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B.E DEGREE EXAMINATIONS: APRIL/MAY 2024

(Regulation 2018)

Fourth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

U18EII4203**:** Modelling and Analysis of Dynamic Systems

COURSE OUTCOMES

CO1:	Model any given 1st and 2nd order physical system and analyse the dynamic response.
CO2:	Apply the block diagram reduction technique, Signal flow Graph, Bond graph and State space modelling for the given physical system.
CO3:	Analyse the time response for the given system and the steady state error.
CO4:	Analyse the stability of the given system using Bode plot, polar plot and Nyquist plot and also analyse the stability in digital domain.

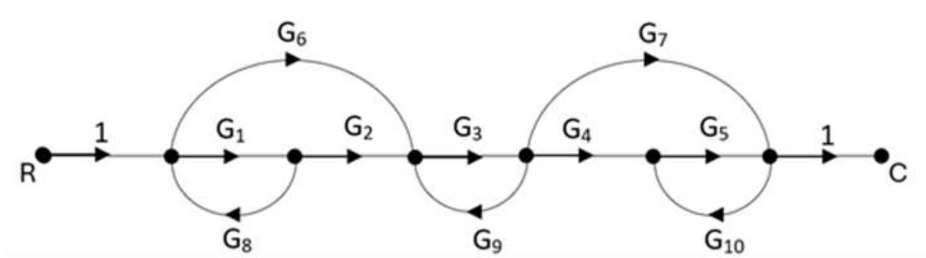
Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

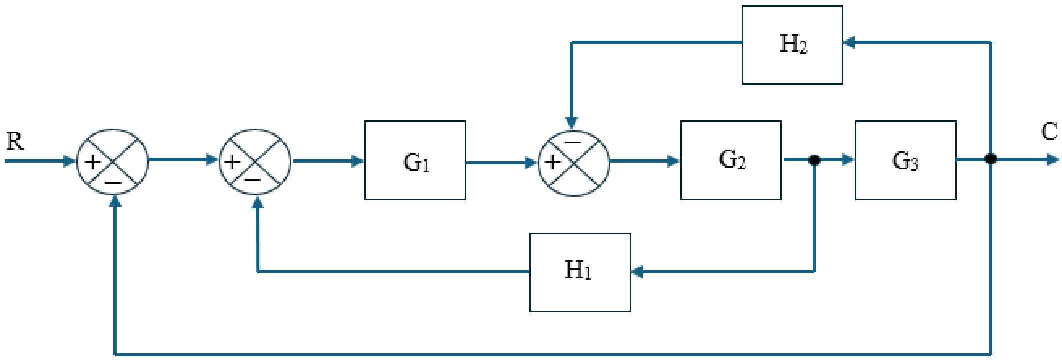
PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	Define feedback? What type of feedback is preferred for the control system?	CO1	[K_1]
2.	Justify the need for mathematical modelling.	CO1	[K_2]
3.	List the basic elements used for modelling mechanical rotational systems?	CO1	[K_1]
4.	Apply the block diagram reduction rule to combine the feed forward paths.	CO2	[K_3]
5.	For the given signal flow graph, identify the number of two non-touching loops and write their gains.	CO2	[K_3]



6. Convert the Block diagram to signal flow graph. CO2 [K_3]



7. Interpret the importance of test signal. CO3 [K_1]

8. For the following transfer function, find the type and order of the system. CO3 [K_2]

i) $G(s)H(s) = \frac{K}{S^2(S+1)(S+2)}$

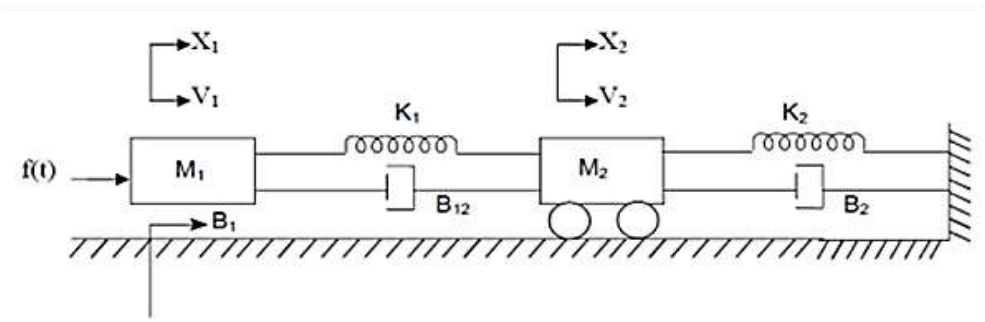
ii) $G(s)H(s) = \frac{K}{S^3(S^2+2S+1)}$

9. Sketch the bode plot, G(s) = 1/(1+sT). CO4 [K_2]

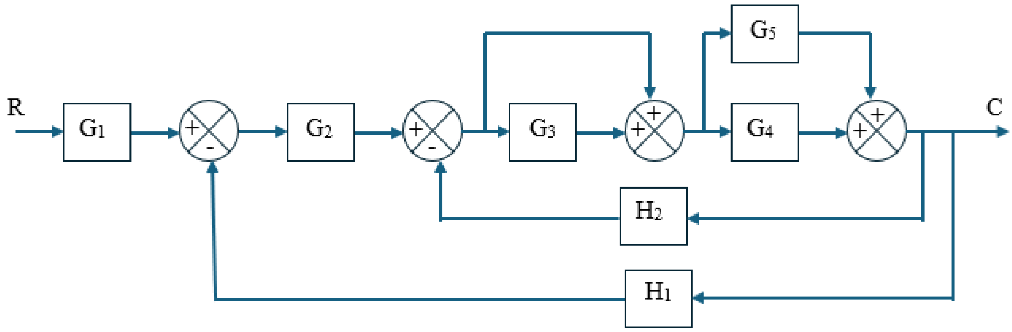
10. State the necessary and sufficient condition for stability. CO4 [K_1]

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

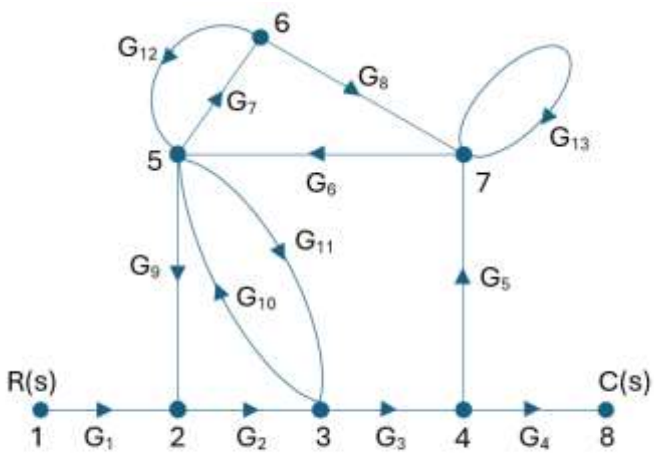
11. Consider a simple system with a mass that is separated from a wall by a spring and a dashpot. The mass could represent a car, with the spring and dashpot representing the car's bumper. An external force is also shown in the figure below. Only horizontal motion and forces are considered. There are two positions in this system defined by the variable "X1 and X2" that is positive to the right. Write the differential equation for the system shown and draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations. 16 CO1 [K_2]



12. a) Consider the block diagram shown in figure. Using block diagram reduction technique, find C/R. 8 CO2 [K_3]



b) Consider the signal flow graph shown. Find C(s)/ R(s) 8 CO2 [K_3]



13. a) The open loop transfer function of a servo system with unity feedback is 8 CO3 [K_2]

$$G(s) = \frac{10}{s(0.1s + 1)}$$

Evaluate the static error constats of the system. Obtain the steady state error of the system, when subjected to an input given by the polynomial, $r(t) = a_0 + a_1 t + \frac{a_2}{2}t^2$.

b) A unity feedback control system has an open loop transfer function, 8 CO3 [K_2]

$$G(s) = \frac{10}{s(s + 2)}$$

Find the rise time, percentage overshoot, peak time and settling time for a unit step input.

14. The open loop transfer function of a unity feedback system is given by 16 CO4 [K_3]

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

Sketch the polar plot and determine the gain and phase margin.

15.	a)	Determine the range of K for stability of unity feedback system whose open loop transfer function is $$G(s) = \frac{K}{s(s+1)(s+2)}$$	8	CO4	[K_3]
	b)	By routh stability criterion, determine the stability of the system represented by the characteristic equation, $9s^5-20s^4+10s^3-s^2-9s-10=0$. Comment on the location of roots of characteristic equation.	8	CO4	[K_3]
16.		The open loop transfer function of a unity feedback system is given by, $$G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$$ Sketch the root locus of the system.	16	CO4	[K_3]

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