Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

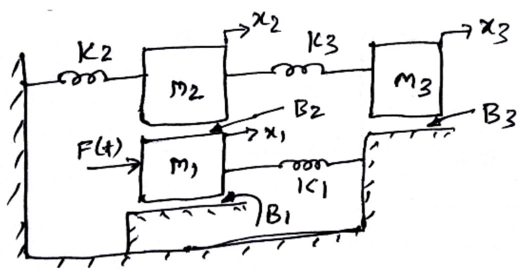
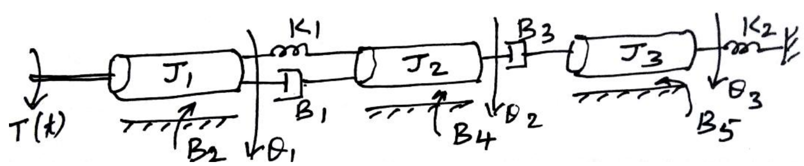
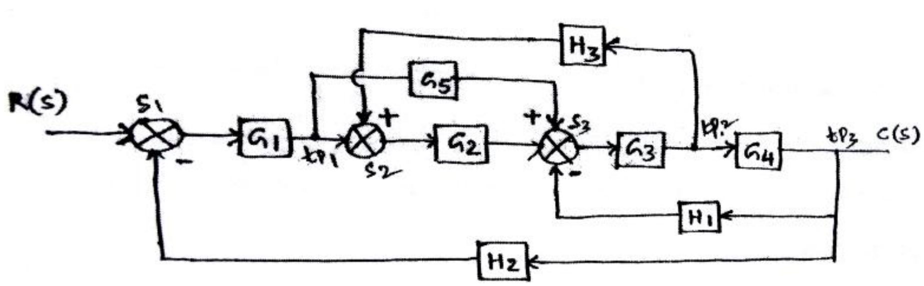
USN | | | | | | | | | |

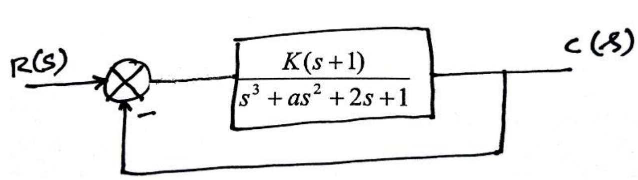
Fourth Semester B.E. Degree Examination

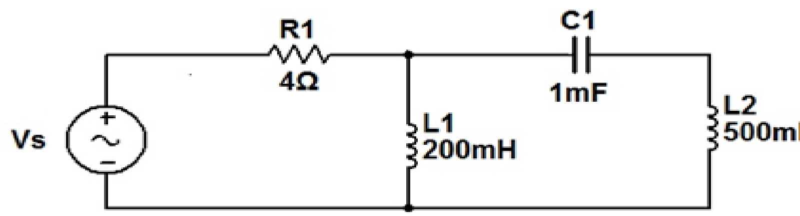
Title Control Systems

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** full question from each **MODULE**.
02. .
03. .

		Module -1	
Q.01	a	Distinguish between open loop and closed loop control system.	6
	b	For the mechanical system shown in Fig.Q1(b) draw the mechanical network and governing differential equations obtain F-V and F-I analogous network.  Fig.Q1(b)	10
	c	Explain with diagrams the following rules of block diagram reduction technique i) Shifting takeoff point after the summing point ii) Shifting takeoff point behind the summing point	4
		OR	
Q.02	a	For the rotational system shown in Fig.Q2(a) draw the mechanical network and governing differential equations representing dynamics of the system, obtain F-V and F-I analogous network.  Fig.Q2(a)	10
	b	Applying the block diagram reduction rules obtain transfer function for the block diagram shown in Fig.Q2(b).  Fig.Q2(b)	10

		Module-2	
Q. 03	a	Define following terms with respect to signal flow graph. i) Node ii **)** Branch iii) Path iv) Loop	8
	b	Construct the signal flow graph from equations given and obtain the transfer function **X8/X1**. **X2= X1 – H3 X8** **X3= G1X2 – H2 X8** **X4= G2X3** **X5= G3 X4 – H4 X6** **X6= G4 X5 – H1 X8** **X7= G7 X4 + G5 X6** **X8= G8 X6 + G6 X7**	12
		OR	
Q.04	a	Derive an expression for step response of a first order system, also find steady state error	6
	b	For the transfer function $G(s) = \frac{25}{S^2 + 6S + 25}$ considering step input, determine rise time, Peak time, Peak overshoot error, and settling time.	8
	c	A certain feedback control system is described by following transfer function $G(s) = \frac{K}{S^2(S+20)(S+30)}$ and H(s) =1 determine the steady state error constants ,also determine the value of 'K' to limit the error to 10 Units, due to input r(t) = 1 + 10t + 20 t^2	6
		Module-3	
Q. 05	a	Discuss the significance of zero row in RH array	4
	b	Characteristic equation is given by $S^6 + 2s^5 + 8s^4 + 12S^3 + 20s^2 + 16s + 16 = 0$ **,**determine the stability using Routh-Hurwitz criteria and discuss on the stability	6
	c	Given open loop $G(s) = \frac{K}{S(S^2 + 2S + 2)}$ Sketch root locus, determine range of K for which the system is stable .	10
		OR	
Q. 06	a	A system oscillates with a frequency of 'ω', if it has poles at S = ±j ω and no poles in the right half of S-plane. Determine the value of 'k' and 'a',so that the system shown in Fig.6Q(a), oscillates at a frequency of 2 rad/sec.  Fig.6Q(a)	6
	b	Consider system $G(s)H(s) = \frac{K}{s(s+2)(s+4)}$ for S = - 0.75 is on the root locus or not using angle condition.	4

	c	Given open loop $G(s)=\dfrac{K}{S(S+2)(S+4)(S+6)}$ Sketch root locus, determine range of K for which the system is stable .	10
		Module-4	
Q. 07	a	Discuss time and frequency domain correlation considering second order system specifications.	8
	b	Draw the bode plot for a system having G(s) = $\frac{K(1+0.2s)(1+0.025s)}{s3(1+0.001s)(1+0.005s)}$ Show that system is conditionally stable find the range of 'k' for which system is stable.	12
		OR	
Q. 08	a	Define Polar plot. Draw polar plot for the transfer functions given i) $G(j\omega)=\dfrac{1}{1+\tau S}$ ii) $G(j\omega)=\dfrac{1}{S(1+\tau S)}$	6
	b	State and explain Nyquist stability criterion.	6
	c	A unity feedback control system has $G(j\omega)=\dfrac{10}{S(S+1)(S+2)}$. Draw Nyquist plot and comment on closed loop stability.	8
		Module-5	
Q. 09	a	Define i) State ii) State space iii) State variable	4
	b	Deduce the state model of the electrical network shown in Fig.9Q(b) by choosing minimal number of state variables.  Fig.9Q(b)	8
	c	Construct a state model for a system characterized by the differential equation $\dfrac{d^3y}{dt^3}+6\dfrac{d^2y}{dt^2}+11\dfrac{d\ y}{dt}+6y+u=0$ Give block diagram representation of the above state model.	8
		OR	
Q. 10	a	List difference between classical control approach and state variable approach in designing a system.	6
	b	Derive an expression for transfer function considering general state model of the system.	6
	c	Determine the canonical state model of the system, whose transfer function is given as $\dfrac{Y(s)}{U(s)}=\dfrac{10(s+4)}{S(S+1)(S+3)}$	8