Q. Code: 263280

Reg. No. | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Fourth Semester

EC16405 – CONTROL SYSTEM ENGINEERING

(Electronics and Communication Engineering)

(Regulation 2016)

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

(Graph sheet and semi log are to be provided)

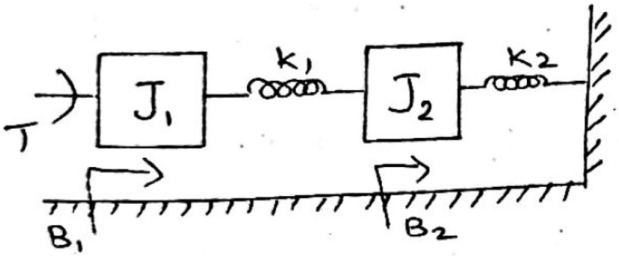
Answer ALL questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	List the advantages of closed loop system.	1	U
2.	What is Block Diagram? What are its basic components?	1	U
3.	Give the steady state errors to various standard inputs for type 2 system.	2	U
4.	Find the unit impulse response of system H(s) = 5 s / (s + 2) with zero initial conditions.	2	AP
5.	The damping ratio and undamped natural frequency of second order system are 0.5 and 5 respectively. Calculate the damped frequency of oscillation.	2	AP
6.	Define Gain and Phase Margin.	2	R
7.	What is meant by relative stability.	2	R
8.	Define Nyquist stability Criterion.	2	R
9.	Define State Equation and State Variable.	3	R
10.	Define Observability of system.	3	R

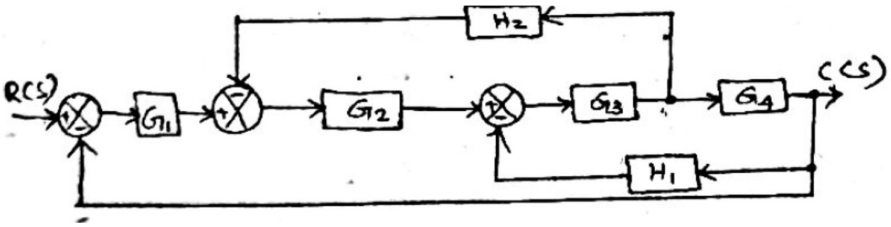
PART B - (5 X16 = 80 Marks)

11. (a) Write the differential equations governing the mechanical rotational system for the fig. shown below. Draw the force voltage and force current electrical analogous circuits and verify by mesh and node equations. **(16)** **1** **AP**



(OR)

(b) Use Masons gain formula to obtain C(S) / R(S) of the system shown below. **(16)** **1** **AP**



12.	(a)	(i)	Determine the steady state errors for the following inputs 5u(t), 5tu(t), $5t^2u(t)$ to a system whose open loop transfer function is given by G(s) =100 (s+2) (s+6) / s (s+3) (s+4).	**(8)**	**2**	**AP**
		(ii)	With its block diagram, explain the concepts of PI and PD compensation.	**(8)**	**2**	**U**
			(OR)			
	(b)		Briefly discuss about step response analysis of second order system for (i) $\zeta = 1$ (ii) $0 < \zeta < 1$ (iii) $\zeta = 0$ (ζ- damping ratio)	**(16)**	**2**	**AN**
13.	(a)		For the following transfer function draw the Bode plot, find the gain and phase margin: G(S)H(S)=5/s(10+s)(20+s).	**(16)**	**2**	**AP**
			(OR)			
	(b)		Explain in detail the design procedure of lag and lead compensator using Bode plot.	**(16)**	**2**	**AP**
14.	(a)		Sketch the root locus for G(S) = k (s + 2)(s + 3) / (s + 1) (s -1)	**(16)**	**2**	**AP**
			(OR)			
	(b)	(i)	Define stability. Give the statement of Routh Hurwitz Criterion.	**(8)**	**2**	**U**
		(ii)	Consider the sixth order system with the characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Use Routh stability criterion to examine about the stability of the system.	**(8)**	**2**	**AN**
15.	(a)		Test the controllability and observability of the system whose state space representation is given as	**(16)**	**3**	**AP**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & +2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u; \; y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}.$$

			(OR)			
	(b)		A discrete time system is described by the difference equation y(k+2) + 5 y(k+1) + 6 y(k) = u(k) with initial conditions Y(0)=Y(1)=0 and T=1 sec, Determine i) state model in canonical form ii) state transition matrix.	**(16)**	**3**	**AP**