MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

Estd. 2000

IQAC

DEPARTMENT OF MEDICAL ELECTRONICS & BIOMEDICAL ENGINEERING

Year / Semester : II / IV

Course code / Title : 18MDD09 & 18BMD09 / LINEAR INTEGRATED CIRCUITS

CO1: Illustrate the Circuit Fabrication Process and internal structure of operational amplifiers

CO2: Characterize and design real time operational amplifiers applications

CO3: Design comparator and generate waveforms using operational amplifier

CO4: Demonstrate the functioning of PLL and Data converters

CO5: Acquire knowledge about special function ICs and its application in modern electronic equipment

K_1- Knowledge K_2- Comprehension K_3- ApplicationK_4- Analysis K_5- Synthesis K_6- Evaluation

QUESTION BANK

UNIT – I IC FABRICATION AND OPERATIONAL AMPLIFIER

PART - A (2 MARKS)

1. Give the difference between monolithic and hybrid ICs.
2. List out the advantages of integrated circuits over discrete circuits.
3. What are the major categories of integrated circuits?
4. List out the steps used in the preparation of Si – wafers.
5. Generalize the steps involved in IC fabrication.
6. Write the basic chemical reaction in the epitaxial growth process of pure silicon.
7. Mention different available IC package configurations.
8. Explain the process of oxidation.
9. Define lithography.
10. Define the term photolithography in IC fabrication.
11. Describe the term diffusion.
12. Give short notes on dielectric isolation.
13. Describe metallization.
14. Why ion implantation is preferred over diffusion process?
15. Illustrate the pin diagram of IC 741.

16. List the ideal characteristics of op-amp.
17. Justify that, why IC741 op-amp not used for high frequency applications?
18. Mention the importance of current mirror circuit used in differential amplifier stages.
19. Develop the internal block diagram of an Op-amp.
20. How an op-amp can be used as a voltage follower?

PART - B (16 MARKS)

1. (i) Describe the epitaxial growth process. (8)
   (ii) Explain in detail about the photolithography process with neat diagram. (8)
2. (i) Discuss the different ways to fabricate diodes. (8)
   (ii) How a BJT can be fabricated? Discuss. (8)
3. Develop the step by step basis, the fabrication of planar P-N junction diode with neat illustrations. (16)
4. List out the various steps involved in fabrication of typical transistor in monolithic ICs. (16)
5. Explain the basic process involved in the silicon planar technology with neat diagram. (16)
6. Derive CMRR for differential amplifier. (16)
7. Explain how monolithic transistors and diodes are fabricated. (16)
8. (i) Compose the concept of Widlar current source used in op-amp circuit with suitable circuit diagram and necessary equations. (8)
   (ii) Sketch and explain the concept of Wilson current source used in op-amp circuit. (8)

UNIT – II CHARACTERISTERISTICS OF OP-AMP AND APPLICATIONS

PART – A (2 Marks)

1. Mention the DC and AC characteristics of Operational Amplifier.
2. List the methods used to provide the external frequency compensation.
3. What do you mean by input offset current and offset voltage?
4. Define slew rate.
5. Design a non inverting amplifier with a gain of 3.
6. Why integrators are preferred over differentiators?
7. Draw the circuit diagram of differentiator using Op-amp.
8. How an op-amp can be used as a voltage follower?
9. Summarize an op-amp integrator. Mention its application.
10. List the features of Instrumentation amplifier.

11. How square root and square of a signal obtained with a multiplier circuit.
12. How does precision rectifier differ from conventional rectifier?
13. List the applications I-V and V-I converters.
14. Draw the circuit diagram of an integrator and give its output equation.
15. Write down the condition for good differentiation.
16. In practical op-amps, what is the effect of high frequency on its performance?
17. What is the need for frequency compensation in practical op-amps?
18. Define virtual ground of an OP-Amp.
19. List out the Basic requirements of output stage.
20. Can you recall offset voltage of an operational amplifier?

Part – B (16 Marks)

1. Explain DC characteristics of Op Amp and write note about each terms of Input Bias current, offset voltage and thermal drift. (16)
2. With a neat diagram derive the AC performance close loop characteristics of Op-amp to discuss on the circuit Frequency response, Frequency Compensation, and slew rate. (16)
3. (i) Explain closed loop configuration of Operational Amplifier Inverting and non-inverting amplifiers and Inverters. (8)

   (ii) With neat circuit diagrams and mathematical expressions, explain the operation of the following op-amp applications (i) Summing amplifier Averaging circuits (ii) subtractor. (8)
4. (i) Evaluate Inverting adder and Non-inverting adder with neat circuit diagram and mathematical expressions. (8)

   (ii) Illustrate the operation of current to voltage and Voltage to current converter circuits. (8)
5. (i) Construct precision diode circuit Using appropriate equations discuss about the working of Half wave Precision Rectifier. (8)

   (ii) Sketch the Differentiator circuit and explain the working principle in detail. (8)
6. (i) With neat sketch explain the working of Full wave Precision Rectifier in detail. (8)

   (ii) Sketch the Integrator circuit and explain the working principle in detail. (8)
7. (i) Draw the circuit diagram of Instrumentation amplifier and explain its operation. List few of its applications. (8)

   (ii) Examine the principal of operation of Voltage follower with the neat circuit diagram and mathematical expressions. (8)
8. Draw the circuit diagram of Differential amplifier and explain its operation. (16)

UNIT – III COMPARATORS AND WAVEFORM GENERATORS

PART - A (2 MARKS)

1. Brief the Op amp application as an inverting comparator.
2. What is comparator?
3. Point out the applications of comparator?
4. What do you mean by chattering effect?
5. Draw the circuit of zero crossing detectors.
6. Differentiate a basic comparator and the Schmitt trigger.
7. Identify the basic characteristics of comparator.
8. Brief comparator application as a window detector.
9. What is a Schmitt trigger?
10. Identify the merits of regenerative comparator.
11. Show the transfer characteristics of a Schmitt trigger.
12. Justify the use of positive feedback in Schmitt trigger.
13. Give the expression for the upper threshold, lower threshold and hysteresis voltages in a Schmitt trigger.
14. What is an astable multivibrator?
15. Sketch the circuit of an astable multivibrator using op amp.
16. What do you mean by monostable multivibrator?
17. What are the requirements for producing sustained oscillations in feedback circuits?
18. Give the expression for the frequency of oscillations in an op-amp sine wave oscillator.
19. Using an op amp, design a RC phase shift oscillator with its frequency of oscillation at 100Hz.
20. Design a Wein bridge oscillator that will oscillate 1.5 KHz.

PART - B (16 MARKS)

1. (i) Discuss in detail about comparator with neat circuit diagram and plot input and output waveforms (8)

   (ii) Describe any one application of comparator. (8)
2. Describe the working of a Schmitt trigger and plot its transfer characteristics. (16)
3. Elucidate about monostable multivibrators and draw the appropriate waveforms. (16)
4. With neat circuit diagram explain the operation of the free running multivibrator using op amp and

also derive the expression for its frequency of oscillation. Draw the appropriate waveforms. (16)

5. (i) With neat circuit diagram explain the working of a Wein bridge oscillator using op amp. (8)
   (ii) Design a Wein bridge oscillator that will oscillate at 1.8 KHz. (8)
6. (i) With neat circuit diagram explain the working of a RC phase shift oscillator using op amp. (8)
   (ii) Design a RC phase shift oscillator that will oscillate at 180 Hz. (8)
7. (i) Describe the applications of comparator in detail. (8)
   (ii) Explain the working of non-inverting comparator and draw the output waveforms. (8)
8. Elucidate the principle of sine wave oscillators and explain any one sine wave oscillator using op amp. (16)
9. (i) With neat circuit explain the working of inverting comparator. (8)
   (ii) Describe the operation of regenerative comparator. (8)
10. Discuss the working of multivibrators using operational amplifiers. (16)

UNIT – IV PHASE LOCKED LOOP AND DATA CONVERTER

PART - A (2 MARKS)

1. List the basic building blocks of PLL.
2. Define lock-in range and capture range of a PLL.
3. Why VCO is also called as V to F converter?
4. On what parameters does the free running frequency of VCO depend on?
5. Give the expression for the VCO free running frequency.
6. Define Voltage to Frequency conversion factor.
7. Identify the purpose of having a low pass filter in PLL.
8. Discuss the effect of having large capture range.
9. Evaluate some typical applications of PLL.
10. Draw the circuit of AM detector using PLL.
11. Define accuracy of converter
12. Distinguish between conversion time and settling time?
13. Write down the drawbacks of weighted D/A converter.
14. Compare and contrast binary ladder and R-2R ladder DAC.
15. How would you classify ADCs?
16. Where successive approximation type A/D converters are used?
17. What is the function of integrating type converter? List out some integrating type converters?
18. How would you justify which type of ADC is the fastest?

19. Compare the advantages and drawbacks of a dual-slop ADC?
20. Invent the number of comparators required for realizing a 4-bit flash ADC.

PART - B (16 MARKS)

1. (i) Illustrate the operation of VCO with neat block diagram. (8)
   (ii) Derive the expression for voltage to frequency conversion factor. (8)
2. (i) Explain the working of IC 565. (8)
   (ii) Label the application of PLL used for FM detection. (8)
3. Measure the closed loop analysis of PLL with necessary diagrams. (8)
4. How would you describe the block diagram of PLL and derive the expression for Lock range and capture range? (16)
5. Discuss the applications of PLL in detail. (16)
6. (i) Discuss in detail about the Flash type Analog to Digital conversion techniques. For an n-bit flash type ADC, how many comparators are required? (8)
   (ii) Compare its performance with the other types of ADCs. (8)
7. (i) Explain the Weighted resistor DAC. (8)
   (ii) Find the number of resistors required for an 8-bit weighted resistor D/A converter. Consider the smallest resistance is R and obtain those resistance values. (8)
8. (i) Differentiate between current mode and voltage mode R-2R ladder D/A converter. (8)
   (ii) Analyze the Inverted or Current mode R-2R Ladder Digital to Analog converter. (8)
9. With example explain the successive Approximation ADC Technique. (16)
10. (i) Compare single slope ADC and dual slope ADC. (8)
    (ii)Draw the circuit and explain the working of dual slope A/D converter. (8)

UNIT – V SPECIALIZED IC APPLICATIONS

PART - A (2 MARKS)

1. Define 555 IC?
2. What are the features of 555 timer?
3. List the basic blocks of IC 555 timer?
4. Mention the applications of 555 timer as Astable multivibrator.
5. Give the applications of 555 time as monostable multivibrator.
6. What is a voltage regulator?

7. Give the classification of voltage regulators.
8. What is a linear voltage regulator?
9. Give the drawbacks of linear regulators.
10. Give some examples of monolithic IC voltage regulators.
11. Define line regulation.
12. Define load regulation.
13. What is a switching regulator?
14. What is the purpose of having input and output capacitors in three terminal IC regulators?
15. List the advantages of switching voltage regulators.
16. What do you infer by switched capacitor filter?
17. What do you mean by universal active filter?
18. Identify the applications of universal active filter.
19. Brief ramp generator using 555 timer IC.
20. Compare linear voltage regulator and switching voltage regulator.

PART - B (16 MARKS)

1. Explain the functional block diagram of 555timer. (16)
2. Describe the Astable mode of operation using 555 timer and derive an expression for its frequency of oscillation. (16)
3. Explain in detail about the function of 555 timer in monostable and derive the expression for frequency of oscillation. (16)
4. (i) Discuss any two applications of astable multivibrator. (10)
   (ii) Describe any one application of monostable multivibrator. (6)
5. Draw and explain the Functional block diagram of a 723 Regulator. (16)
6. (i) Draw and Explain the functional block diagram of the LM-317 three terminal adjustable regulators. (8)
   (ii) Explain the operation of switching regulator. Give its advantages. (16)
7. Explain the working of dual power supply. (16)
8. Describe the working of switched capacitor filter? (16)
9. Explain the working of universal active filter. (16)
10. Discuss about (i) Fixed voltage regulator and (ii) Adjustable voltage regulator. (8+8)