Q1: Choose the right answer :

1. The value of damping ratio of 0.6 in the step response of a second order system results in maximum overshoot of : [1 mark]

a. 10 b. 8.54 c.9.44 d.7.55

2. The ratio of damped frequency to natural frequency of a system having damping factor ξ is : [1 mark]

a- $\sqrt{1-\xi^2}$ b- $\sqrt{1+\xi^2}$ c- $\frac{1}{\xi}$ d- $\frac{\xi}{1+\xi}$

3. The number of sign changes in the entries in the first column of routh's array denotes : [1 mark]

a- the number of roots of the characteristic polynomial in RHP
b- the number of roots of open-loop poles in RHP
c- the number of zeros of the system in RHP
d- the number of open-loop zeros in RHP

4. Routh's array is given below : [1 mark]

s^6	1	9	23	15
s^5	3	18	15	
s^4	3	18	15	
s^3	0	0		

The auxiliary equation of this array is :

a- $3s^4+15s^2+9=0$
b- $2s^4+18s^2+15=0$
c- $3s^4+18s^2+15=0$
d- $s^4+9s^2+15=0$

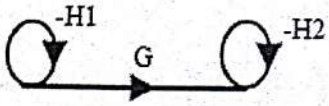
5. The open-loop gain for a unity feedback system is $G(s)=\frac{12}{s(s+12)}$. the steady state velocity error of the system is : [2 marks]

a. 0 b- 1 c- 12 d- 10

6. For type 2 system the steady-state error due to ramp input is equal to : [1 mark]

infinity b.finite c.zero

7. For the signal flow graph shown , the overall transfer function of the system will be : [2 marks]



a- $\frac{C}{R}=G$ b- $\frac{C}{R}=\frac{G}{1+H2}$ c- $\frac{C}{R}=\frac{G}{(1+H1)(1+H2)}$ d- $\frac{C}{R}=\frac{G}{1+H1+H2}$

8. The inverse laplace transform of $\frac{6}{s^2+6s+9}$ is : [1 mark]

a- $6e^{-2t}$ b- $6e^{-3t}$ c- $9te^{-4t}$ d- $6te^{-3t}$

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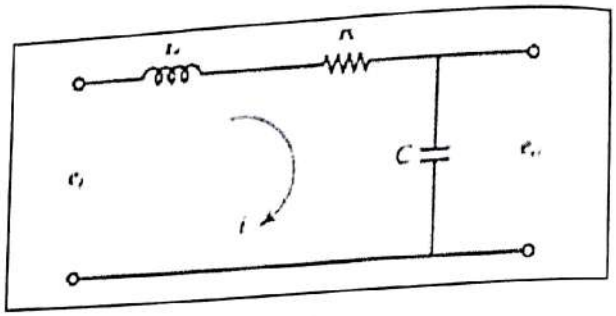
[10 marks]

Q2: a)Derive the 2^{nd} order control system

a) Determine values of ξ, W_n, W_d.

b) Find c(t), when the input signal is $\frac{2}{S}$.

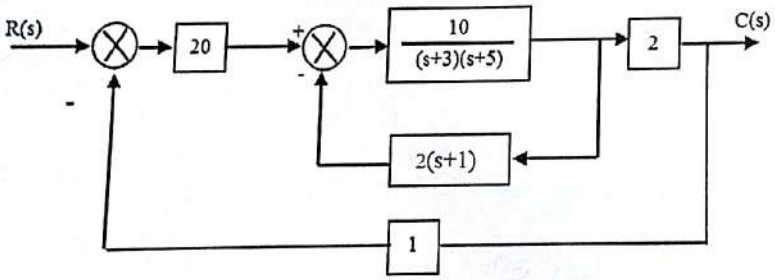
c) Determine values of M_p, t_p, t_s, t_r



where R=1k Ohm C=0.5μ F L=0.5MH

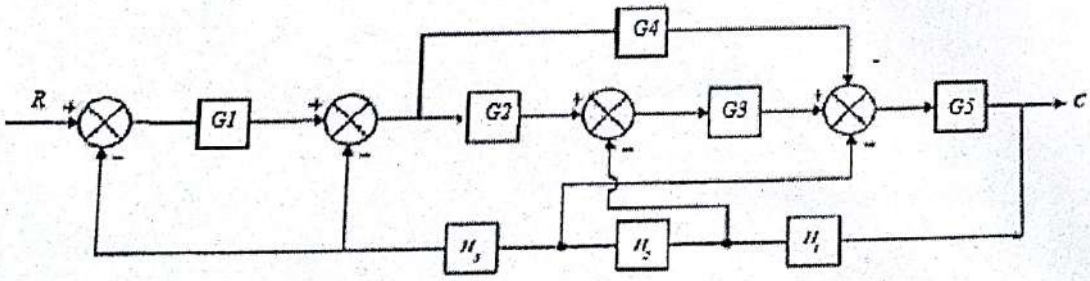
Q3 : For unity feedback system having forward transfer function $G(S) = \frac{K}{S(1+0.6S)(1+0.4S)}$ using Routh criterion to determine the range of (k) for stable system . [6 marks]

Q4: For the system shown , determine : [7 marks]



a- The type and order of system .
b- Error coefficient .
c- Steady state error if the input signal r(t)=8t

Q4: Using block diagram reduction rules,determine the close loop transfer function [7 marks]



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