Q. Code: 371786

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

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

Third Semester

EE18304 – CONTROL SYSTEMS

(Electrical and Electronics Engineering)

(Regulation 2018)

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

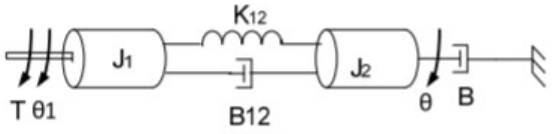
Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	Define transfer function of a system.	1	R
2.	What are analogous systems?	1	U
3.	Determine the steady state error for servomechanism whose open loop transfer function is $G(s)=\frac{20(s+2)}{s(s+1)(s+3)}$ with ramp input.	2	AP
4.	Write the relation between generalized and static error coefficients.	2	U
5.	State Nyquist Stability Criterion.	4	R
6.	Using Routh array criterion, determine the stability of the system represented by the characteristic equation $s^3+s^2+s+21=0$ and comment on the location of roots .	3	AP
7.	What are the advantages of state space analysis?	5	R
8.	Define Observability.	5	R
9.	What are the effects of PI and PID controller?	6	U
10.	Why compensation is necessary in feedback control system?	6	U

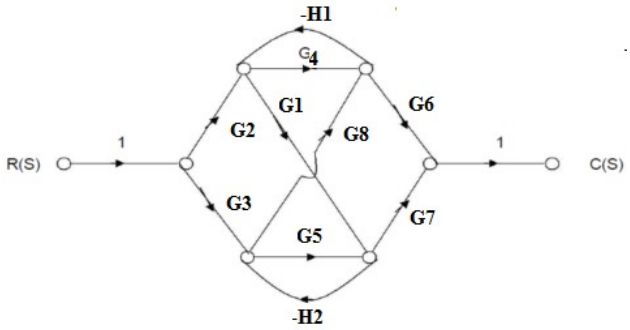
PART B - (5 X16 = 80 Marks)

11. (a) Write the differential equations governing the mechanical rotational system shown below. Obtain the transfer function $\frac{\theta(s)}{T(s)}$.Draw the Torque Voltage electrical analogous circuit and verify by writing mesh equations. **(16)** 1 AP



(OR)

(b) (i) Find the overall gain of the system whose signal flow graph is shown in figure. **(10)** 1 AP



		(ii)	Briefly explain the operation of AC servomotor.	**(6)**	**1**	**U**
12.	(a)	(i)	Derive the expressions for rise time, peak over shoot, settling time of Second order system of unit step input.	**(8)**	**2**	**AP**
		(ii)	A unit feedback system is characterized by an open-loop transfer function G(s) = $\frac{K}{s(s+5)}$. Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak overshoot and times to peak overshoot for a unit-step input.	**(8)**	**2**	**AP**
			(OR)			
	(b)		Sketch the root locus of the system with unity feedback control whose open loop transfer function is G(s)=$\frac{K}{s(s^2+4s+13)}$	**(16)**	**2**	**AP**
13.	(a)		The open loop transfer function of an unity feedback system is given by G(s)=$\frac{K}{s(1+0.02s)(1+0.04s)}$.Draw the Bode plot, find Gain margin and Phase margin. Hence find the value of open loop gain so that the closed loop system has a PM of 45°.	**(16)**	**3**	**AP**
			(OR)			
	(b)	(i)	Draw the typical sketches of the systems. a.) Type 1 order 3 b.)Type 2 order 4 c.) Type 2 order 5	**(6)**	**3**	**AP**
		(ii)	The open loop transfer function of a unity feedback system is given by G(s)=$\frac{1}{s(1+s)(1+2s)}$.Sketch the polar plot and determine the Gain margin and Phase margin.	**(10)**	**3**	**AP**
14.	(a)		Obtain the state space model of field-controlled DC motor.	**(16)**	**5**	**AP**
			(OR)			
	(b)		A system is given by the state equation $x(t)+u(t)\begin{bmatrix}0 & 1\\ 0 & 0\\ 2 & 1\end{bmatrix}$ and output equation $y(t)=\begin{bmatrix}0 & 0 & 1\\ 1 & 1 & 0\end{bmatrix}$ Check whether the system is controllable and observable.	**(16)**	**5**	**AP**
15.	(a)		A unity feedback system has an open loop transfer function, G(s)= $\frac{K}{s(1+2s)}$. Design a suitable lag compensator so that phase margin is 40° and the steady state error for ramp input is less than or equal to 0.2.	**(16)**	**6**	**AN**
			(OR)			
	(b)		Describe in detail the various steps involved in the design of Lead compensator using Bode plot.	**(16)**	**6**	**AP**