## **GUJARAT TECHNOLOGICAL UNIVERSITY** BE - SEMESTER-VI • EXAMINATION – WINTER 2013

<b>BE - SEMESTER-VI • EXAMINATION – WINTER 2013</b>						
	Code: 160104 Date: 06-12-2013 Name: Basic Control Theory					
Time: 02:30 pm to 05:00 pm Total Marks: 7						
Inst	Instructions:					
		Attempt all questions. Make suitable assumptions wherever necessary.				
		Figures to the right indicate full marks.				
Q.1	<b>(a)</b>	Define transient response specifications with neat diagram along with	07			
		equations.				
	(b)	Find system equation and derive $F \rightarrow I$ analogy network for fig.1 (b).	07			
Q.2	<b>(a)</b>	An unity feedback system has a loop transfer function	07			
		$\mathbf{G}(\mathbf{s}) = \frac{10(\mathbf{s}+1)}{10(\mathbf{s}+1)}$				
		s(s+2)(s+5)				
		Determine (i) Stability gain (ii) step, ramp, parabolic coefficients (iii) $e_{ss}$ when $r(t)=3+10t$ .				
	(b)	Reduce the following block diagram in fig.2 (b) (i) to open loop form using	07			
	(-)	block diagram reduction technique.				
		OR				
	<b>(b)</b>	Using Manson's Gain formula find $C(s)/R(s)$ .Refer fig.2 (b) (ii).	07			
Q.3	<b>(a)</b>	The characteristic equation of a feedback system is	07			
		$F(s) = s^{6} + 2s^{5} + 8s^{4} + 12s^{3} + 20s^{2} + 16s + 16$				
	<b>(1</b> )	Using the Routh's Hurwitz criterion determine the stability of the system.	~ <b>-</b>			
	<b>(b)</b>	A unity feedback system has $C(a) = K(a+1)$	07			
		$G(s) = \frac{K(s+1)}{s^2(s+2)(s+5)}$				
		Using Routh's Hurwitz criteria find the range of K for closed loop system to be				
		stable.				
		OR				
Q.3	<b>(a)</b>	For the system shown in fig.3 (a) with unity feedback find the time domain	07			
	<b>(h)</b>	specification when a unit step i/p is applied.	07			
	(b)	Calculate the transient response parameters for the given system with $i/p r(t)=2t$ .	07			
		G(s) = 6/s(s+4).				
0.4	$(\mathbf{a})$		07			
Q.4	(a)	Draw the root locus for the system and obtain value of K when $\zeta$ =0.6 from root locus.	07			
		G(s) = K/s(s+3)(s+6)				
	<b>(b)</b>	The open loop transfer function of a system $G(s) = K/s(s+2+2j)(s+2-2j)$ .	07			
		Determine the complete root locus and comment on the stability of the closed				
		loop system.				
<u> </u>		OR	~-			

Q.4 (a) Sketch bode plot for the following system and find gain margin, phase margin, 07 gain crossover frequency and phase crossover frequency.

$$G(s) = \frac{4(s+0.5)}{s(s+0.2)(s+1)}$$

(b) Sketch bode plot for the following system and determine gain margin, phase 07 margin and stability of system.

$$G(s) = \frac{25(s+4)}{s(s+1)(s+10)}$$

Q.5	(a)	Define transfer function. Find the transfer function of the lead compensator for the network shown in fig.5 (a).	07
	<b>(b)</b>	Draw the polar plot of $GH(s)=100/(s+2)(s+4)(s+8)$ .	07
	(0)	OR	07
Q.5	<b>(a)</b>	Find the eigen values for the following matrix.	07
		0 1 0	
		A = 0  0  1	
		-6 -11 -6	
	<b>(b)</b>	Draw the Nyquist plot for the system given below. Determine phase crossover	07
		frequency, gain crossover frequency, gain margin and phase margin.	
		G(s)H(s)=10/1+0.2(1+0.02s)	

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