QP Code:EC2T06-1 **(Pages:3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24EC2T06

Course Name: LINEAR INTEGRATED CIRCUITS

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. Define CMRR. Give the typical value of CMRR for a 741 op-amp.
2. Draw the circuit of a voltage to current converter with floating load.
3. List any three advantages of active filters over passive filters.
4. Draw the circuit diagram of an op-amp based summing amplifier with 3 inputs V_1, V_2 and V_3 that produces an output $V_o = -2(V_1 + 3V_2 + 9V_3)$. Calculate the values of resistors as well.
5. Draw the pin diagram of AD633 analog multiplier IC and mention the functionalities of the pins.
6. Draw the block diagram of an FM detector using PLL.
7. Justify the need for electronic switches in D/A converters.
8. Differentiate between Flash ADC and Successive Approximation ADC.
9. Explain how a 555 timer IC can be configured as a square wave generator.
10. Draw a fixed voltage regulator circuit and explain its operation.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any one full question from each module.

Module 1

11. a) Draw the block diagram of an op-amp and explain the functions of each block. (8 Marks)
    b) Identify and tabulate the typical parameter values of the 741 op-amp. (6 Marks)

OR

12. a) With neat circuit diagrams, derive the expression for the closed-loop gain of (i) an inverting amplifier and (ii) a non-inverting amplifier using an ideal op-amp. Compare their gains. (10 Marks)

b) A sensor produces 20 mV signal. Design an amplifier circuit to obtain 2V output without phase inversion. (4 Mark)

Module 2

13. a) Design a Schmitt trigger circuit with upper and lower thresholds +4V and -4V respectively. Assume saturation voltage levels as 12V and -12V. Draw its output waveform for an input signal v_{in} = 10sin(200πt). (7 marks)

b) With the help of a diagram, explain the working of a precision half wave rectifier. (7 marks)

OR

14. a) The sensor output in a system is a very low amplitude signal which is not sufficient to drive the next stage of the system. Design an op-amp circuit with high CMRR and high input impedance which can be used to amplify this low-level signal. Justify your design. (7 marks)

b) With a neat circuit diagram, explain the operation of a practical log amplifier. (7 marks)

Module 3

15. a) Explain the basic operation of monolithic PLL IC 565 with the help of a block diagram. (7 marks)

b) With the help of a diagram, explain the operation of a VCO. (7 marks)

OR

16. a) With the help of a dc transfer characteristics, explain how an emitter-coupled pair enables analog multiplication. (7 marks)

b) With the help of diagrams, explain how double-balanced operation in a Gilbert cell provides improved performance over emitter-couple pair. (7 marks)

Module 4

17. a) Explain the working of a 3-bit voltage-mode R-2R ladder type DAC. (8 Marks)

b) A 4-bit current mode R-2R ladder type D/A converter having resistor value of R = 10 kΩ, uses V_{ref} of 10V. Find:

(i) The resolution of the D/A converter, and

(ii) Current through R_f for a digital input of 1101. (6 Marks)

OR

18. a) With a neat diagram explain the working of a successive approximation type ADC. (8 Marks)

b) Illustrate the operating principle of a Sample-and-Hold circuit with neat figures. (6 Marks)

Module 5

19. a) Explain the principle of operation of voltage-to-frequency and frequency-to-voltage converters. (10 Marks)

b) State the advantages of switched capacitor filters over RC filters. (4 Marks)

OR

20. a) Design an astable multivibrator circuit using op-amp to generate a frequency of 1 KHz. (7 Marks)

b) Draw the circuit of a triangular wave generator using a comparator and an integrator. Explain its operation with the output waveform. (7 Marks)

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