JAF-003-1275001 Seat No. _____

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

November – 2019

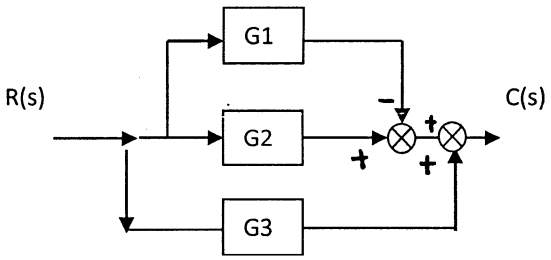
Paper - 17 : Basic Concepts of Control Systems

Faculty Code : 003
Subject Code : 1275001

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

1 Answer the following questions in brief : (any **seven**) **14**

1. What is an open loop control system?
2. Define state space equation.
3. Describe PID (Proportional-Integral-Derivative) control mode in brief.
4. Briefly describe properties of linear time-invariant system.
5. Define Laplace transform.
6. Reduce the block-diagram to minimum :



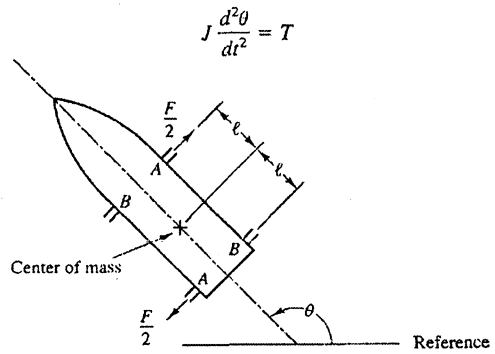
7. For a given function, F(s) = $\frac{1}{s(s+1)}$, find its final value at, $\lim_{t\to\infty} f(t)$.
8. How can one define a linear time-varying system?
9. Find inverse Laplace of the function given as :

$$F(s) = \frac{s^4+5}{s(s+1)}.$$

10. What is a transfer function?

2 Attempt any two of the following questions : 14

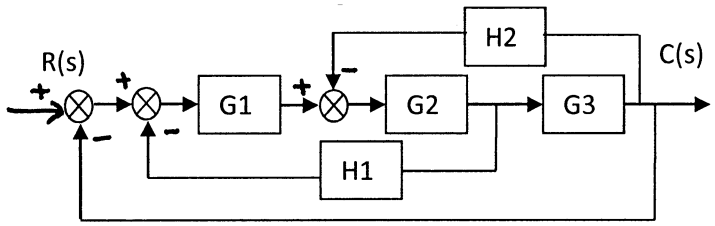
1. Derive mathematical model representing satellite attitude control system as shown in figure below.



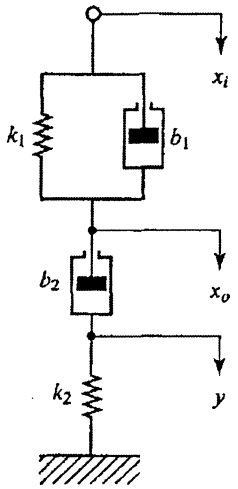
2. Mention and explain all rules to manipulate block-diagrams.
3. Derive the step, ramp and unit pulse response of first order system.

3 Answer the following questions :

1. Reduce the following block diagram to minimum. 5



2. Obtain the transfer function of the mechanical system shown in figure. 5

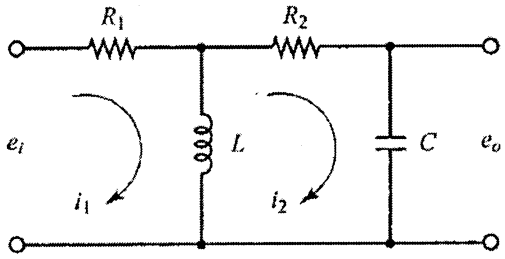


3. State and prove the real integration theorem. 4

OR

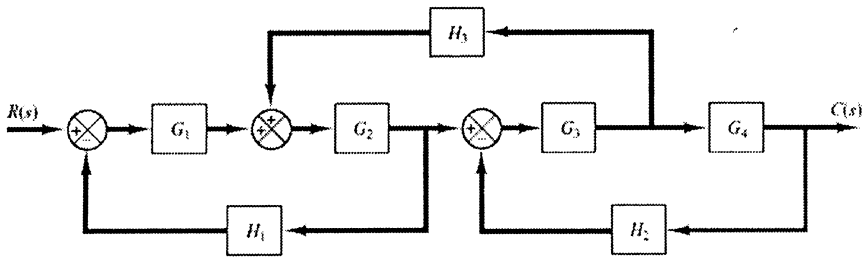
3 Answer the following questions :

1. Obtain the transfer function E,(s)/E,(s) of the electrical circuit shown in figure **5**



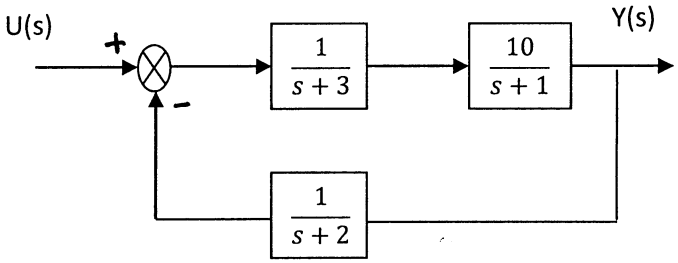
2. Define delay time, rise time, peak time, maximum overshoot and settling time for a transient response with necessary diagram. **5**

3. Reduce the block diagram to minimum. **4**

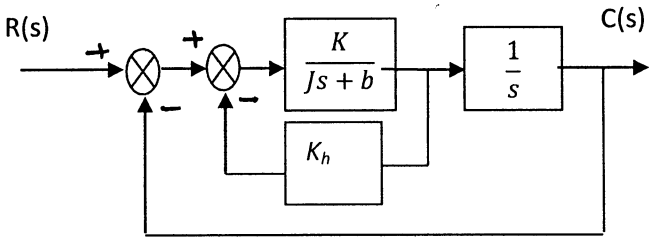


4 Answer the following questions :

1. Derive state space representation for the system in the block diagram. **5**



2. For the system shown in figure, determine the values of K and velocity feedback constant K_h, so that maximum overshoot in unit-step response is 0.2 and peak time is 1 sec. For the same K and K_h; determine rise time and settling time. (J=1 kgm^2 and B=1 Nm/rad/sec) **5**



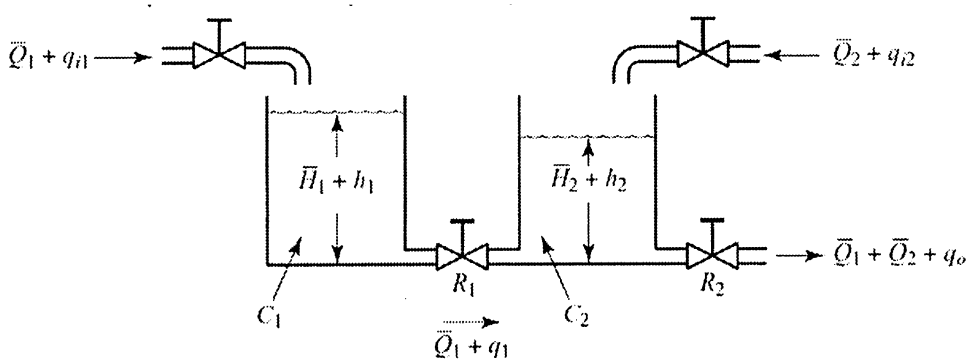
3. State and prove the real differentiation and final value theorems. 4

5 Answer any two of the following questions : **14**

1. Describe the state space representation of a dynamic system.

2. Derive the transient response of a second order system for unit step input.

3. Consider the liquid-level system shown in figure below. In the system, Q_1 and Q_2 are steady-state inflow rates and H_1 and H_2 are steady-state heads. The quantities q_{i1}, q_{i2}, h_1, h_2, q_1, and q_0 are considered small. Obtain a state-space representation for the system when h_1 and h_2 are the outputs and q_{i1}, and q_{i2} are the inputs.



4. What will be effect of multiplication by e^{-at} and change of time scale on Laplace transform of a function, f (t). Also find inverse Laplace transform of,

$$F(s) = \frac{5(s+7)}{(s+1)^2\,(s+2)}.$$