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Question Paper Code : 81283

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fourth Semester

Electrical and Electronics Engineering

EE 3402 – LINEAR INTEGRATED CIRCUITS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define epitaxial growth in IC fabrication.
2. What is diffusion in semiconductor processing?
3. List the ideal characteristics of an operational amplifier. How do these differ from practical op-amp characteristics?
4. What is the significance of the slew rate in an op-amp? How does it affect the performance of high-frequency signals?
5. Mention the transfer function of a first-order low-pass active filter.
6. List two differences between R-2R ladder and weighted resistor DACs.
7. Mention the different operating modes of the 555 timer.
8. How does the control voltage affect the output of a VCO?
9. Mention the fixed output voltages of LM7812 and LM7912.
10. Compare linear and switching regulators.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Explain the fundamental steps involved in monolithic IC fabrication. Illustrate with a process flow diagram.

Or

- (b) With neat sketches, describe how a resistor, capacitor, diode and FET are fabricated in a monolithic IC.

12. (a) (i) An op-amp integrator is to be designed for a low-pass signal conditioning system with a time constant of 1 ms. (7)
- (1) Calculate appropriate resistor and capacitor values.
 - (2) Explain what happens if a pure integrator (without feedback resistor) is used in practice.
- (ii) Derive the expression for differential amplifier output voltage and discuss the effect of resistor mismatches on its performance. (6)

Or

- (b) (i) Design a 3-input inverting summing amplifier using an ideal op-amp. The inputs are $V_1 = 1$ V, $V_2 = 2$ V and $V_3 = -1$. The input resistors are $R_1 = 10$ k Ω , $R_2 = 20$ k Ω and $R_3 = 40$ k Ω . (7)
- The feedback resistor is $R_f = 10$ k Ω .
- (1) Derive the output voltage equation.
 - (2) Compute the output voltage.
 - (3) How would the output change if $R_f = 20$ k Ω ?
- (ii) Can an op-amp be configured to produce a non-inverting summing output? Justify your answer with a circuit diagram and output expression. (6)
13. (a) Explain the working of an instrumentation amplifier with a neat circuit diagram. How an instrumentation amplifier achieves high common-mode rejection ratio.

Or

- (b) Compare first-order and second-order active filters using op-amps. Derive the transfer functions for both. Highlight the differences in frequency response.
14. (a) Describe the internal structure and pin configuration of AD633. Derive the output expression for analog multiplication. Explain its application in amplitude modulation (AM) generation.

Or

- (b) Explain the functional block diagram of the 565 PLL IC and analyse its operation in frequency multiplication or demodulation applications.
 - (i) Define lock range and capture range.
 - (ii) Describe VCO and phase detector roles.
 - (iii) Discuss applications in FM demodulation.
15. (a) Explain the working principle of the ICL8038 function generator. What are the main internal blocks and how do they produce different waveforms?

Or

- (b) Describe the features and functional block diagram of IC723 voltage regulator. How can it be configured for low voltage and high voltage outputs?

PART C — (1 × 15 = 15 marks)

16. (a) (i) Two op-amps are cascaded : The first in non-inverting configuration and the second as an inverting amplifier. Analyze how the overall gain and phase shift will be impacted across frequency. (8)
- (ii) Design a non-inverting amplifier using an op-amp to interface a pressure sensor with a microcontroller (input : 10 mV to 100 mV; required output : 0-5 V). Calculate gain, resistor values and explain why the non-inverting configuration is preferred. (7)

Or

- (b) Design a PWM-based speed control circuit for a DC motor using the 555 timer.
 - (i) Explain how the 555 timer operates in astable mode to generate PWM. (5)
 - (ii) Show the connection to a motor driver or transistor interface. (5)
 - (iii) Include circuit diagram and waveform explanation. (5)

