A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54303

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Fourth Semester

Electrical and Electronics Engineering

15UEE403- CONTROL SYSTEMS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Loop which do not possess any common node are said to be ____________ loops. CO1- R

   (a)) Forward gain (b) Touching loops (c) Non touching loops (d) Feedback gain

2. In ___________electrical signal is converted in to angular motion. CO1- R

   (a)Series motor (b) Generator (c) Servomotor (d) Shunt motor

3. Rise time is time taken for response to raise from ___________ CO2- R

   (a) 0 to 100%. (b) 10 to 100%. (c) Infinity (d) Both a and b

4. The steady state error is value of error signal when time t is___________ CO2- R

   (a) $t<\infty$. (b) $t>\infty$. (c) $t=\infty$. (d) $t\to\infty$.

5. The Gain Cross Over Frequency is the frequency at which the phase of the open loop transfer function is______________ CO3- R

   (a) 90° (b) Greater than 180° (c) Less than 180° (d) 180°

6. Resonance Peak is the_________ value of the magnitude of closed loop transfer function. CO3- R

(a) Maximum (b) Minimum

(c) Zero (d) None of the above

7. Location of roots on the imaginary axis makes the system : CO4- R

(a)Stable (b) Unstable (c) Marginally stable (d) Linear

8. The characteristic equation of a system is given as $3S^4 + 10S^3 + 5S^2 + 2 = 0$. This system is : CO4- R

(a) Stable (b) Marginally stable (c) Linear (d) Unstable

9. If $X(0)$ is initial value, solution of state equation is_________ CO5- R

(a) A $e^{At} X(0)$ (b) $e^{At} X(0)$ (c) At $e^{At} X(0)$ (d) t $e^{At} X(0)$

10. The transfer function for the state variable representation $\overset{0}{X} = AX + BU$, $Y = CX + DU$ is given by CO5- R

(a) $D + C(sI - A)^{-1} B$ (b) $B(sI - A)^{-1} C + D$

(c) $D(sI - A)^{-1} B + C$ (d) $C(sI - A)^{-1} D + B$

PART – B (5 x 2= 10Marks)

11. Define transfer function. CO1- R

12. What is rise time and settling time? CO2- R

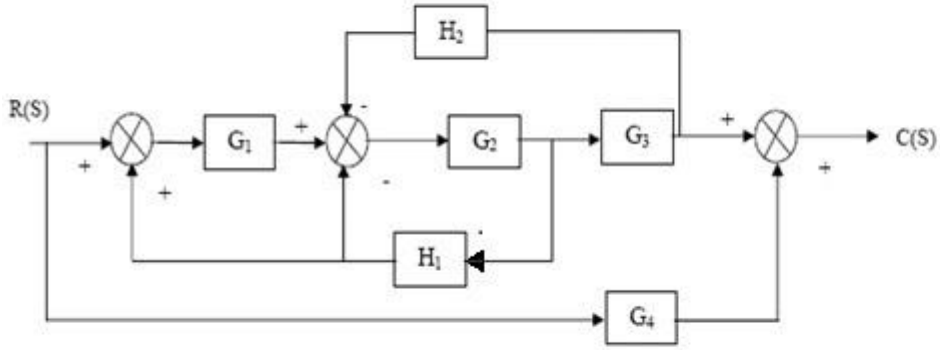
13. Define Gain margin. CO3- R

14. State Routh stability criterion. CO4- R

15. Define State and State variables. CO5- R

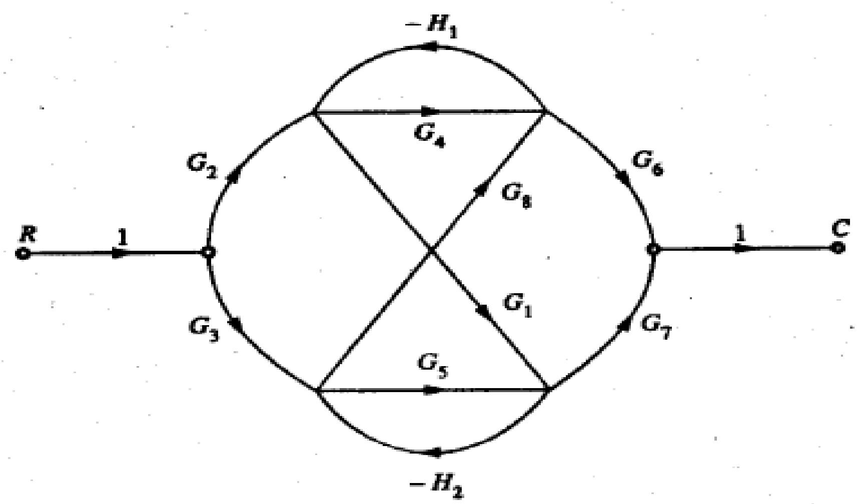
PART – C (5 x 16= 80Marks)

16. (a) Obtain the closed loop transfer function C(S)/R(S) of the system whose block diagram is shown in fig. CO1- App (16)



Or

(b) Obtain the overall gain of the system by using Mason's gain formula — CO1- App (16)



17. (a) Derive an expression for the time response of an under damped second order when it is system subjected to unit step input. — CO2- App (16)

Or

(b) Determine the steady state error for a system having — CO2- Ana (16)

$$G(S)H(S) = \frac{100}{S^2(1+0.05S)(S+2)}$$ and input as $r(t) = t^2$

18. (a) For the following transfer function draw bode plot and obtain gain cross-over frequency. — CO3- Ana (16)

$$G(S) = \frac{20}{S(1+3S)(1+4S)}$$

Or

	(b)	The open loop transfer function of a unity feedback system is given by $G(S) = \frac{1}{S(S+1)(2S+1)}$. Sketch the polar plot and determine the gain margin and phase margin.	CO3- Ana	(16)
19.	(a)	Draw the Nyquist plot for the system whose open loop transfer function is $G(S)H(S) = \frac{K}{S(S+2)(S+10)}$.Determine the range of K for which closed loop system is stable.	CO4- U	(16)
		Or		
	(b)	Explain the procedure for the design of the lag compensator based on frequency response approach using bode plot.	CO4- Ana	(16)
20.	(a)	Determine the canonical state model of the system, whose transfer function is $T(S) = \frac{2(S+5)}{(S+2)(S+3)(S+4)}$	CO5- U	(16)
		Or		
	(b)	Evaluate the controllability and observability of the following state model	CO5- U	(16)

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix} U$$

$$Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$