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

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

B.Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2010-11

BASIC SYSTEM ANALYSIS

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **all** questions which carry equal marks.

(2) Assume suitable data wherever necessary.

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) Distinguish between continuous time and discrete time signals. How are they different from Analog and digital signals ? Suitable waveforms for explanation.

(b) Explain the terms causality and time invariance of a system with the help of examples.

(c) Explain the Force-voltage analogy taking a suitable example.

(d) Given a signal x(t) as shown below in figure 1.

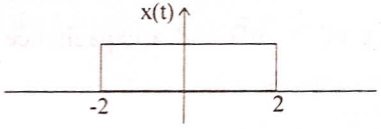

Figure 1

Draw and explain the procedure of construction of the waveform $y(t) = x(2t - 6)$.

(e) Explain briefly the mathematical representation and characteristics of the basic continuous time signals. Establish a relationship between them.

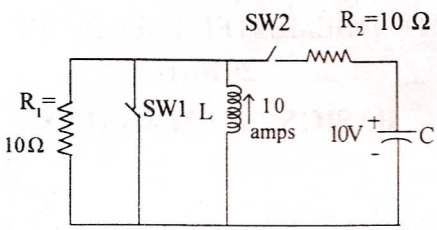

Figure 2

In the circuit shown in figure 2, switch SW1 is initially closed and switch SW2 is open. The inductor L carries a current of 10 A and the capacitor is charged to 10 volts with polarities as indicated.

At t = 0, SW1 is opened and SW2 is closed. Find the current through 'C' and the voltage across 'L' at $t = 0^+$.

2. Attempt any **two** parts : **(10×2=20)**

(a) A voltage $v = 200 \sin 314t + 50 \sin (942t + 45^0)$ volts is applied to a circuit consisting of a resistance of 20 Ω, and inductance of 20 mH and a capacitance of 56.3 μF all connected in series. Find :

(i) the rms value of the applied voltage

(ii) an expression for the instantaneous value of the current

(iii) rms value of the current

(iv) power consumed in the circuit.

(b) Explain :

(i) Even function symmetry

(ii) Odd function symmetry

(iii) Half-wave or mirror symmetry and

(iv) Quarter-wave symmetry with suitable waveforms.

(c) Find the magnitude and phase spectrum of the Fourier transform of the Pulse waveform shown in figure 3.

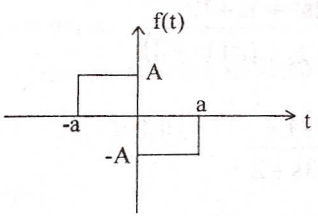

Fig. 3

Draw the two spectrum of given pulse waveform.

3. Attempt any **two** parts : **(10×2=20)**

(a) State and prove convolution theorem.

(b) Write the Laplace transforms of :

(i) Unit impulse

(ii) Unit step

(iii) Unit ramp and

(iv) Parabolic functions.

Find the Laplace transform of the truncated ramp function as shown in Fig.4.

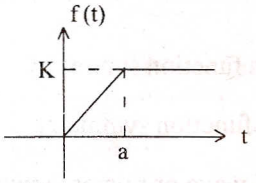

Fig. 4

(c) Find the inverse Laplace transform of following functions :

(i) $\dfrac{2s^2+5s+12}{(s^2+2s+10)(s+2)}$

(ii) $\dfrac{s-1}{s^2+3s+2}$

4. Attempt any **two** parts : **(10×2=20)**

(a) What are state variables ? Explain.

Write the state - variable formulation of the network given in figure 5.

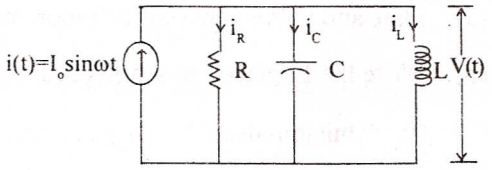

Fig.5

(b) Derive an expression for the transfer function from the state variable Model.

What is state transition matrix ? Derive its expression and mention its properties.

(c) A vector matrix differential equation of a system is given by

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -6 & 5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

and output $Y = [1\ 0]X$

with initial conditions being zero.

Find time response of the above system.

5. Attempt any **two** parts : **(10×2=20)**

(a) Find the z- transform of the following signals :

(i) $x[n] = 7\left(\frac{1}{3}\right)^n u[n] - 6\left(\frac{1}{2}\right)^n u[n]$

(ii) $a^n u[n]$

Also discuss the region of convergence (ROC) for each signals.

(b) Mention (with proof) the properties of the region of convergence (ROC) for the z-transform.

(c) Find the inverse z-transforms of the following signals :

(i) $$x(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)} \quad |z| > \frac{1}{3}$$

(ii) $$\frac{1 - \frac{1}{3}z^{-1}}{\left(1 - z^{-1}\right)\left(1 - 2z^{-1}\right)} \quad |z| > 2$$