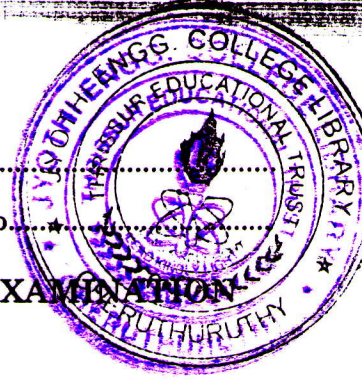


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(Pages : 4)

Name.....

Reg. No.....



**FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION**  
**JUNE 2008**

**EE 04 406—LINEAR SYSTEM ANALYSIS**

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

I. (a) How will you differentiate the following systems ?

Linear and Non-linear systems.

(2½ marks)

Time Invariant and Time varying systems.

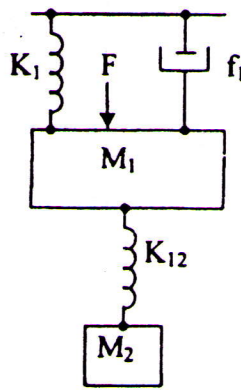
(2½ marks)

(b) Define the following terms in signal flow graph :

Node, Branch, path, loop, Non-touching loop.

(5 × 1 = 5 marks)

(c) Find the Force-voltage analogous circuit of the following mechanical system :—



(d) Describe the derivation of transfer function of a hydraulic system.

(e) Derive the Fourier series representation of periodic signals.

(f) Find the Fourier series representation of the signal

$$x, (t) = \begin{cases} 1, & |t| < T_1 \\ 0, & T_1 < |t| < \frac{T}{2} \end{cases} \text{ elsewhere and is periodic over one period.}$$

(g) Describe the standard test signals used in control system with their mathematical representation and graph.

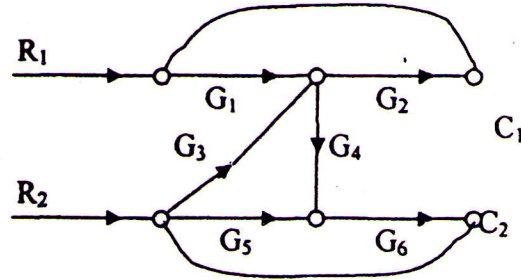
(h) Determine the Laplace transform of  $x(t) = e^{-5t} u(t - 1)$ .

(8 × 5 = 40 marks)

Turn over

II. (a) A control system with two inputs and two outputs is shown in the figure below. Find  $C_1(s)/R_1(s)$ ,  $C_2(s)/R_1(s)$  when  $R_2$  is zero.

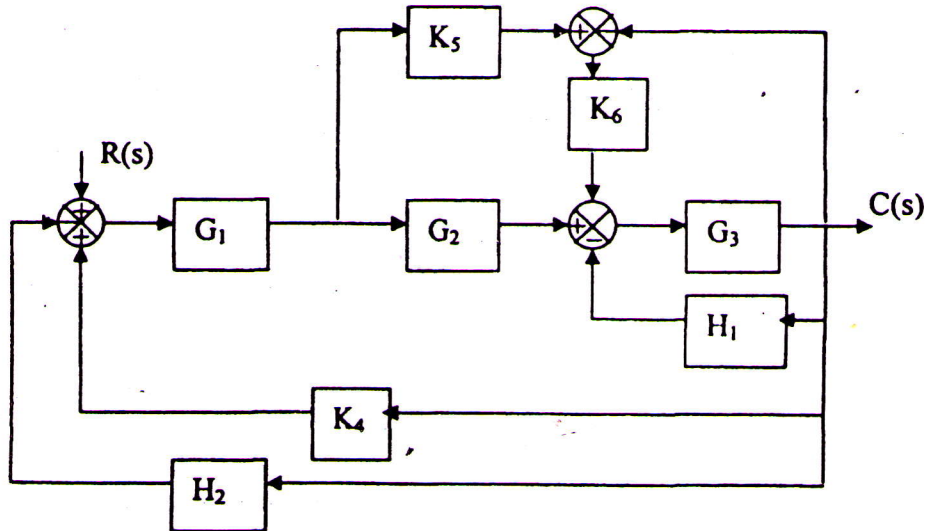
- H1



(15 marks)

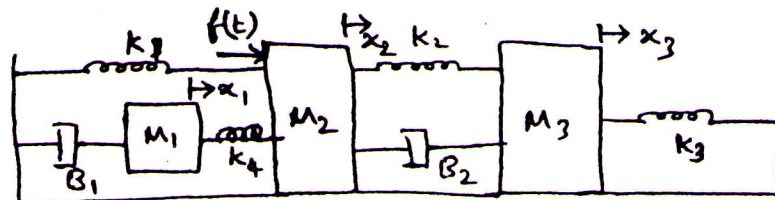
Or

(b) Find the transfer function for the system shown by the block diagram shown below :



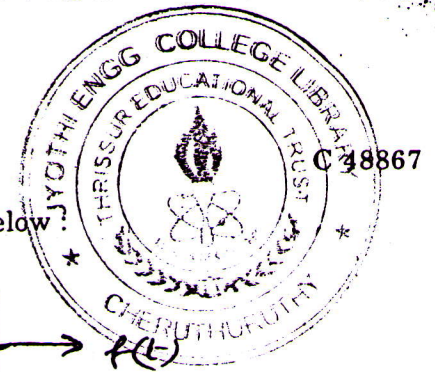
(15 marks)

III. (a) Obtain the electrical analogous circuit in force-current analogy for the following system :

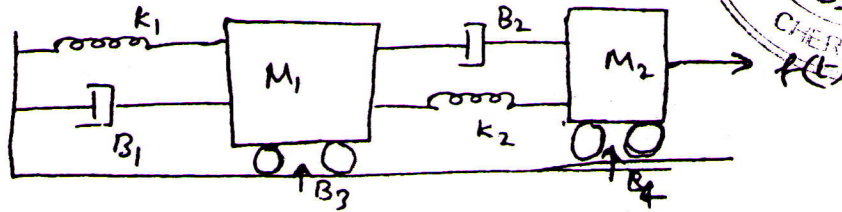


(15 marks)

Or



- (b) (i) Determine the transfer function of the system shown below:



(9 marks)

- (ii) Develop the mathematical model for a thermal system. (6 marks)

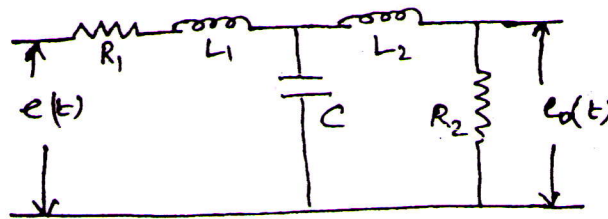
- IV. (a) (i) Describe the proof for convolution and Multiplication properties of Fourier transforms. (9 marks)

- (ii) Explain the relationship between Laplace and Fourier transforms. (6 marks)

Or

- (b) Develop the Fourier transform representation of the aperiodic signals. (9 marks)

- V. (a) (i) Find the transfer function of the electrical system. (9 marks)



(9 marks)

- (ii) Determine the Inverse Laplace transform of the following function :-

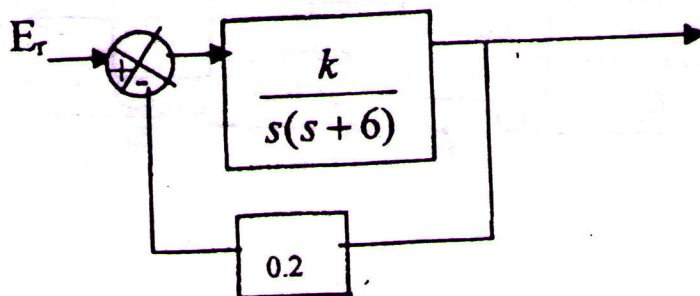
$$X(s) = \frac{s+2}{s^2+7s+12}$$

(6 marks)

Or

- (b) (i) Derive the expression for the response of a general second order under damped system for a step input. (9 marks)

- (ii) A closed loop system is shown below. The system is to have damping ratio of 0.7. Determine value of  $k$  to satisfy this condition and calculate the peak overshoot for the value of  $k$  determined.



(6 marks)

[4 × 15 = 60 marks]