Reg. No. : | | | | | | | | | | |

Question Paper Code: 44304

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Electrical and Electronics Engineering

14UEE404 - ANALOG INTEGRATED CIRCUITS

(Common to Instrumentation and Control Engineering)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In Monolithic IC

   (a) Performance depends on the substrate
   (b) Performance does not depend on the substrate
   (c) Performance depends on interconnects
   (d) Performance depends on packaging

2. How many leads does the TO-5 metal can package of an operational amplifier have
   (a) 8, 10, or 12 (b) 6, 8, or 10 (c) 8 or 14 (d) 8 or 16

3. Specified value of CMRR for 741 opamp is
   (a) 30 dB (b) 40 dB (c) 90 dB (d) 120 dB

4. What is the scale multiplier (factor) of a basic integrator?
   (a) R/C (b) C/R (c) –RC (d) –1/RC

5. In applications where measurement of a physical quantity is involved, the Op-amp circuit recommended is

   (a) Basic non-inverting amplifier (b) A comparator
   (c) An active filter (d) An instrumentation amplifier

6. In a sample and hold circuit the following statement is false

   (a) Sample time is much smaller than hold time
   (b) Aperture time is the delay between the time that the pulse is applied to the switch and the actual time the switch closes
   (c) Acquisition time is the time it takes for the capacitor to charge from one voltage to another voltage
   (d) The voltage across the hold capacitor changes by 50% during hold time

7. Which of the following techniques are used for the analog multipliers?

   (a) Logarithmic multipliers (b) Variable trans-conductance multipliers
   (c) Both (a) and (b) (d) None of these

8. How many V_{cc} connections does the 565 PLL use?

   (a) 0 (b) 1 (c) 2 (d) 3

9. Regulators in which the transistor act in the active region are called

   (a) linear regulator (b) switching regulator
   (c) non linear regulator (d) adjustable regulator

10. Voltage regulator LM7805 has an output voltage of

    (a) 5 volts (b) -5 volts (c) 0.5 volts (d) -0.5 volts

PART - B (5 x 2 = 10 Marks)

11. Why inductors are difficult to fabricate in ICs?

12. What is virtual ground?

13. What is a precision diode?

14. Enumerate the features of 555 Timer Integrated Circuits.

15. Mention the limitations of linear IC voltage regulators. What is the order of the voltage drop across the current limiting resistor in an IC regulator when the limiting action occurs.

PART - C (5 x 16 = 80 Marks)

16. (a) Mention the dimensions of a typical Integrated Circuits and different types of packaging of IC's. List the steps involved in the manufacturing process of an Integrated Circuits. Discuss the following processes in the monolithic IC technology with necessary diagram wherever necessary.
(i) Epitaxial Growth, (ii) Isolation by diffusion. (16)

Or

b) Briefly explain the various processes involved in the fabrication of monolithic bipolar transistor. (16)

17. (a) (i) An IC 741 op-amp whose slew rate is 0.5 V/μs is used as an Inverting Amplifier with a gain of 50. The voltage gain against frequency curve of IC 741 is flat upto 20 kHz. Evaluate what maximum peak to peak signal can be applied without distorting the output. (6)

(ii) For a practical integrator, the component values are R_1 = 120 kΩ, R_F = 1.20 MΩ and the capacitor C_F = 10 nF. Draw the circuit diagram. Determine the safe frequency above which true integration will take place and DC gain. Find the peak of the output voltage for a sine wave input with 5 V peak and 10 kHz frequency. Sketch the rough nature of the frequency response. (10)

Or

(b) (i) The Common Mode Rejection Ratio (CMRR) of an Op-amp is 10^4. Two sets of signals are applied to it. First set is V_1= + 20 μV, V_2 = - 20 μV and second set V_1= 540 μV, V_2 = 500 μV. Calculate the percent difference in output voltage for the two sets of signals. (6)

(ii) Design an op-amp differentiator that will differentiate an input signal with f_{max} = 100 Hz. Draw the output waveform for a sine wave of 1 V peak at 100 Hz applied to the differentiator. Also repeat the same for a square wave input. (10)

18. (a) (i) What is an Instrumentation Amplifier? Draw a system whose gain is controlled by an adjustable resistance. Name the circuit that is used to detect the peak value of the non-sinusoidal waveforms. (8)

(ii) Draw the circuit of a voltage to current converter if the load is floating and grounded. Is there any limitation on the size of the load when grounded? Discuss. (8)

Or

(b) (i) Sketch the circuit diagram of clamper and explain its operation. (8)

(ii) Explain the operation of successive approximation A/D converter. (8)

19. (a) Enumerate the desirable properties for a Voltage Controlled Oscillator (VCO). Draw the circuit diagram of a Voltage Controlled Oscillator (VCO) and discuss its operation in a detailed manner with proper mathematical equation. State assumptions and approximations, if any. (16)

Or

(b) Draw the block schematic diagram of PLL IC NE/SE 565and describe its functions. (16)

20. (a) With neat circuit diagram explain the operation of SMPS. (16)

Or

(b) (i) Describe the operation of isolation amplifiers. (6)

(ii) Explain the operation of opto-coupler. (10)