Printed Pages : 7 EEE-301

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

PAPER ID : 0208 Roll No. | | | | | | | | | | |

B. Tech.

(Semester-III) Theory Examination, 2011-12

BASIC SYSTEM ANALYSIS

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from all Sections as per directions.

Section-A

1. Attempt *all* parts of this question. 2×10=20

(a) Differentiate between Loop analysis and Nodal analysis.

(b) Define reciprocity theorem.

(c) State convolution theorem.

(d) Sketch the waveform from the expression :

$$i(t) = 1.5\left(1 - e^{-4t}\right)u(t) - 1.5\left[1 - e^{-4(t-0.1)}\right]u(t-0.1)$$

$u(t)$ and $u(t-0.1)$ are unit step functions.

(e) Determine Laplace transform of $\sinh \alpha t$.

(f) List the properties of a R-L admittance function.

(g) What will be analogous of damping in f-v model ?

(h) Define a state variable.

(i) What will be the derivative of a step function ?

(j) Find the time constant of series RL circuit.

Section-B

2. Attempt *all* parts of this question. 6×5=30

(a) Sketch the waveform from the expression :

$$V(t) = u(t) + \sum_{k=1}^{\infty} (-1)^k 3u(t-k)$$

(b) Draw force-current analogy of the mechanical system (Fig. 1) :

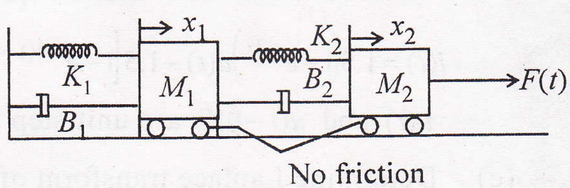

Fig. 1

(c) Define odd and even function. Also find Fourier coefficient for odd and even function.

(d) Find Laplace inverse of the function :

$$\left(\frac{s+4}{2s^2+5s+3}\right).$$

(e) Define state transition matrix. Explain the properties of state transition matrix.

Section-C

Attempt *all* questions from this Section. 10×5=50

3. Attempt any two parts of the following :

(a) Explain the gate, impulse and ramp signal used in basic system analysis.

(b) Synthesize a triangular wave given in Fig. 2 in terms of ramp and step signals.

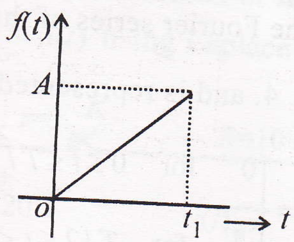

Fig. 2

(c) Determine $\frac{X(s)}{F(s)}$ of the given system shown in Fig. 3.

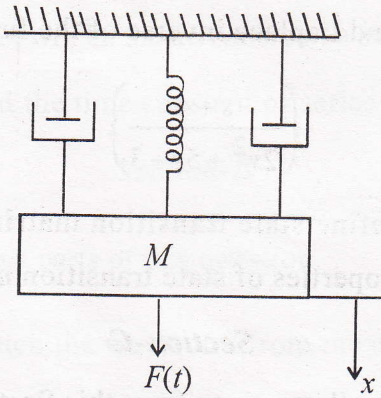

Fig. 3

4. Attempt any one part of the following :

(a) Determine the Fourier series for the sawtooth waveform of unity magnitude.

(b) Find the Fourier series of the function given in Fig. 4. and is represented by :

$$f(t) = \begin{cases} 0 & \text{for} \quad 0 \le t \le T/2 \\ A & \text{for} \quad T/2 \le t < T \end{cases}$$

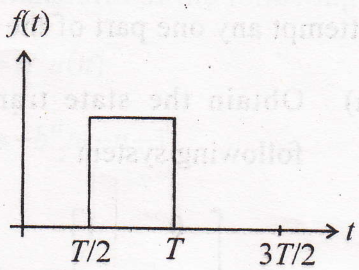

Fig. 4

5. Attempt any two parts of the following :

(a) Find $L[t^2 \sin \omega t]$ using the following relation :

$$L[t\, f(t)] = -\frac{d}{ds} F(s).$$

(b) Using Laplace transform, solve differential equation :

$$2\ddot{x} + 7\dot{x} + 6x = 0\,,$$

where $x(0) = 0, \;\; \dot{x}(0) = 1.$

(c) Consider a series RL circuit shown in Fig. 5. The switch is closed at time $t = 0$, find the current $i(t)$ using Laplace transform.

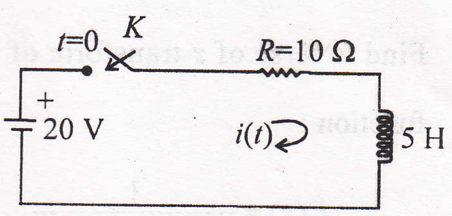

Fig. 5

6. Attempt any one part of the following :

(a) Obtain the state transition matrix of the following system :

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} X \text{ with } X(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

(b) Define controllability and observability in state variable analysis with suitable example.

7. Attempt any two parts of the following :

(a) State and explain initial and final value theorem using z-transform analysis.

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

$$F(z) = \frac{1}{2(z+0.5)(z-1)}.$$

(c) Find the z-transform of the following :

(i) $x(n) = a^n u(n)$

(ii) $x(n) = -b^n u(-n-1)$.