

**FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE  
EXAMINATION JULY 2009**

EE 04 406—LINEAR SYSTEMS ANALYSIS

(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

*Answer all questions.*

**Part A**

- I. (a) Explain what is meant by linear and non-linear systems ?  
 (b) State and explain Kirchoff's current law.  
 (c) State D'Alembert's principle and explain.  
 (d) What are the basic elements of hydraulic system ? Explain.  
 (e) Explain Dirichlet's conditions for Fourier series representation of a periodic signal.  
 (f) Define trigonometric Fourier series representation for symmetric and anti-symmetric signal and explain.  
 (g) State and prove time shifting property of Fourier transform.  
 (h) Explain the relationship between Laplace transform and Fourier transform.

(8 × 5 = 40 marks)

**Part B**

- ii. (a) (i) Explain about distributed and lumped systems. (7 marks)  
 (ii) Check whether the system described by the differential equation :

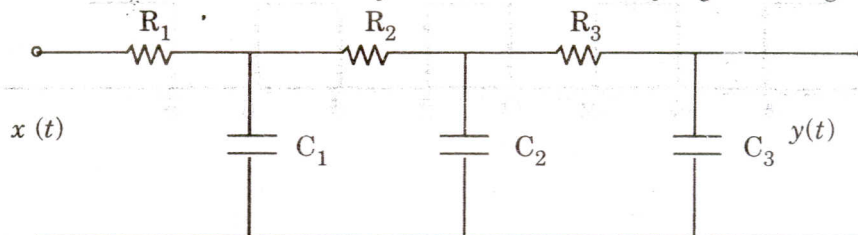
$$a \frac{d^2 y(t)}{dt^2} + b \frac{dy(t)}{dt} + cy(t) = x(t)$$

is linear time invariant ?

(8 marks)

Or

- (b) Find the transfer function of the system shown below by signal flow graph diagram.



(15 marks)

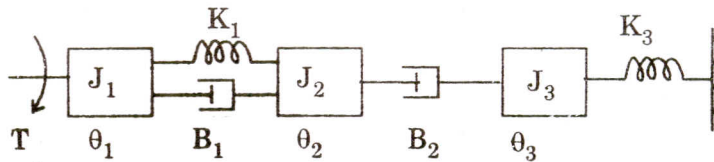
**Turn over**

- III. (a) Explain geartrain system and derive torque equation of geartrain referred to both motor shaft and load shaft.

(15 marks)

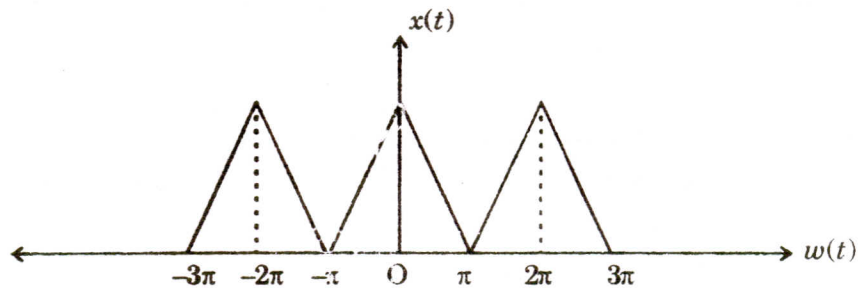
Or

- (b) Write the differential equation governing the mechanical rotational system shown below and draw torque-voltage and torque-current analogous circuits.



(15 marks)

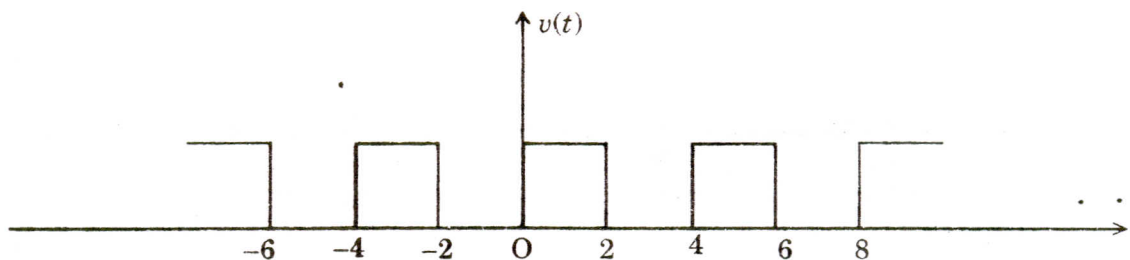
- IV. (a) Find the Fourier series representation of the triangular wave shown below :



(15 marks)

Or

- (b) A series RC circuit in which  $R = 5 \text{ k}\Omega$  and  $C = 0.8 \mu\text{F}$  has an applied voltage waveform as shown below. Find the steady state output.



(15 marks)

- V. (a) Using convolution theorem, find the inverse Laplace transform of :

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

(15 marks)

*Or*

- (b) Derive response of second order system for underdamped case and when the input is unit step signal.

(15 marks)

[4 × 15 = 60 marks]