WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2021

ELSACOR09T-ELECTRONICS (CC9)

SIGNAL AND SYSTEMS

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***five*** questions from the following: 2×5 = 10

   (a) Define — Unit Impulse Signal.

   (b) What is the relation between impulse and unit step signals?

   (c) Distinguish between causal and non-causal signals.

   (d) Define — Time-invariant System.

   (e) State Dirichlet's conditions for a function to be expanded as a Fourier series.

   (f) State the Final value theorem of Laplace Transform.

   (g) Define the linearity property of a system.

   (h) State any two properties of continuous time Fourier Transform.

GROUP-B

Answer any *six* questions from the following 5×6 = 30

2. (a) Determine whether the given signal is energy or power signal and calculate the energy or power of $x(t) = e^{-2t}u(t)$. 3

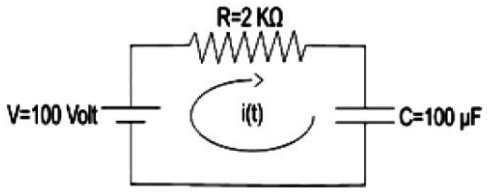
   (b) Determine the even and odd components of the signal $x(t) = e^{jt}$. 2

3. Explain the statement "Discrete-time signals are represented mathematically as sequences of numbers." 5

4. Find the Inverse Laplace Transform of $F(s) = \dfrac{2}{(s+2)(s+8)}$. 5

5. A series R-L circuit is excited by an impulse input function such that $x(t) = \delta(t)$. Using Laplace Transform, find the value of $i(t)$. 5

6. For circuit below, calculate the initial charging current of capacitor using Laplace Transform. 5



7. (a) Find the constant term a_0 in the Fourier series corresponding to $f(x) = x - x^3$ in $(-\pi, \pi)$. $2\frac{1}{2}$

   (b) If $f(x) = x^2 - x^4$ is expanded as a Fourier series in (–l, l), find the value of b_n. $2\frac{1}{2}$

8. Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π to be valid in the interval 0 to 2π. Hence, deduce the value of the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots\cdots$. 5

9. Show that, a linear system can be completely characterized by its impulse response. 5

10.(a) A discrete time LTI system has an impulse response $h[n]$ with $h[0] = 1$, $h[1] = -1$, $h[2] = 2$ and zero otherwise. The system is given an input sequence $x[n]$ with $x[0] = x[2] = 1$ and zero otherwise. What are the number of non-zero samples in the output sequence $y[n]$ and the value of $y[2]$? 2

   (b) Two discrete-time signals $x[n]$ and $h[n]$ are both non-zero only for $n = 0, 1, 2$ and are zero otherwise. It is given that $x[0] = 1$, $x[1] = 2$, $x[2] = 1$, $h[0] = 1$. Let, $y[n]$ be the linear convolution of $x[n]$ and $h[n]$. Given that $y[1] = 3$ and $y[2] = 4$. Find the value of $(10y[3] + y[4])$. 3

11.(a) Find the convolution integral of $x(t)$ and $h(t)$. 3

   Given that, $x(t) = 1$, $0 \le t \le 2a$;

   $h(t) = \delta(t + 2a) - \delta(t - 2a)$;

   Draw the final diagram after convolution.

   (b) Find the result of the convolution of $x(-t) * \delta(-t - t_0)$. 2

12. State, with proper expressions, the Convolution Theorem. 5

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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