B.Sc. Semester-IV Examination, 2022-23

ELECTRONICS [Honours]

Course ID : 41712 Course Code : SH/ELC/402/C-9(T-9)

Course Title : Signals and Systems

Time : 1 Hour 15 Minutes Full Marks : 25

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **three** from the following questions: 1×3=3

   a) Give example of a discrete time signal.

   b) Give the definition of a random signal.

   c) What is periodic signal?

   d) What is unit step function?

   e) What is causal signal? Draw the sketch of it.

   f) Define multiplication in time domain.

2. Answer any **three** of the following questions: 2×3=6

   a) What is L.T.I (Linear time Invariant) system?

   b) Define convolution theorem between two signals.

   c) If $g(t) \rightleftharpoons G(f)$, then show that $g(-t) \rightleftharpoons G(f)$.

   d) If $g(t) \rightleftharpoons G(f)$, then find the area under the function G(t) when $g(t) = e^{-t}u(t)$, where u(t) is a unit step function.

   e) What is complex exponential Fourier series? Hence define complex Fourier co-efficient.

   f) "A signal cannot behave both as an energy signal and a power signal"– Explain it.

3. Answer any **two** of the following questions: 5×2=10

   a) Find the fourier series for the given function:

$$F(t) = \frac{1}{2}a \quad \text{for} \quad \frac{-T}{2} \le t \le 0,$$

$$= -\frac{1}{2}a \quad \text{for} \quad 0 \le t \le \frac{T}{2}. \qquad 5$$

   b) Find the Fourier Transform of a decaying exponential path by using unit step function. Draw the amplitude spectrum and phase spectrum in frequency domain. 3+2=5

   c) Prove the conjugate function Property and multiplication theorem if- $2\frac{1}{2}+2\frac{1}{2}=5$

$$g(t) \rightleftharpoons G(f) \text{ then } g^*(t) \rightleftharpoons g^*(-f);$$

$$g_1(t)g_2(t) \rightleftharpoons \int_{-\infty}^{\infty} G_1(\lambda)G_2(f-\lambda)\,d\lambda.$$

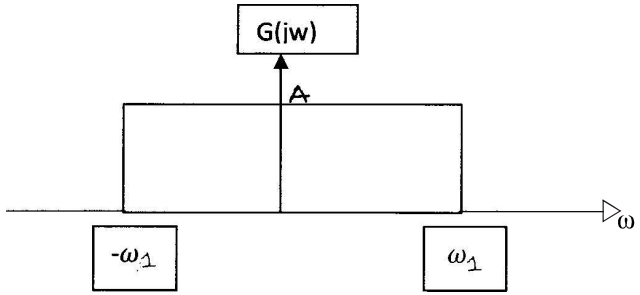
d) i) Find the Laplace Transformation of the function f(t) = sin(at).

ii) Derive Inverse Laplace Transformation of the function $f(t) = \frac{1}{s-a}$.

iii) What is the main advantage of Laplace Transformation technique? 2+2+1=5

4. Answer any **one** of the following questions: 6×1=6

a) Consider the I.F.T of the given rectangular pulse shown in the figure: 6



Given $G(i\omega) = A, \quad |\omega| < \omega_1$
$0, \quad |\omega| > \omega_1.$

b) Using Fourier series method, obtain the expression for the different parameter of half-wave rectifier output waveform. 6

c) Write short notes on: 2+2+2=6

i) Causality,

ii) Stability,

iii) Invariability.

———