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PBA-003-1275001 Seat No. _____

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

November / December - 2018

Basic Concepts of Control Systems : Paper - 17

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) Briefly describe properties of linear time-invariant system.

(2) Define Laplace transform.

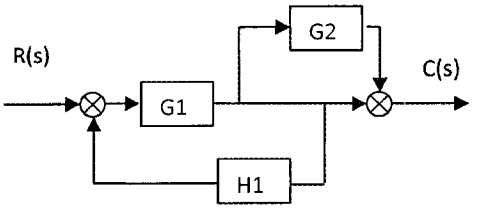
(3) State and prove initial value theorem.

(4) Define a 2^{nd} order system. Also mention suitable examples.

(5) What is an open loop control system?

(6) What are state variables?

(7) Reduce the block-diagram to minimum :



(8) Find inverse Laplace of the function given as :

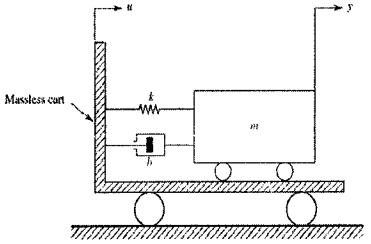
$$F(s) = \frac{s+3}{(s+2)(s+1)}$$

(9) How can one define a linear time-varying system?

(10) Derive Laplace transform of a pulse function.

2 Attempt any **two** of the following questions : **14**

(1) Derive state-space equation for a spring-mass-dashpot system shown in figure below.



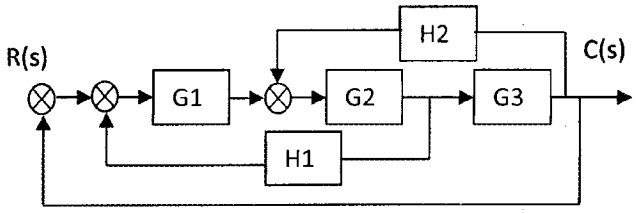
(2) Mention and explain all rules to manipulate block-diagrams.

(3) Explain the step-response of second order system (servo motor) with necessary equations.

3 Answer the following questions : **14**

(1) Describe in brief unit-step, unit-ramp and unit-impulse functions. Derive Laplace transforms of each. **5**

(2) Reduce the following block diagram. **5**

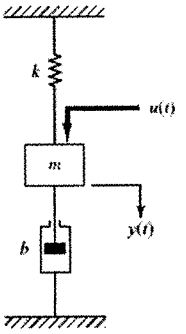


(3) State and prove the real integration theorem. **4**

OR

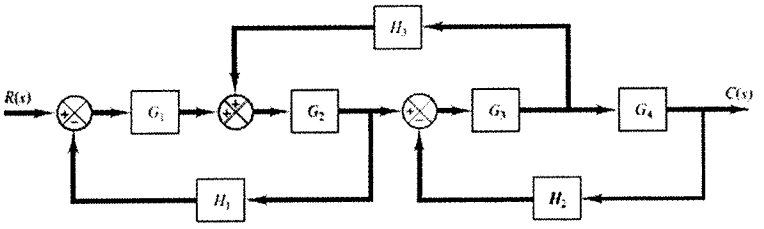
3 Answer the following questions : **14**

(1) For a spring-mass mechanical system shown in figure below derive the state space equations. **5**



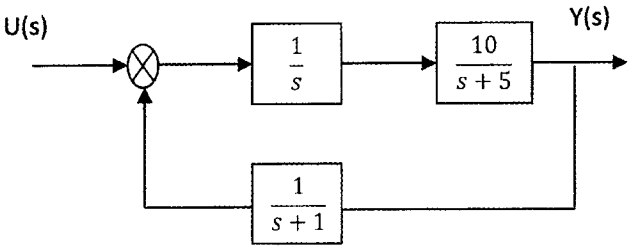
(2) Define delay time, rise time, peak time, maximum overshoot and settling time for a transient response with necessary diagram. **5**

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

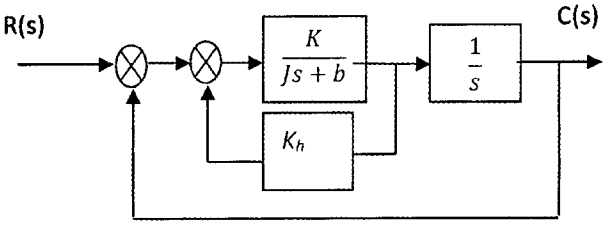


4 Answer the following questions :

(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. $\left(J = 1\, kgm^2 \;\&\; B = 1\, Nm/rad/\sec\right)$ **5**

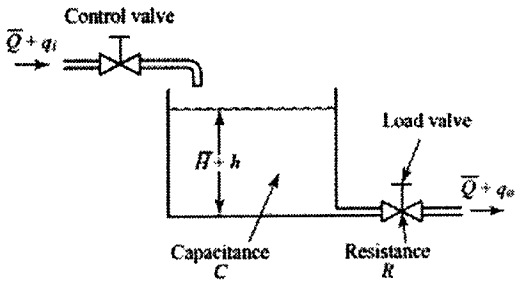


(3) Explain pulse and impulse functions in detail. **4**

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

(1) Derive the transient response of a first order system for unit step, unit ramp and unit impulse input. Also discuss its inference.

(2) Derive the mathematical model of a liquid level system without interaction as shown below.



(3) 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,

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

(4) Derive the mathematical model of a thermal system shown below.