HDV-003-1153002 Seat No. _____

M. Sc. (Sem. III) (CBCS) (Electronics) Examination

November / December – 2017

Control System Analysis : Paper - 10

Faculty Code : 003

Subject Code : 1153002

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Answer the following in brief : (any **7** out of 10) **14**

(1) What is damping factor? How it is useful to determine the damping of the system?

(2) For the following LTI equation find $x(t)$

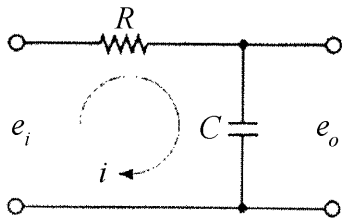
$\ddot{x} + 3\dot{x} + 2x = 0;$

$x(0) = a \text{ and } \dot{x}(0) = b$

(3) What is Transient and Steady state Response? Explain in brief.

(4) If characteristic equation of system is given as $S^3 + 5s^2 + 4s + k = 0$, find the point at which root locus branches cross imaginary axis. Also find the gain K for the imaginary roots.

(5) Draw the block diagram of the following circuit.



(6) What is conditionally stable system? Explain it briefly.

(7) Find the Laplace Transform of the following :

(i) $\sin\left(4t + \frac{\pi}{3}\right)$

(8) Write the definition of "control variable and Manipulated Variable" with suitable diagram.

(9) Give an example of system with transportation lag and derive its transfer function.

(10) Find an inverse Laplace Transform of the following:

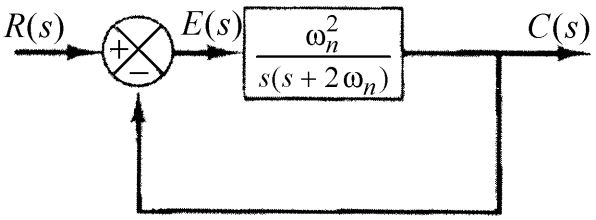
(i) $F(S) = \dfrac{5(s+2)}{s^2(s+1)(s+3)}$

2 Answer the following : (any **2** out of 3) **14**

(1) Write a short note on "Temperature control of Passenger compartment of car".

(2) Write and explain in brief a rules of designing Root locus for positive feedback system.

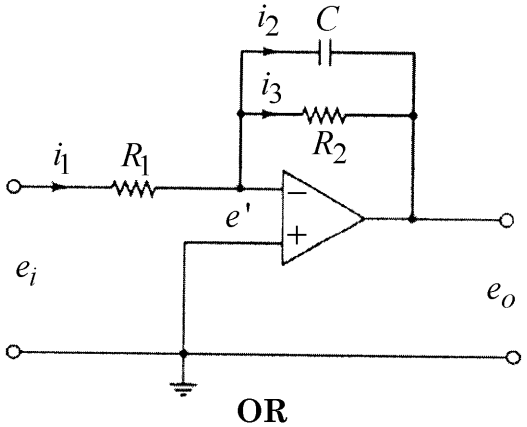
(3) For the following Unity Feedback System Find Unit impulse Response.



3 Answer the following : **14**

(1) Write a short note on "Initial and Final Value Theorem". Explain the usage of both in context of Control system analysis briefly with suitable diagram

(2) What is $E_0(s)/E_i(s)$ of the following electrical circuit using complex impedance method?



OR

3 Answer the following : **14**

(1) What is non-linear system? Explain in brief with suitable diagram. Draw and Explain characteristic curves for various non-linearity occurs commonly in physical-systems.

(2) Consider the transfer function of the system

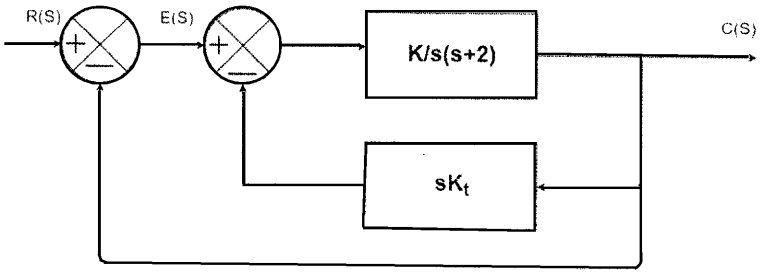
$$\frac{C(s)}{R(s)} = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

if $\zeta = 0.6$ and $\omega_n = 5\,rad/\sec$ then find rise time, peak time, maximum percentage overshoot and settling time when system is subjected to unit step signal.

4 Answer the following : **14**

(1) For the under-damped Second Order System, Derive an equation for rise time, peak time, settling time and Maximum Percentage overshoot when subjected to step input.

(2) For the following multi-loop system, Plot the root locus as K_a varies from 0 to ∞ so as K.



5 Answer the following : (any 2 out of 4) **14**

(1) Write a short note on "Electric Furnace Control system"

(2) For the following polynomial Equation determine the range of gain K such that system remains stable.

$$s^4 + 3s^3 + 3s^2 + 2s + k = 0$$

(3) Write a short note on Industrial Controllers.

(4) Find the transfer function $Y(s)/U(s)$ for the following mechanical system