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 $G(S) = \dfrac{K}{S(1+ST)}$.

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

$$x(t) = 3 \text{ for } 0 \le t < 4$$
$$= 0 \text{ for } 4 \le t \le \infty .$$

$x(t)$ is applied to a series R-C circuit of capacitance. 1 μF and resistance 1 kΩ. Consider the output is obtained across resistance and the capacitor is initially unchanged. Hence, derive the unit impulse response in S domain and find the output voltage at $t = 1.5$ 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,

$$x(t) = 1,\ 0 \le t \le 2a ;$$
$$h(t) = \delta(t+2a) - \delta(t-2a) ;$$

Draw the final diagram after convolution.

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

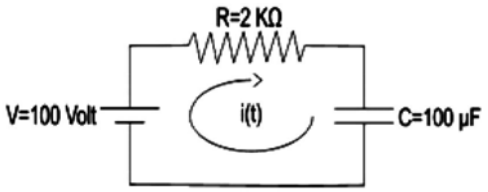
8. Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π to be valid in the interval 0 to 2π. Hence, deduce the value of the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$ 5

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 $h(n) = (.9)^n u(n-1)$ is BIBO stable or not. Is it causal? 2+1

(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.*

——×——

WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2022

ELSACOR08T-ELECTRONICS (CC8)

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 is the cause of slow rate in an OP-AMP? 2

   (b) How does CMRR of OP-AMP vary with frequency? 2

   (c) What is the utility of an unity-gain buffer? 2

   (d) Why are dual power supply voltages provided to an OP-AMP? 2

   (e) Find input impedance of inverting amplifier using OP-AMP. 2

   (f) Why is a stable multivibrator called as free running multivibrator? 2

   (g) Write down the significance of zero output impedance of an ideal OP-AMP. 2

   (h) State any two factors responsible for offset voltage in an OP-AMP. 2

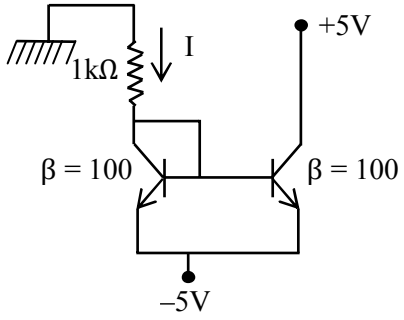
GROUP-B

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

2. Derive the condition of oscillation in a Wien-bridge oscillator. Hence explain how amplitude stabilization is achieved in an OP-AMP based implementation of the oscillator. 3+2

3. Realise a bistable multivibrator using IC 555 and explain its operation. 2+3

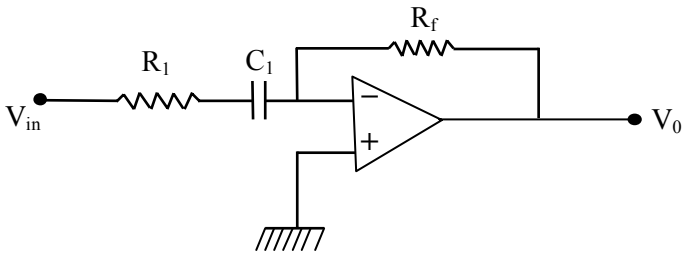
4. (a) Show that the circuit functions as a current mirror and find the value of I. 4



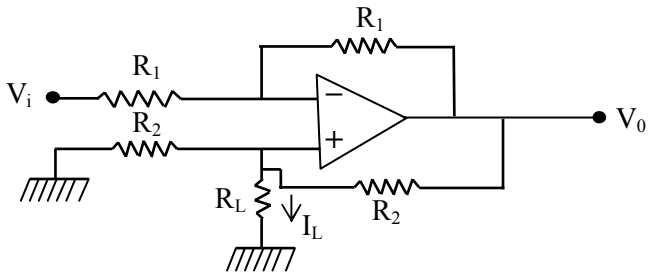
   (b) Define PSRR of an OP-AMP. 1

5. (a) Find expression for the gain of a non-inverting amplifier assuming the gain to be finite. 3

(b) Explain with reason, the type of filter realized by the given circuit. 2



6. (a) Find the value of I_L in the given circuit. 3



(b) What are the unique characteristics of differential amplifier? 2

7. Describe how an OP-AMP can be used as a square-wave generator and find out the expression of frequency of the output. 5

8. (a) Explain with a block diagram, how OP-AMPs can be used for multiplication of two voltages. 3

(b) Draw and explain the transfer characteristics of an OP-AMP. 2

9. (a) Find expression for output voltage of a practical integrator. 3

(b) What are the advantages of active filter over passive filter? 2

10.(a) For a similar gain, explain the advantage of non-inverting mode over non-inverting mode of operation. 2

(b) Draw a labelled block diagram of the different stages of an OP-AMP and explain the function of each stage. 3

11.(a) Design a practical integrator that integrates signals with frequency down to 500 Hz. It produces a peak output of 0.5 V when the input is a sine wave with a peak amplitude of 10 V with a frequency of 10 kHz. 3

(b) Design an active first order low pass butterworth filter with cut-off frequency 1 kHz and for a given gain 3.2 (Given C = 0.1 μF). 2

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.*

——×——