Reg. No.															

Question Paper Code	12977

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fourth Semester

Electrical and Electronics Engineering

20EEPC404 - CONTROL ENGINEERING

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	In control system block diagrams, which mathematical operation is performed at summing points? (a) Addition or subtraction (b) Multiplication (c) Integration (d) Differentiation	1	K2	CO1
2.	In a mechanical system, what is the equivalent of resistance in an electrical system? (a) Mass (b) Dashpot (c) Spring constant (d) Inertia	1	K2	CO1
3.	In Mason's Gain Formula, what is meant by a "non-touching loop"? (a) Two loops that share a node (b) Two loops that do not share any common nodes (c) Two loops that share a branch (d) Two loops with the same gain	1	K1	CO1
4.	State the name of the formula used to find the overall transfer function of a system from its signal flow graph? (a) Mason's Gain Formula (b) Routh-Hurwitz Criterion (c) Nyquist Criterion (d) Root Locus Method	1	K2	CO1
5.	The time taken by the system output to reach 50% of the final value for the first time is called (a) Rise time (b) Settling time (c) Delay time (d) Peak time	1	K2	CO2
6.	In mechanical systems, what does the term "damping ratio" measure? (a) The rate at which the system's motion decays over time (b) The system's natural frequency (c) The stiffness of the system (d) The system's resistance to force	1	K1	CO2
7.	The following condition is used for representing _____. $F(t) = At$; for $t > 0$ $F(t) = 0$; for $t<0$ (a) Step function (b) Impulse function (c)Ramp function (d) Parabolic function	1	K2	CO2
8.	The amount by which the system output exceeds its steady-state value is referred to as: (a) Peak time (b) Settling time (c) Overshoot (d) Delay time	1	K1	CO2
9.	The Routh-Hurwitz criterion is used to determine: (a) The transient response of the system (b) The stability of a linear time-invariant system (c) The frequency response of the system (d) The steady-state error of the system	1	K2	CO3

10.	State the stability of the system if all the branches of the root locus remain on the left half of the s-plane (a) The system is stable (b) The system is unstable (c) The system has a damping ratio greater than 1 (d) The system oscillates with increasing amplitude	*1*	*K2*	*CO3*
11.	If any of the elements in the first column of the Routh array is zero, it indicates: (a) The system is marginally stable (b) The system is stable (c) The system is unstable (d) Special methods must be used to determine stability	*1*	*K2*	*CO3*
12.	The auxiliary equation in Routh-Hurwitz criterion is formed using: (a) The coefficients of the highest-order polynomial in the characteristic equation (b) The row just above the row of all zeros (c) The first column of the Routh array (d) The first row of the Routh array	*1*	*K2*	*CO3*
13.	Which of the following is NOT typically assessed from a polar plot? (a) Gain margin (b) Phase margin (c) System stability (d) Steady-state error	*1*	*K1*	*CO4*
14.	-------- is the slope of the magnitude plot in dB/decade for a first-order system with a pole? (a) +20 dB/decade (b) -20 dB/decade (c) +40 dB/decade (d) -40 dB/decade	*1*	*K2*	*CO4*
15.	In a Bode plot, the gain margin is determined from: (a) The phase plot at a frequency where the magnitude is 0 dB (b) The magnitude plot at a frequency where the phase is -180 degrees (c) The magnitude plot at the cut-off frequency (d) The phase plot at the resonant frequency	*1*	*K2*	*CO4*
16.	The Bode plot is used to analyze (a) Time-domain response (b) Frequency response (c) Stability margins (d) Transient response	*1*	*K1*	*CO4*
17.	A compensator is classified as a lead compensator if the phase introduced by the compensator is: (a) Positive (b) Negative (c) Zero (d) None of the above	*1*	*K2*	*CO5*
18.	---------- Compensator improves both transient and steady-state response? (a) Lead compensator (b) Lag compensator (c) Lead-lag compensator (d) Proportional compensator	*1*	*K2*	*CO5*
19.	Which of the following compensators tends to reduce overshoot and improve system stability? (a) Lead compensator (b) Lag compensator (c) Lead-lag compensator (d) None of the above	*1*	*K2*	*CO5*
20.	Find the compensators tend to reduce overshoot and improve system stability? (a) Lead compensator (b) Lag compensator (c) Lead-lag compensator (d) None of the above	*1*	*K2*	*CO5*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

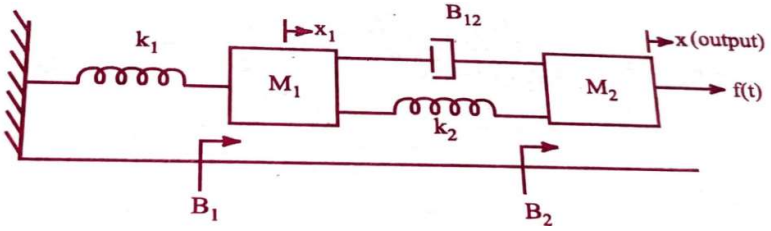
21.	Define transfer function.	*2*	*K1*	*CO1*
22.	Give some examples of control systems.	*2*	*K1*	*CO1*
23.	Distinguish between Type and Order of the system.	*2*	*K2*	*CO2*
24.	The CLTF of the 2nd order system is C(s) / R(s) = 10 / (S^2 +6S+10). Find the type of Damping of this system.	*2*	*K2*	*CO2*
25.	Define asymptotes? Give the formula for angle of Asymptotes.	*2*	*K2*	*CO3*
26.	State Routh's criterion for stability.	*2*	*K1*	*CO3*
27.	Define gain crossover frequency.	*2*	*K1*	*CO4*

28.		State Nyquist stability criterion.	2	K1	CO4
29.		Draw the circuit of the lag-lead compensator and draw its pole zero diagram.	2	K2	CO5
30.		Sketch the circuit of the lag compensator and draw its pole zero diagram.	2	K2	CO5

PART - C (6 × 10 = 60 Marks)

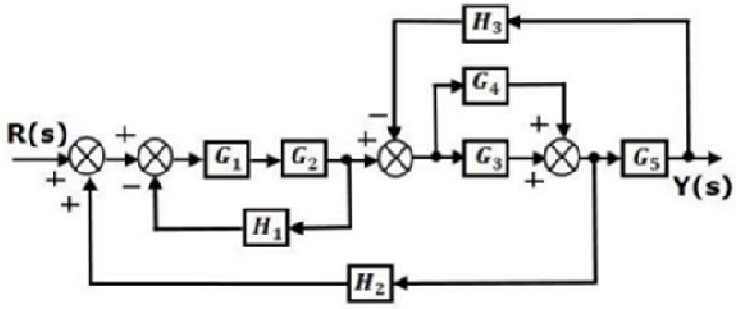
Answer ALL Questions

31.	a)	Write the differential equations governing the mechanical system and determine the transfer function.	10	K3	CO1



OR

	b)	Apply block diagram reduction rules and obtain the transfer function of the following system.	10	K3	CO1



32.	a)	Obtain the time response of second order system-under damped condition for unit step input.	10	K2	CO2

OR

	b)	Derive the expression of steady state error and Static error Coefficients for various types of inputs.	10	K2	CO2
33.	a)	A UFB Control system has an OLTF of G(S) = K / S (S^2 + 4S+13). Sketch the root locus.	10	K3	CO3

OR

	b)	Using the Routh-Hurwitz criterion determines stability of a system whose characteristic equation is: S^5 + S^4 +2S^3+ 2S^2 + 3S + 5 =0. Comment on the Location of roots.	10	K3	CO3
34.	a)	The OLTF of a UFB system is G(s) = 1/ S (1+S) (1+2S). Sketch the Polar plot and determine the Gain Margin and Phase Margin.	10	K3	CO4

OR

	b)	Sketch Bode plot for the transfer function and determine the gain crossover frequency. G(s) = 20/ S(1+3S) (1+4S)	10	K3	CO4
35.	a)	Brief the procedure for design of Lag Compensator using Bode plot.	10	K3	CO5

OR

	b)	Design a lead compensator for a unity feedback system with open loop transfer function, G(S) = K/[S(S+1)(S+5)] to satisfy velocity error constant ≥ 50 and phase margin ≥ 20^{o}.	*10*	*K3*	*CO5*
36.	a) i)	Discuss the graphical techniques available for frequency response analysis.	*5*	*K2*	*CO4*
	ii)	Write the need of compensators and list types of compensators with circuit diagram.	*5*	*K2*	*CO5*
		OR			
	b) i)	Explain the frequency domain specifications.	*5*	*K2*	*CO4*
	ii)	Write the procedure to design a Lag Compensator using Root locus.	*5*	*K2*	*CO5*