WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2021

ELSACOR08T-ELECTRONICS (CC8)

OPERATIONAL AMPLIFIER AND APPLICATIONS

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

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

1. Why the name 'operational amplifier' is given so?

2. Mention two ideal characteristics of Op-Amp. What are typical values of these characteristics' parameters for practical Op-Amp?

3. Draw an Op-Amp based inverting unity-gain buffer circuit. Apart from signal inversion, mention at least one application of the circuit.

4. Two identical amplifiers are cascaded in series each of having gain of 10 dB. If the input voltage is 10 mV, find the output voltage at the final stage.

5. What is duty cycle? Draw a schematic of waveform of a signal of 75% duty cycle.

6. What are advantages of active filters over the passive counter parts?

7. The timer IC 555 is designed to have output voltage range 0 to 5 V. Why it is so designed?

8. What is (are) the difference (s) between a comparator and a Schmitt trigger?

GROUP-B

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

9. Op-Amp is designed for small signal (amplitude < 1 V) applications. "For practical Op-Amp, small signal bandwidth is limited by unity-gain frequency whereas, the large signal bandwidth is limited by slew rate" – Explain. 5

10. Draw an Op-Amp based 1st order active low-pass filter. Derive its transfer function (Frequency dependent gain). What is the expression for pass-band gain in dB? Show that beyond the cut-off frequency, the gain falls at a rate of 20 dB/decade. 2+1+1+1

11. Explain operating principle of three terminal IC regulator. Design a current source using IC 7805 which can supply a current of 0.5 amp across a 50 Ω load (given I_Q = 4.5 amp for IC 7805). 5

12. Draw the circuit diagram of an astable multivibrator using IC 555 (showing internal components) and find expression of operating frequency. Explain why it cannot achieve 50% duty cycle? 2+2+1

13. Explain the concept of virtual ground. Derive an expression for the voltage gain of an inverting op-amp circuit. Find the input impedance of the circuit. 2+2+1

14. Draw and explain the operation of an ideal integrator circuit using Op-Amp 741. Sketch input and output waveforms with proper label. 4+1

15. What is common mode rejection ratio (CMRR)? How CMRR is expressed. Determine the output voltage of a differential amplifier for the input voltages of 300 μV and 200 μV. The differential gain and CMRR of the amplifier are 5000 and 100 respectively. 1+1+3

16. Find an expression for Slew Rate (S_R) of Op-Amp. An amplifier of gain 40 dB is constructed using an Op-Amp having S_R of 1 V/μS. What is the maximum possible amplitude of the input signal which can be amplified faithfully? 2+3

17. Draw a circuit using one or more Op-Amp where output v_0 is given as $v_0 = 10v_1 + 25v_2$, where v_1 and v_2 are two input signals. 5

18. Draw the circuit diagram of monostable multivibrator using IC555 timer and explain its working principle. Draw relevant waveforms. 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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