(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1253 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2013-14

BASICS OF SIGNALS AND SYSTEMS

Time : 3 Hours *Total Marks : 100*

Note :– Attempt questions from all Sections as per directions.

SECTION–A

1. Attempt **all** parts : **(2×10=20)**

   (a) What is the difference between continuous-time and discrete-time signals ?

   (b) Define unit impulse function $\delta(t)$.

   (c) Explain the analogy between mechanical and electrical systems.

   (d) What are the dirichlet conditions for the existence of Fourier Series ?

   (e) Find the Fourier transform of Unit-Step function.

   (f) Prove the time-shift property for Laplace transform.

   (g) Explain the applications of Laplace transform.

(h) Explain the terms 'state' and 'state variables' with examples.

(i) List the advantages of state space representation of Linear Systems.

(j) Explain initial and Final Value Theorem for z-transform.

SECTION–B

2. Attempt **three** parts : **(3×10=30)**

(a) Express the signal shown in Fig. 1 in terms of step signals.

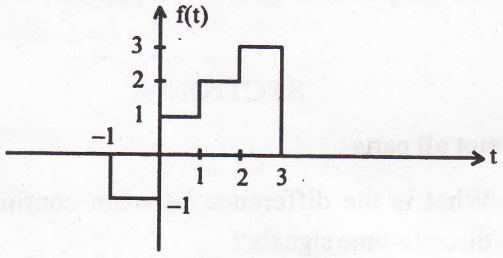

Fig. 1

(b) Draw the force-current analogy of the mechanical system shown in Fig. 2.

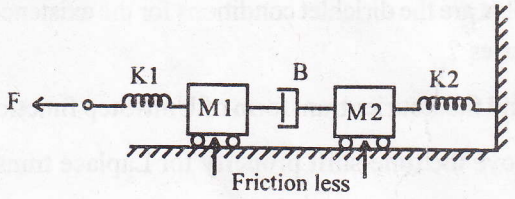

Fig. 2

(c) Find the Fourier transform of signal shown in Fig. 3.

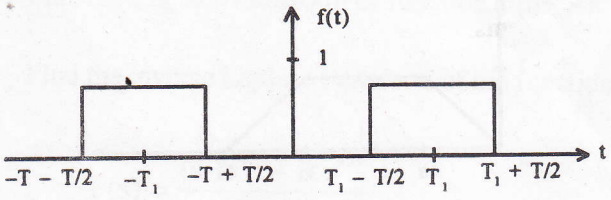

Fig. 3

(d) Find the inverse Laplace transform of following function :

$$F(s) = \frac{3s^2 + 8s + 6}{(s + 2)(s^2 + 2s + 1)}$$

(e) Define the state transition matrix and its properties.

SECTION–C

Note :– Attempt **all** questions from this Section. **(10×5=50)**

3. Attempt any **two** parts of the following :

(a) Distinguish between Periodic and Non-periodic Signals.

Find the time-period of the signal $x(t) = \cos\frac{\pi}{3}t + \sin\frac{\pi}{4}t$.

(b) Synthesize the signal (Fig. 4) using basic signals.

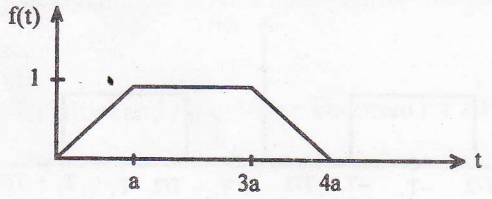

Fig. 4

(c) What is a LT1 system ? Check whether the system $y(t) = x^2(t)$ is a LT1 system.

4. Attempt any **one** part of the following :

(a) Determine the Fourier series for a square wave signal of unity magnitude using trigonometric series.

(b) Find the exponential Fourier series of the signal shown in Fig. 5 :

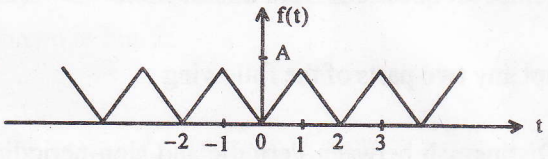

Fig. 5

5. Attempt any two parts of the following :

(a) Find the Laplace transform of function $x(t) = Ae^{-a|t|}$.

(b) Find the inverse Laplace transform of the function :

$$F(s) = \frac{(s+1) + 3.e^{-4s}}{(s+2)(s+3)}$$

(i) ROC : $Re\{s\} > 3$

(ii) ROC : $Re\{s\} < 2$.

(c) Consider the circuit shown in Fig. 6. Initially the switch is in position 1. At t = o, the switch is moved to position 2. Find the expression for the current in the inductor L.

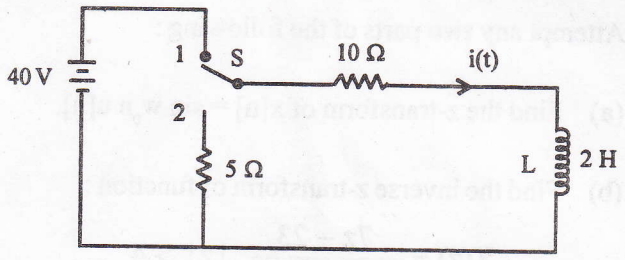

Fig. 6

6. Attempt any **one** part of the following :

(a) State space representation of a system is given by :

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \, , \; y(t) = [1 \quad 0] x(t)$$

where u(t) is the unit step input. All the initial conditions are zero. Find the time-response of the system.

(b) Develop the state model for the circuit shown in Fig. 7 :

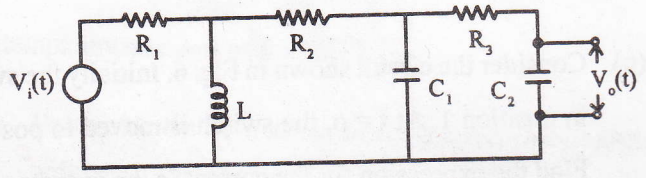

Fig. 7

7. Attempt any **two** parts of the following :

(a) Find the z-transform of $x[n] = \sin w_0 n \, u[n]$.

(b) Find the inverse z-transform of function :

$$X(z) = \frac{7z - 23}{(z-3)(z-4)} \quad |z| > 4 .$$

(c) Find the response of the following difference equation for step input. Assume zero initial conditions :

$$y[n] - \frac{5}{6}y[n-1] + \frac{1}{6}y[n-2] = x[n] - \frac{1}{2}x[n-1].$$