VETRI VINAYAHA COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ECE
EC 6404 - LINEAR INTEGRATED CIRCUITS
QUESTION BANK(2013 Regulation)

UNIT I
BASICS OF OPERATIONAL AMPLIFIERS

1. Define an Integrated circuit.

An integrated circuit(IC) is a miniature, low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon. The active components are transistors and diodes and passive components are resistors and capacitors.

2. What are the basic processes involved in fabricating ICs using planar technology?

1.Silicon wafer (substrate) preparation
2.Epitaxial growth
3.Oxidation
4.Photolithography
5.Diffusion
6.Ion implantation
7.Isolation technique
8.Metallization
9.Assembly processing & packaging

3.List out the steps used in the preparation of Si – wafers.

1.Crystal growth &doping
2.Ingot trimming & grinding
3.Ingot slicing
4.Wafer policing & etching
5.Wafer cleaning

4. Define virtual ground of OP-Amp?

A virtual ground is a ground which acts like a ground. It is a point that is at the fixed ground potential (0v), though it is not practically connected to the actual ground or common terminal of the circuit.

5. What are the advantages and limitations implantation of ion implantation?

Advantages:

• Accurate control over doping

• Very good reproducibility
• Precise resistance value
• A room temperature process

Limitations:

• Annealing at higher temperature is required for avoiding the crystal damage
• The possibility of doping implanting through various layers of wafer.

6. Why IC 741 is not used for high frequency applications?

IC741 has a low slew rate because of the predominance of capacitance present in the circuit athigher frequencies. As frequency increases the output gets distorted due to limited slew rate.

7. In practical op-amps, what is the effect of high frequency on its performance?

The open-loop gain of op-amp decreases at higher frequencies due to the presence of parasitic capacitance. The closed-loop gain increases at higher frequencies and leads to instability.

8. Define input offset voltage.

A small voltage applied to the input terminals to make the output voltage as zero when the two input terminals are grounded is called input offset voltage.

9. Define input offset current. State the reasons for the offset currents at the input of the op-amp.

The difference between the bias currents at the input terminals of the op-amp is called as input offset current. The input terminals conduct a small value of dc current to bias the input transistors. Since the input transistors cannot be made identical, there exists a difference in bias currents.

10. Define sensitivity.

Sensitivity is defined as the percentage or fractional change in output current per percentage or fractional change in power-supply voltage.

11. What are the limitations in a temperature compensated zener-reference source?

A power supply voltage of at least 7 to 10 V is required to place the diode in the breakdown region and that substantial noise is introduced in the circuit by the avalanching diode.

12. Define CMRR of an op-amp. (DEC 09)

The relative sensitivity of an op-amp to a difference signal as compared to a common –mode signal is called the common –mode rejection ratio. It is expressed in decibels.

$$CMRR = Ad/Ac$$

13. What are the applications of current sources?

Transistor current sources are widely used in analog ICs both as biasing elements and as load devices for amplifier stages.

14. Justify the reasons for using current sources in integrated circuits.

(i) Superior insensitivity of circuit performance to power supply variations and temperature.

(ii) More economical than resistors in terms of die area required providing bias currents of small value.

(iii) When used as load element, the high incremental resistances of current source results in high voltage gain at low supply voltages.

15. What is the advantage of widlar current source over constant current source?

Using constant current source output current of small magnitude(micro amp range) is not attain able due to the limitations in chip area.Widlar current source is useful for obtaining small output currents. Sensitivity of widlar current source is less compared to constant current source.

16. Mention the advantages of Wilson current source.

(i) Provides high output resistance.

(ii) Offers low sensitivity to transistor base currents.

17. Mention the advantages of integrated circuits over discrete components. (May 2010)

*Miniaturization and hence increased equipment density.

*Cost reduction due to batch processing.

*Increased system reliability due to the elimination of soldered joints.

*Improved functional performance.

*Matched devices. *Increased operating speeds.

*Reduction in power consumption.

18. Define sheet resistance.(May 2010)

Sheet resistance is defined as the resistance in ohms /square offered by the diffused area.

19. What is the use of buried n+ layer in monolithic IC transistor? (MAY 2010)

The buried n+ layer provides a low resistance path in the active collector region for the flow of current

20. What is active load? Where it is used and why? (MAY/JUNE 2010)

The active load realized using current source in place of the passive load in the collector arm of differential amplifier makes it possible to achieve high voltage gain without requiring large power supply voltage.

21. Why open loop OP-AMP configurations are not used in linear applications?(may/june 2010)

The open loop gain of the op-amp is not a constant and it varies with changing the temperature and variations in power supply. Also the bandwidth of the open loop op-amp is negligibly small. For thi reasons open loop OP-AMP configurations are not used in linear applications.

22. What are the two common methods for obtaining integrated capacitors? (May 2010)

- Monolithic junction capacitor
- Thin-flim capacitor

23. Define slew rate.(MAY 2010)

The slew rate is defined as the maximum rate of change of output Voltage caused by a step input voltage. An ideal slew rate is infinite which means that op-amp's output voltage should change instantaneously in response to input step voltage.

24. What causes slew rate? (DEC 09)

There is a capacitor with-in or outside of an op-amp to prevent oscillation. The capacitor which prevents the output voltage from responding immediately to a fast changing input.

25. What happens when the common terminal of V+ and V- sources is not grounded? (DEC 09)

If the common point of the two supplies is not grounded, twice the supply voltage will get applied and it may damage the op-amp.

16 MARKS

1. Explain the different types of resistor fabrication in an IC. (16) **(Nov/Dec 2014)**
2. a) Describe the AC performance characteristics of a operational amplifier. (8) **(Nov/Dec 2014).** b) Describe the DC performance characteristics of a operational amplifier. (8) **(Nov/Dec 2014)**
3. Explain the construction of monolithic bipolar transistor, monolithic diode and integrated resistors. (16) **(May/ June 2014)**
4. Explain the internal circuit diagram of IC 741. Discuss its AC and DC performance characteristics. (16) **(May/ June 2014)**
5. a) Explain the working of a Wildar current source. (6) **(Nov/Dec 2008), (Nov/Dec 2009).**b) What is slew rate? |Discuss the methods of improving slew rate. (10) **(Nov/Dec 2008), (May/June 2009), (Nov/Dec 2009)**
6. a) What is an active load? Explain the CE amplifier with active load. (6) **(May/June 2009).**b) Explain pole-zero compensation (10) **(Nov/Dec 2008)**
7. a) Briefly explain the method of using constant current bias for increasing CMRR in differential amplifier. (10) **(May/June 2009).** b) State the difference

between constant current bias and current mirror in differential amplifier. (6) **(May/June 2009)**

8. a) Discuss the frequency compensation in operational amplifier. (8) **(May/June 2009).**b) What is a current mirror? Give the current mirror circuit analysis. (8) **(Nov/Dec 2009)**
9. Briefly explain the various processes involved in fabricating monolithic IC which integrates bipolar transistor, diode, capacitor and resistor. (16) **(April/May 2010)**
10. a) Briefly explain the design considerations in monolithic operational amplifiers. (8) **(Nov/Dec 2009)**.b) Explain the importance of isolation and discuss the method of isolation. (8)
11. Explain in detail the fabrication of ICs using silicon planar technology. (16)
12. Explain how a monolithic capacitor can be fabricated. (16)

UNIT- II
APPLICATION OF OPERATIONAL AMPLIFIERS

1. Mention some of the linear applications of op – amps. (DEC 09)

- Adder, subtractor,
- Voltage –to current converter,
- current –to- voltage converters,
- Instrumentation amplifier,
- Analog computation
- power amplifier,

2. Mention some of the non – linear applications of op-amps.

- Rectifier, peak detector,
- clipper, clamper,
- sample and hold circuit,
- log amplifier, anti –log amplifier,

3. What are the areas of application of non-linear op- amp circuits?

1. Industrial instrumentation
2. Communication
3. Signal processing

4. What is voltage follower?(MAY 2010)

A circuit in which output folloes the input is called voltage follower.

5. What is the need for an instrumentation amplifier?

In a number of industrial and consumer applications, the measurement of physical quantities is usually done with the help of transducers. The output of

transducer has to be amplified So that it can drive the indicator or display system. This function is performed by an instrumentation amplifier.

6. List the features of instrumentation amplifier:

1.High gain accuracy
2.High CMRR
3.High gain stability with low temperature co-efficient
4Low dc offset
5.Low output impedance

7. What are the applications of V-I converter?

1.Low voltage dc and ac voltmeter
2.L E D
3.Zener diode tester

8. Define Band pass filter. (MAY 2010)

The band pass filter is the combination of high and low pass filters, and this allows a specified range of frequencies to pass through.

9. Write transfer function of op amp as an integer. (MAY 2010)

The transfer function of the integer is

$$|A| = 1/\omega R1cf$$

10. What do you mean by a precision diode?

The major limitation of ordinary diode is that it cannot rectify voltages below the cut – in voltage of the diode. A circuit designed by placing a diode in the feedback loop of an op – amp is called the precision diode and it is capable of rectifying input signals of the order of milli volt.

11. Write down the applications of precision diode.

1.Half - wave rectifier
2.Full - Wave rectifier
3.Peak – value detector
4.Clipper
5.Clamper

12. Define Logarithmic and antilogarithmic amplifier. (MAY 2010)

When a logarithmic PN junction is used in the feedback network of op-amp, the circuit exhibits log or antilog response. The logarithmic amplifier is a current to voltage converter with the transfer characteristics v0=vi In(If/Ii) Antilog amplifier is a decoding circuit which converts the logarithmically encoded signal back to the original signal levels as given by v_1=vR10-kvi

13. Differentiate Schmitt trigger and comparator

1. It compares the input signal with references voltage then yields the output voltage
2. It need not consist of feedback
3. comparator output need not to be square wave

4. It operates between two reference points namely UTP&LTP.

5. It employs positive feedback 6. Its output is square wave.

14. List the applications of Log amplifiers

1.Analog computation may require functions such as lnx, log x, sin hx etc. These functions can be performed by log amplifiers

2.Log amplifier can perform direct dB display on digital voltmeter and spectrum analyzer

3.Log amplifier can be used to compress the dynamic range of a signal

15. What are the limitations of the basic differentiator circuit?

1.At high frequency, a differentiator may become unstable and break into oscillations

2.The input impedance decreases with increase in frequency , thereby 0making the circuit sensitive to high frequency noise.

16. Write down the condition for good differentiation.

1. For good differentiation, the time period of the input signal must be greater than or equal to Rf C1

2.T > R f C1 Where, Rf is the feedback resistance

3. Cf is the input capacitance

17. What is a comparator?(MAY 2010)

A comparator is a circuit which compares a signal voltage applied at one input of an opamp with a known reference voltage at the other input. It is an open loop op - amp with output + Vsat

18. What are the applications of comparator?

1. Zero crossing detectors
2. Window detector
3. Time marker generator
4. Phase detector

19. What is a Schmitt trigger? (DEC 09,MAY 10)

Schmitt trigger is a regenerative comparator. It converts sinusoidal input into a square wave output. The output of Schmitt trigger swings between upper and lower threshold voltages, which are the reference voltages of the input waveform.

20. What is a multivibrator?

Multi vibrators are a group of regenerative circuits that are used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square output. It has two states stable or quasi- stable depending on the type of multivibrator.

21. What do you mean by monostable multivibrator?

Monostable multivibrator is one which generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state.

Application of a trigger causes a change to the quasi-stable state. An external trigger signal generated due to charging and discharging of the
capacitor produces the transition to the original stable state.

22. What is an astable multivibrator?

Astable multivibrator is a free running oscillator having two quasi-stable states. Thus, there is oscillations between these two states and no external signal are required to produce the change in state.

23. What is a bistable multivibrator?

Bistable multivibrator is one that maintains a given output voltage level unless an external trigger is applied. Application of an external trigger signal causes a change of state, and this output level is maintained indefinitely until an second trigger is applied. Thus, it requires two external triggers before it returns to its initial state

24. Mention any two audio frequency oscillators.

i. RC phase shift oscillator
ii. Wein bridge oscillator

25. What are the characteristics of a comparator?

1. Speed of operation
2. Accuracy
3. Compatibility of the output

26. What is a filter?

Filter is a frequency selective circuit that passes signal of specified band of frequencies and attenuates the signals of frequencies outside the band

27. What are the demerits of passive filters?

Passive filters works well for high frequencies. But at audio frequencies, the inductors become problematic, as they become large, heavy and expensive. For low frequency applications, more number of turns of wire must be used which in turn adds to the series resistance degrading inductor's performance ie, low Q, resulting in high power dissipation.

28. What are the advantages of active filters?

Active filters used op- amp as the active element and resistors and capacitors as passive elements.

29. Define low pass filter.

A low pass filter allows only low frequency signals upto a certain break point fH to pass through.

30. Define High pass filter.

A low pass filter allows only high frequency signals upto a certain break point f_h to pass through

16 MARKS

1. With neat sketch explain the operation of a 3 op-amp instrumentation amplifier. (16) **(Nov/Dec 2014)**
2. With neat diagram explain logarithmic amplifier and antilogarithmic amplifier. (16) **(May/ June 2014)**
3. With neat diagram explain the application of op-amp as precision rectifier, clipper and clamper. (16) **(May/ June 2014)**
4. a) Sketch the basic circuit using op-amp to perform the mathematical operation of differentiation and explain. What are the limitations of an ordinary op-amp differentiator? Draw and explain the circuit of a practical differentiator that will eliminate these limitations. (8) **(May/June 2012).** b) Draw and explain the circuit of a voltage to current converter if the load is (i) floating (4) (ii) Grounded (4) **(May/June 2012)**
5. a) Explain the working of an op-amp based Schmitt trigger circuit? (8) **(May/June 2012), (Nov/Dec 2011).**b) Design an op-amp based second order active low pass filter with cut off frequency 2KHz. (8) **(May/June 2012)**
6. a) Explain log amplifier. Using log amplifiers construct a multiplier circuit. (8) **(Nov/Dec 2009).** b) What is an active integrator? Explain the working of an active integrator. (8) **(Nov/Dec 2009)**
7. a) With a neat circuit diagram explain the working of op-amp based sine wave oscillator. (8) **(Nov/Dec 2009)**

   b) Design an instrumentation amplifier whose gain can be varied continuously over the range $1 \leq A \leq 1000$. Assume all other relevant details.(8) **(Nov/Dec 2009)**
8. Draw the circuit diagram of op-amp differentiator, integrator and derive an expression for the output in terms of the input. (16)
9. a) Design an op-amp based second order active low pass filter with cut off frequency 2KHz. (8) **(Nov/Dec 2011)**
10. With the help of circuits and necessary equations, explain how log and antilog computations are performed using IC 741. (16) **(Nov/Dec 2014)**

11.. Explain in detail about voltage series feedback amplifier. (16)

12. Derive the gain of inverting and non-inverting. (16)
13. Explain and derive the condition for DC-characteristics of an operational amplifier. (16)

UNIT- III
ANOLOG MULTIPLIER AND PLL

1. List the basic building blocks of PLL:

1.Phase detector/comparator
2.Low pass filter
3.Error amplifier
4.Voltage controlled oscillator

2. Define FSK modulation.(MAY 2010)

FSK is a type of frequency modulation ,in which the binary data or code is transmitted by means of a carrier frequency that is shifted between two fixed frequency namely mark(logic1) and space frequency(logic 0).

3. What is analog multiplier?(MAY 2010)

A multiplier produces an output v0, which is proportional to the product of two inputs vx and vy

V_0= kvxvy

4. List out the various methods available for performing for analog multiplier.

- Logarithmic summing technique
- Pulse height /width modulation technique
- Variable trans conductance technique
- Multiplication using gilbert cell
- Multiplication technique using trans conductance technique

5. Mention some areas where PLL is widely used. (DEC 2009)

1.Radar synchronizations
2. Satellite communication systems
3. Air borne navigational systems
4. FM communication systems
5.Computers.

6. What are the three stages through which PLL operates?

1.Free running
2.Capture
3.Locked/ tracking

7. Define lock-in range of a PLL. (MAY 2010)

The range of frequencies over which the PLL can maintain lock with the incoming signal is called the lock-in range or tracking range. It is expressed as a percentage of the VCO free running frequency.

8. Define capture range of PLL. (MAY 2010)

The range of frequencies over which the PLL can acquire lock with an input signal is called the capture range. It is expressed as a percentage of the VCO free running frequency.

9. Write the expression for FSK modulation.(MAY 2010)

$\Delta vf=f2-f1/k0$

10. Define free running mode .(MAY 2010)

An interactive computer mode that allows more than one user to have simultaneous use of a program.

11. For perfect lock, what should be the phase relation between the incoming signal and VCO output signal?

The VCO output should be 90 degrees out of phase with respect to the input signal.

12. Give the classification of phase detector:

1.Analog phase detector .

2.Digital phase detector

13. What is a switch type phase detector?

An electronic switch is opened and closed by signal coming from VCO and the input signal is chopped at a repetition rate determined by the VCO frequency. This type of phase detector is called a half wave detector since the phase information for only one half of the input signal is detected and averaged.

14. What are the problems associated with switch type phase detector?

1. The output voltage V_e is proportional to the input signal amplitude. This is undesirable because it makes phase detector gain and loop gain dependent on the input signal amplitude.

2. The output is proportional to cosφ making it non linear.

15. What is a voltage controlled oscillator?

Voltage controlled oscillator is a free running multivibrator operating at a set frequency called the free running frequency. This frequency can be shifted to either side by applying a dc control voltage and the frequency deviation is proportional to the dc control voltage.

16. Define Voltage to Frequency conversion factor.

Voltage to Frequency conversion factor is defined as,

$Kv = fo / Vc= 8fo /Vcc$

- Vc is the modulation voltage fo frequency shift

17. What is the purpose of having a low pass filter in PLL?

- It removes the high frequency components and noise.
- Controls the dynamic characteristics of the PLL such as capture range, lock-in range,band-width and transient response.
- The charge on the filter capacitor gives a short- time memory to the PLL

18. Discuss the effect of having large capture range.

The PLL cannot acquire a signal outside the capture range, but once captured, it will hold on till the frequency goes beyond the lock-in range. Thus, to increase the ability of lock range, large capture range is required. But, a large capture range will make the PLL more susceptible to noise and undesirable signal.

19. Mention some typical applications of PLL:

- Frequency multiplication/division
- Frequency translation
- AM detection
- FM demodulation
- FSK demodulation.

20. What is a compander IC? Give some examples.(DEC 2009)

The term commanding means compressing and expanding. In a communication system, the audio signal is compressed in the transmitter and expanded in the receiver.

Examples: LM 2704- LM 2707; NE 570/571.

21. What are the merits of companding?

*The compression process reduces the dynamic range of the signal before it is transmitted.

*Companding preserves the signal to noise ratio of the original signal and avoids non linear

distortion of the signal when the input amplitude is large.

*It also reduces buzz,bias and low level audio tones caused by mild interference.

16 MARKS

1. Describe the working principle of a analog multiplier using emitter coupled transistor pair. (16) **(Nov/Dec 2014)**
2. a) With neat diagram describe the AM detection using PLL. (8) **(Nov/Dec 2014).**b) With neat diagram describe the FM detection using PLL. (8) **(Nov/Dec 2014)**
3. a) Explain PLL used as an AM Detection. (8) **(Nov/Dec 2008).**b) Explain how frequency multiplication is done using PLL. (8) **(Nov/Dec 2008)**
4. a) With a neat sketch, explain the working of variable transconductance multiplier. (10) **(Nov/Dec 2008), (April/May 2010).** b) Write short notes on frequency synthesizer. (6) **(Nov/Dec 2008), (Nov/Dec 2009)**
5. Explain the working of analog multiplier using emitter coupled transistor pair. Discuss the application of analog multiplier IC. (16) **(May/ June 2014)** 6. Explain the application of PLL as AM detection FM detection and FSK demodulation. (16) **(May/ June 2014)**

6. a) List and define the various performance parameters of a multiplier IC. (6) **(May/June 2012).**b) How the multiplier is used as voltage divider? (5) **(May/June 2012).** c) How the multiplier is used as frequency doubler? (5) **(May/June 2012)**
7. Explain with neat block diagrams, how PLL is used as (i) AM Detector (5) (ii) FM Detector (5) (iii) Frequency synthesizer (6) **(May/June 2012)**
8. a) With neat diagram, explain the working principle of isolation amplifier. (8) **(May/June 2012)** b) With neat diagram, explain the principle of operation of opto-couplers. (8) **(May/June 2012)**
9. a) Explain the function of video amplifier IC. (8) **(Nov/Dec 2009)** b). With a neat functional block diagram explain switched capacitor filter IC.(8) **(Nov/Dec 2009)**
10. Explain the working of 555 Timer in astable mode. Using the same IC design a circuit to toggle an led with one second delay between on and off time repeatedly (16) **(Nov/Dec 2009)**
11. a) How is voltage regulators classified? Explain a series voltage regulator. (8) **(April/May 2010)** b) What is an opto-coupler? Briefly explain its characteristics. (8) **(April/May 2010)**
12. Describe the working of IC723 voltage regulator and explain the importance of current limiting techniques. (16) **(Nov/Dec 2010)**
13. a) Explain the working of voltage controlled oscillator.(8) **(Nov/Dec 2009), (April/May 2010)**
14. Explain the working of an instrumentation amplifier with a circuit. Give its characteristics and applications (16)
15. Explain the working of any one of sinusoidal oscillators. (16)
16. Explain the working of Schmitt trigger. (16)
17. Explain the R-2R ladder type DAC. (16)
18. Explain how a comparator can be used as a zero crossing detector.(16)
19. Draw the circuit of a first order and second order butter worth active low pass filter and derive its transfer functions. (16)

UNIT-IV
ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

1. Explain the operation of basic sample and hold circuit.

A typical sample and hold circuit stores electric charge in a capacitor and contains at least one fast FET switch and at least one operational amplifier. To sample the input signal the switch connects the capacitor to the output of a buffer amplifier. The buffer amplifier charges or discharges the capacitor so that the voltage across the capacitor is practically equal, or proportional to, input voltage. In hold mode the switch disconnects the capacitor from the buffer. The capacitor is invariably discharged by its own leakage currents and useful load currents, which makes the circuit inherently volatile, but the loss of voltage (*voltage droop*) within a specified hold time remains within an acceptable error margin.

2. State the advantages and applications of sample and hold circuits.

A sample and hold circuit is one which samples an input signal and holds on to its last sampled value until the input is sampled again. This circuit is mainly used in digital interfacing, analog to digital systems, and pulse code modulation systems.

3. List the drawbacks of binary weighted resistor technique of D/A conversion.

a) Wide range of resistor values needed

b) Difficulty in achieving and maintaining accurate ratios over a wide range of variations

4. What is the advantage and disadvantages of flash type ADC?

Flash type ADC is the fastest as well as the most expensive.

The disadvantage is the number of comparators needed almost doubles for each added bit (For a n-bit convertor 2(n-1) comparators, 2n resistors are required).

5. The basic step of a 9 bit DAC is 10.3 mV. If 000000000 represents 0Volts, what is the output for an input of 101101111?

The output voltage for input of 101101111 is

= 10.3 mV (1*28+0*27+1*26+1*25+0*24+1*23+1*22+1*21+1*20)

= 10.3 * 10-3 * 367 = 3.78 V

6. Find the resolution of a 12 bit DAC converter.

Resolution (volts) = VFS/(212-1) = I LSB increment

VFS – Full scale voltage

7. What are the advantages and disadvantages of R-2R ladder DAC.

Advantages:

a) Easier to build accurately as only two precision metal films are required.

b) Number of bits can be expanded by adding more sections of same R/2R values.

Disadvantage:

a) In this type of DAC, when there is a change in the input, changes the current flow in the resistor which causes more power dissipation which creates non-linearity in DAC.

8. Define start of conversion.

Start of Conversion in ADC (SOC): This is the control signal for start of conversion which initiates A/D conversion process.

9. Define end of conversion.

End of Conversion in ADC (EOC): This is the control signal which is activated when the conversion is completed.

10. What are the types of ADC.

Types of ADC:

1. Flash (comparator) type converter
2. Counter type converter
3. Tracking or servo converter
4. Successive approximation type converter

11.What are the types of DAC:

1. Weighted resistor DAC
2. R-2R Ladder
3. Inverted R-2R Ladder

12. What is the difference between direct ADC and integrating type ADC.

a) The integrating type of ADC's do not need a sample/Hold circuit at the input.

b) It is possible to transmit frequency even in noisy environment or in an isolated form.

13. Define Resolution.

The resolution of a converter is the smallest change in voltage which may be produced at the output or input of the converter.

Resolution (in volts)= VFS/2n-1=1 LSB increment. The resolution of an ADC is defined as the smallest change in analog input for a one bit change at the output.

14. What is mean by Accuraccy?

Absolute accuracy:

It is the maximum deviation between the actual converter output & the ideal converter output.

15. What is thepurpose of used in DAC Monotonicity

A monotonic DAC is one whose analog output increases for an increase in digital input.

16. Define Conversion time

It is defined as the total time required to convert an analog signal into its digital output. It depends on the conversion technique used & the propagation delay of circuit components.

The conversion time of a successive approximation type ADC is given by

T(n+1)

where T---clock period

Tc---conversion time n----no. of bits

17. Define Relative accuracy:

It is the maximum deviation after gain & offset errors have been removed.The accuracy of a converter is also specified in form of LSB increments or % of full scale voltage.

18. Which is the fastest ADC and why?

This type of ADC are fastest because it it is performed through a set of comparator.

19. Define dither

It is very small amount of noise to add a before the the a/d conversion

20. Define sampling period and hold period

Time duration of capacitor to sample and hold the equal valiue of voltage input period is called as sampling period and the time duration of voltge across the capacitor at constant time duration is called as hold peroid

16 MARKS

1. Describe the working of a weighted resistor type DAC. (8) **(Nov/Dec 2014)** .b) Describe the working of a R-2R type DAC. (8) **(Nov/Dec 2014)**
2. With neat sketch explain the working of a flash type ADC. (16) **(Nov/Dec 2014)**
3. a) Explain the working of Dual scope ADC. (8) **(Nov/Dec 2008).**b) With a neat circuit explain the operation of a binary weighted resistor D/A converter. (8) **(Nov/Dec 2008)**
4. a) Write note on Analog switches.(6) b) Explain Delta modulation. What are its advantages and disadvantages. (10) **(Nov/Dec 2008)**
5. Explain weighted resistor type and R-2R ladder type DAC. (16) **(May/ June 2014)**
6. Explain Flash type, single slope type and dual slope type ADC. (16) **(May/ June 2014)**

7. a) Explain the following types of electronic switches used in D/A converter with suitable diagrams: (i) Totem pole MOSFET switch(4). (ii) CMOS inverter as a switch(4) **(May/June 2012)** b) Explain the working of R-2R ladder DAC by taking example of a 3-bit DAC circuit. Sketch the corresponding equivalence circuits and hence obtain the equation for output. (8) **(May/June 2012)**
8. a) With neat circuit diagram and waveform of output, explain the working of dual slope A/D converter. (10) **(May/June 2012).** b) Give a table of comparison of Flash, Dual slope and successive-approximation ADCs in terms of parameters like speed, accuracy, resolution, input-hold-time. (6) **(May/June 2012)**

UNIT-V
SPECIAL FUNCTION INTEGRATED CIRCUITS

1. What are the operating modes of a 555 timer?

a. Monostable mode
b. Astable mode

2. List out the applications of 555 timer?

a. Oscillator
b. pulse generator
c. ramp and square wave generator d. mono-shot multivibrator
e. burglar alarm
f. traffic light control.

3. Define sink current and source current?

Sink current: When the output is low, the load current that flows through cted between Vcc and o/p terminal is called sink current. **Source current:** When the output is high, the load current that flows through the load connected between ground and o/p terminal is called source current.

5. What is the use of reset pin of 555 timer?

This is an interrupt for the timing device when pin 4 is grounded, it stops the working of device and makes it off.

6. What is the purpose of control voltage pin (5) of 555 timer?

This pin is the inverting input terminal of comparator. This is reference level for comparator with which threshold is compared. If reference level is other than 2/3 VCC, then external input is to be given to pin 5. Pulse width modulation is possible due to pin 5.

7. List out the major blocks of 555 timer functional diagram?

The IC 555 timer combines the following elements.

1) A relaxation oscillator
2) RS flip-flop
3) Two comparators
4) Discharge transistor

8. Define duty cycle?

It is defined as the ratio of on time to the total time of one cycle. D = W/ T

W – time for output is high = TON

T – total time of one cycle.

9. Write the expression for pulse width of 555 timer in monostable mode?

Pulse width W = 1.1 RC seconds

R – resistor in ohms, C – capacitor in farads

10. Write the expression for total time period of 555 timer in astable mode?

T = 0.693 (RA + 2 RB) C seconds

11. What is the frequency of oscillation of free running mode of 555 timer?

F = 1.44/ (RA + 2 RB) C Hz

12. List out the applications of 555 timer in astable mode.

a. missing pulse detector b. Linear ramp generator c. Frequency divider
d. Pulse width modulation.

13. List out the applications of 555 timer in monostable mode.

a. FSK generator

b. Pulse-position modulator

14. Define voltage regulators and give the types?

A voltage regulator is an electronic circuit that provides a stable dc voltage independent of the load current, temperature, and ac line voltage variations.

The classification of voltage regulators:

*Series / Linear regulators

*Switching regulators.

15. What do you mean by linear voltage regulators?

Series or linear regulator uses a power transistor connected in series between the unregulated dc input and the load and it conducts in the linear region .The output voltage is controlled by the continuous voltage drop taking place across the series pass transistor.

16. Define switched voltage regulators?

Switching regulators are those which operate the power transistor as a high frequency on/off switch, so that the power transistor does not conduct current continuously. This gives improved efficiency over series regulators

17. What are the advantages of adjustable voltage regulators over the fixed voltage regulators?

i) Improved line and load regulation by a factor of 10 or more.

ii) Because of the improved overload protection, greater load current can be drawn.

iii) Improved reliability.

18. List out the parameters related to the fixed voltage regulators?

1) Line regulation
2) Load regulation
3) Ripple rejection
4) Output impedance
5) Maximum power dissipation
6) Rated output current

19. Define dropout voltage of a fixed voltage regulator?

It is the minimum voltage that must exist between input and output terminals. For most of regulators, it is 2 to 3 volts.

20. What is an opto-coupler IC? Give examples.

Opto-coupler IC is a combined package of a photo-emitting device and a photosensing device.

Examples for opto-coupler circuit : LED and a photo diode,
LED and photo transistor, LED and Darlington.

Examples for opto-coupler IC : MCT 2F , MCT 2E .

21. Mention the advantages of opto-couplers.

- *Better isolation between the two stages.
- *Impedance problem between the stages is eliminated.
- *Wide frequency response.

16MARK

1. Describe the working of a Astable multivibrator using op-amp. (16) **(Nov/Dec 2014)**
2. Explain the operation of a switching regulator with neat diagram. (16) **(Nov/Dec 2014)**
3. What are the various blocks that form a Basic Voltage Regulator. Explain the series and shunt voltage regulator. List advantages of IC voltage regulators. (16) **(Nov/Dec 2008)**
4. a) Discuss the operation of IC 555 as a monostable multivibrator. Draw the waveform and explain. (8) **(Nov/Dec 2008)**
5. b) Draw the functional block diagram of switching regulator and explain. (8) **(Nov/Dec 2008)** With neat diagram explain IC 723 general purpose regulator. (16) **(May/ June 2014)**

6. Explain in detail voltage to frequency and frequency to voltage converters. (16) **(May/ June 2014)**
7. Sketch the functional block diagram of the following and explain their working principle: (i) IC 555 Timer (8) **(May/June 2012)** (ii) General purpose voltage regulator IC 723 (8) **(May/June 2012)**
8. a) With neat diagram, explain the working principle of isolation amplifier. (8) **(May/June 2012)** b) With neat diagram, explain the principle of operation of opto-couplers. (8)**(May/June 2012)**
9. a) Explain the function of video amplifier IC. (8) **(Nov/Dec 2009)** b) With a neat functional block diagram explain switched capacitor filter IC.(8) **(Nov/Dec 2009)**
10. Explain the working of 555 Timer in astable mode. Using the same IC design a circuit to toggle an led with one second delay between on and off time repeatedly (16) **(Nov/Dec 2009)**