



HCU-003-027501      Seat No. \_\_\_\_\_

**M. Sc. (ECI) (Sem. V) (CBCS) Examination**

October / November - 2017

**Paper - 17 : Basic Concept of Control System**

**Faculty Code : 003**

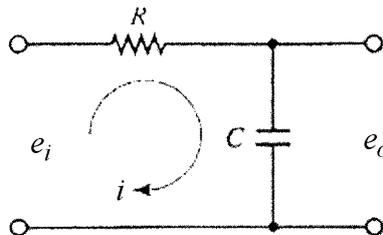
**Subject Code : 027501**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

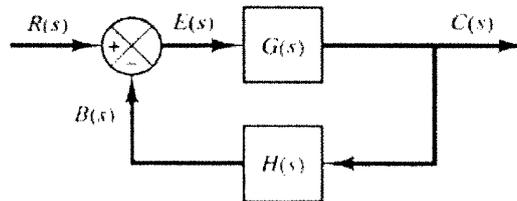
1 Answer the following in brief : (any 7 out of 10, each carries 2 marks) 14

- (1) Name the standard Test signal used in control system.
- (2) Draw the block diagram of the following circuit :



- (3) For the following LTI equation find  $x(t)$   
 $\ddot{x} + 3\dot{x} + 2x = 0;$   
 $x(0) = a$  and  $\dot{x}(0) = b$
- (4) What is Transient and Steady State Response? Explain in brief.
- (5) Find the Laplace Transform of the following :
  - (i)  $t^n$
  - (ii)  $f(t - \alpha)$
- (6) Write the definition of "Control Variable and Manipulated Variable" with suitable diagram.

- (7) What is Sensitivity? Write Forward path and Feedback path sensitivity for the following closed-loop system.



- (8) Find the inverse Laplace transformation of the following :

$$f(s) = \frac{s^4 + 13s^3 + 66s^2 + 200s + 300}{s^2 + 9s + 20}$$

- (9) Explain in brief the standard method of determining the system is of First order.
- (10) Explain the difference between Open loop Control System and Closed loop Control System with suitable examples.

**2** Answer the following : (any 2 out of 3, each carries 7 marks) **14**

- (1) Consider the transfer function of the system

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

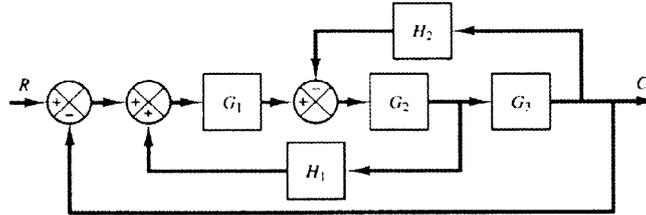
if  $\xi = 0.6$  and  $\omega_n = 5$  rad/sec then find rise time, peak time, maximum percentage overshoot and settling time when system is subjected to unit step signal.

- (2) Derive the unit step and unit ramp response of Standard First order system with suitable diagrams.
- (3) 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.

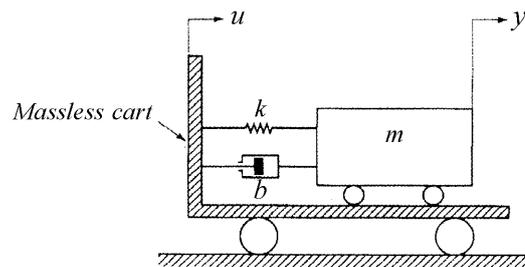
3 Answer the following : (each carries 7 marks)

14

- (1) Simplify the following Block diagram, explain each step of simplification and find the transfer function  $C/R$  :



- (2) Find the Transfer Function  $Y(s)/U(s)$  for the following mechanical system :

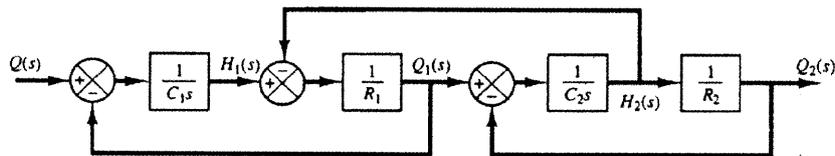


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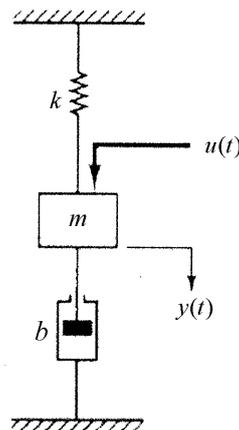
3 Answer the following : (each carries 7 marks)

14

- (1) Simplify the following Block diagram, explain each step of simplification and find the transfer function  $Q_2(s)/Q(s)$  :

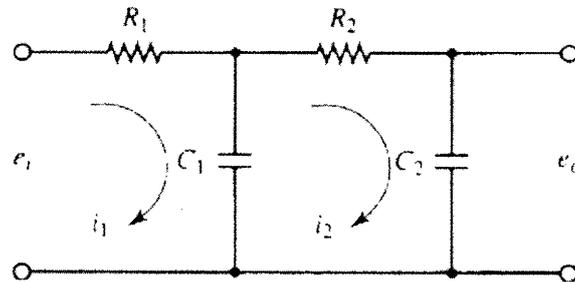


- (2) Find the transfer function  $Y(s)/U(s)$  for the following mechanical system :



4 Answer the following : (each carries 7 marks) 14

- (1) Find the transfer function  $E_o(s)/E_i(s)$  for the following electrical system.



- (2) Explain "Electrical Furnace Temperature Control System" with suitable diagram.

5 Answer the following : (any 2 out of 4, each carries 7 marks) 14

- (1) Draw the Schematic and block diagram of Positional servo system, writes its various parameters of control and derive the Transfer function.
- (2) Answer the following in context of non-linear characteristic of the system :
- (i) What is non-linear system? Explain in brief. Draw and explain characteristic curves for various non-linearity occurs commonly in physical-systems.
  - (ii) Linearize the non-linear system equation  $z = xy$  in the region  $5 \leq x \leq 7$  and  $10 \leq x \leq 12$ . Find the linearized equation and also find error if  $x = 5$  and  $y = 10$ .
- (3) Write a short note on "Industrial Controllers".
- (4) Explain "Temperature control system of Passenger compartment of Car" with suitable diagram.