



WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 4th Semester Examination, 2022

ELSACOR09T-ELECTRONICS (CC9)

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) What are even signals? Give examples.
 - (b) Write down the difference between energy and power signals.
 - (c) Find the fundamental period of $x(n) = \sin 2\pi n + \exp(j7\pi n/3)$.
 - (d) What is the relation between impulse and unit step signals?
 - (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) Clearly explain periodic signal.
 - (h) Explain the function of memory element in LTI system.

GROUP-B

Answer any six questions from the following

5×6 = 30

2. State and prove Parseval's theorem for power signal. 1+4
3. (a) Derive the Laplace transform of the function $x(t) = e^{-2t} \sin 4\pi t$. 3
- (b) Given, $x(n) = \alpha^n$ for $n \geq 0$ and 0 for $n < 0$. Show that for $\alpha < 1$, $x(n)$ is an energy signal. 2
4. Derive the unit ramp response of a second order unity feedback system in time domain. Hence, find the lagging time and the time constant of the system. 3+1+1
- Given Transfer function $G(S) = \frac{K}{S(1+ST)}$.

5. A square pulse of amplitude 3 volt is defined as: 3+2

$$x(t) = 3 \text{ for } 0 \leq t < 4$$

$$= 0 \text{ for } 4 \leq t \leq \infty.$$

$x(t)$ is applied to a series R-C circuit of capacitance. $1 \mu\text{F}$ and resistance $1 \text{ k}\Omega$. Consider the output is obtained across resistance and the capacitor is initially uncharged. Hence, derive the unit impulse response in S domain and find the output voltage at $t = 1.5 \text{ sec}$.

6. (a) Apply the symmetry property of Fourier transform, show that $2\frac{1}{2}$
 $\delta(t+T) - \delta(t-T) = 2j \sin Tw$.

- (b) Show that the Fourier transform of a Gaussian pulse is also Gaussian in nature. $2\frac{1}{2}$

7. (a) Find the convolution integral of $x(t)$ and $h(t)$. Given that,

$$x(t) = 1, 0 \leq t \leq 2a;$$

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

Draw the final diagram after convolution.

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

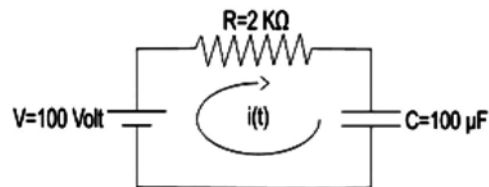
8. Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π to be valid in the 5
interval 0 to 2π . Hence, deduce the value of the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$

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

- 10.(a) Determine whether the discrete time LTI system with impulse response 2+1
 $h(n) = (.9)^n u(n-1)$ is BIBO stable or not. Is it causal?

- (b) Define stability of a LTI system. 2

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