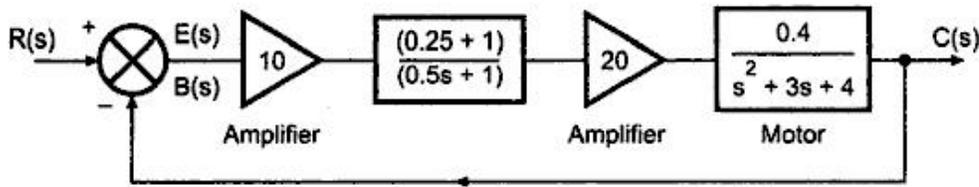
b) Draw the signal flow graph and obtain the transfer function

8 CO2 [K₃]



12. a) Find the time response of the given transfer function $C(S) = \frac{12}{R(S) S^2+8s+16}$ for a unit step input. 8 CO3 [K₃]

- b) For the system shown in fig. Determine the steady state error for unit step input. 8 CO3 [K₃]



13. a) Draw the bode plot for the given transfer function $G(S) = \frac{100(1+0.1S)}{S(1+0.2S)(1+0.5S)}$. Determine the gain and phase margin 16 CO4 [K₃]

14. a) The open loop transfer function of a unity feedback control system is given by $G(S) = \frac{K}{(s+2)(s+4)(s^2+6s+25)}$. By applying the Routh criterion, Discuss the stability of the closed loop system as a function of K. Determine which will cause sustained oscillations in the closed loop system. What are the corresponding oscillating frequency 16 CO4 [K₃]

15. a) A unity feedback control system has an open loop transfer function $G(S) = \frac{K}{S(S^2+4S+13)}$. Sketch the root locus. 16 CO5 [K₃]

16. a) Explain in details about controllers and its types with neat sketch. CO6 [K₂]
