

JAYA ENGINEERING COLLEGE
Thiruninravur

UNIT-I

BASICS OF OPERATIONAL AMPLIFIERS

8 Mark Questions

1. Explain various stability criteria of op-amp circuit.
2. Design an active load for an emitter-coupled pair(differential amplifier)
3. What are the methods used to improve the slew rate? Briefly explain
4. Define Slew Rate. Explain the cause of slew rate and derive an expression for Slew rate for an op-amp voltage follower.
5. Define CMRR. Draw the circuit of an Op-amp differential amplifier and give the expression for CMRR.

16 Mark Questions

1. Discuss the various AC and DC characteristic of op-amp.
2. With circuit and waveforms explain the working operation of voltage series feedback amplifier.
3. Obtain the frequency response of an open-loop op-amp and discuss about the methods of frequency compensation .
4. Explain basic operational amplifier and its characteristics.
5. Explain with the neat diagrams about the internal circuit diagrams of an IC 741 op-amp.
6. Explain in detail about current sources, current mirror , voltage sources and voltage references.
7. State briefly about the open loop and closed loop configuration of an opamp.
8. With a neat block diagram, explain the general stages of an OP-AMP IC.
9. Explain, with a circuit diagram, the working of BJT - emitter coupled differential amplifier. Also explain the concept of active load and sketch the relevant circuit diagram.

UNIT-II

APPLICATIONS OF OPERATIONAL AMPLIFIERS

8 Mark Questions

1. Design a first order Low-pass filter for cut-off frequency of 2 KHz and pass-band gain of 2.
2. Explain a positive clipper circuit using an Op-amp and a diode with neat diagrams.
3. Design a circuit to implement $V_0 = 0.545 V_3 + 0.273 V_4 - 1.25 V_1 - 2V_2$
4. Draw and explain a simple Op-amp differentiator. Mention its limitations. Explain with a neat diagram how it can be overcome in a practical differentiator. Design an Op-amp differentiator that will differentiate an input signal with maximum frequency $f_{max} = 100\text{Hz}$.
5. Explain the construction and working of OP-AMP based instrumentation amplifier.
6. Explain the working of OP-AMP based Schmitt trigger circuit.
7. Design an OP-AMP based second order active low pass filter with cut off frequency 2 kHz

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8. Design an OP-AMP based second order active high pass filter with cut off frequency 2 kHz

16 Mark Questions

1. Discuss the need for an instrumentation amplifier? Give a detailed analysis for the same.
2. Explain the operation of following op-amps : Scale Changer, Voltage Follower, Integrator, adder,
3. Discuss in detail about a. Precision rectifier, b. Peak detector
4. Explain the operation of following op-amps : Inverter, Differentiator, Adder-Subtractor.
5. Explain briefly about the sine waveform generator using Wein bridge and RC phase shift.
6. With neat diagram explain the working function of an log and antilog amplifier circuits.

UNIT III

ANALOG MULTIPLIER AND PLL

2 Mark Questions

16 Mark Questions

1. With circuit diagram describe the working of Gilbert Multiplier cell. Explain how a frequency doubler can be realized using this cell.
2. Draw the block diagram of a PLL and derive an expression for its closed loop transfer function.
3. Draw the block diagram of the circuit that converts 1 KHz to 10 KHz.
4. With circuit diagram describe the working of variable transconductance multiplier. What is its limitation?
5. Explain how a multiplier can be modified as square root extractor.
6. Draw the circuit of FM demodulator using PLL.
7. Explain PLL used as an AM Detection.
8. Explain how frequency multiplication is done using PLL.
9. Write notes on frequency synthesizer.
10. With a neat diagram explain the variable transconductance technique in analog multiplier and give its output equation.
11. Briefly explain the working of voltage controlled oscillator.
12. What are important building block of phase locked loop (PLL) explain its Working?
13. Sketch and explain the following applications of multipliers: i. Squaring ii. Finding square root
14. Sketch and explain the following applications of multipliers: i. Frequency doubler ii. phase angle detector.
15. Draw the block diagram of VCO and explain its operation. Also derive the frequency of oscillator.
16. Sketch and explain the multiplier cell using emitter-coupled transistor pair.
17. Prove that the output voltage is proportional to the product of the two input voltages.

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18. State the limitations of emitter-coupled pair.
19. Explain how the IC 565 PLL can be used as a FSK demodulator.
20. With a neat functional diagram, explain the operation of VCO. Also derive an expression for f_o .
21. Analyze the Gilbert's four quadrant multiplier cell with a neat circuit diagram. Discuss its applications.

UNIT IV

ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

8 Mark Questions

1. Explain the working of R-2R ladder DAC.
2. Explain the working of success approximation ADC.
3. A dual slope ADC uses a 16-bit counter and a 4 MHz clock rate. The maximum input voltage is +10V. The maximum integrator output voltage should be -8V when the counter has recycled through n counts. The capacitor used in the integrator is $0.1\mu\text{F}$. Find the value of resistor R of the integrator.
4. What is a sample and hold circuit? Briefly explain its construction and application.
5. Draw the circuit of a flash type ADC and explain.
6. Draw the circuit of a R-2R ladder type digital to analog converter and explain.
7. Draw the circuit of a four bit R-2R D/A converter with feedback resistance of $3R$ for the Op-Amp. Calculate its output voltage for a digital input of 0100 if the reference voltage is 2.5V.
8. Explain the working of flash analog to digital converter.
9. How many comparators are required for a 4 bit flash ADC? For an input signal in the range of 0 to +10V. What are the reference voltages needed? Show how they can be generated using a 10V reference and several 1Kohm resistors.
10. Explain the working of Dual slope ADC.
11. With a neat circuit explain the operation of a Binary Weighted resistor D/A converter.
12. Write notes on Analog Switches.
13. Explain Delta Modulation? What are its advantages and disadvantages.
14. Draw and explain the operation of sample and hold circuits.
15. Explain the operation of voltage to time converter.
16. Explain delta sigma modulation with required diagram.
17. Explain the principle of operations in ADC.
18. Draw and Explain Single slope ADC converter.
19. Briefly Explain about Dual slope ADC converter.
20. Draw and explain the functional diagram of the successive approximation ADC converter.

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21. Explain the operation of R- 2R ladder type DAC and the weighted resistor type DAC.
22. A dual slope ADC uses a 16 bit counter and a 4 MHz clock rate. The maximum input voltage is =10V.
23. The maximum integrator output voltage should be -8V when the counter has cycled through 2^n counts. The capacitor used in the integrator is $0.1\mu\text{F}$. Find the value of the resistor R of the integrator. If the analog signal is = 4.129 V, find the corresponding binary number.
24. Draw the circuit diagram of a 6 bit inverted R - 2R ladder DAC and For $V(I) = 5\text{ V}$
25. What is the maximum output voltage ? What is minimum voltage that can be resolved?
26. What is the conversion time of a 10 bit successive approximation A/D converter if the input clock is 5 MHZ
27. What is the fastest ADC and why?
28. How many levels are possible I a two bit DAC?What is its resolution if the output range is 0 to 3V
29. Draw and Explain Weighted resistor type ADC converter
30. Draw and Explain ADC converter

UNIT-V

WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs

8 Mark Questions

1. Derive and explain about triangular wave generator
2. Draw the internal functional diagram of 555 timer and explain briefly about each pin .
3. Design a adjustable voltage regulator using IC 723 to obtain positive low voltage and high voltage.
4. Explain briefly about Power amplifiers
5. Explain briefly about Tuned amplifiers
6. Explain about Square wave generator.
7. Explain about monostable Multivibrator.
8. Explain about Astable multivibrator.
9. Explain about Single tuned amplifier.
10. Describe in detail, the working principle of IC 8038 function generator.
11. With a neat functional diagram, explain the operation of LM 380 power amplifier.
12. Explain the operation of switched capacitor filter. What are the advantages and disadvantages of this type of filter?
13. How is voltage regulators classified? Explain a series voltage regulator.
14. What is an optocoupler? Briefly explain its characteristics.
15. Design a voltage using LM 723 with short circuit current protection for the following specifications. $V_0 = 12\text{V}$, $I_L = 500\text{mA}$, $I_{SC} = 600\text{mA}$

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16. Draw the circuit of an IC tuned amplifier and explain how you will realize RF amplifier with AGC and a video amplifier using this building block.
17. Draw the functional block diagram of switching regulator and explain.

16 Mark Questions

1. Explain in detail the function of 555 timer in astable mode and derive the expression for frequency of oscillation.
2. Explain in detail the function of 555 timer in monostable and derive the expression for frequency of oscillation.
3. Briefly explain about Multivibrators and draw its output waveform.
4. Draw and explain the astable operation using 555 to achieve 50% duty cycle and derive the expression for the frequency of Oscillation.
5. What are the various blocks that form a basic Regulator? Explain the series and shunt voltage regulator. List advantages of IC voltage regulator.