0EE6303 Linear Integrated Circuits and Applications

UNIT I : IC FABRICATION

1. **What is an IC?**
   An integrated circuit is a miniature, low cost electronic circuit consisting of active and passive components that are irreparably joined together on a single crystal chip of silicon.
2. **List the advantages of IC over discrete component circuit.**
   - ❖ Low cost (due to the large quantities processed)
   - ❖ Small size.
   - ❖ High reliability. (All components are fabricated simultaneously and there are no soldered joints)
   - ❖ Improved performance. (Because of the low cost, more complex circuitry may be used to obtain better functional characteristics.)
3. **Classify ICs on the basic of application, device used and chip complexity**.
   - ❖ Based on application, ICs can be classified as monolithic integrated circuits and hybrid circuits.
   - ❖ Based on the active devices used, ICs can be classified as Bipolar (using BJT) and unipolar (using FET).
   - ❖ Based on the chip complexity, ICs can be classified as SSI – Small Scale Integration, MSI – Medium Scale Integration, LSI – Large Scale Integration, VLSI – Very Large Scale Integration, ULSI – Ultra Scale Integration and GSI – Giant Scale Integration.
4. **Name the technology used for the fabrication of transistors or ICs.**
   Monolithic Integrated Circuit Technology which means a circuit fabricated from a single stone or a single crystal.
5. **List the basic processes used in the silicon planar technology.**
   Silicon wafer (substrate) preparation,Epitaxial growth,Oxidation,Photolithography Diffusion,Ion implantation,Isolation Technique,Metallization,Assembly Processing and Packaging
6. **Explain the word "Epitaxy"**
   The word epitaxy is derived from Greek word epi meaning 'upon' and taxy is the past tense of the word teinon meaning 'arranged'. Therefore, epitaxy means arranging atoms in single crystal fashion upon a single crystal substrate, so that the resulting layer is an extension of the substrate crystal structure.
7. **What is the function of silicon –di- oxide on an IC ?**
   Silicon dioxide has the property of preventing the diffusion of almost all impurities through it. It serves two very important purposes.
   - ❖ Sio_2 is an extremely hard protective coating and is unaffected by almost all reagents except hydrofluoric acid. Thus it stands against any contamination.
   - ❖ By selective etching of Sio_2, diffusion of impurities through carefully defined windows in the Sio_2 can be accomplished to fabricate various components.
8. **Photolithography process** is used for producing windows and the law that governs the diffusion process is **the diffusion law .**
9. **Name the major crystal growth technique. What are ingots?**
   The major crystal growth technique is Czochralski crystal growth.
   Ingots (1 to 2 inches in diameter and about 10 inches long) are grown from a silicon melt with a predetermined number of impurities.

10. What are positive photoresists?

Materials which are more soluble when subjected to light and therefore yield a positive image of the mask are known as positive photoresists.

11. What are negative photoresists?

Materials which are rendered less soluble in a developer solution by illumination yield a negative pattern of the mask and are called as negative photoresists.

12. What are the two types of capacitors that can be fabricated in IC?

Junction capacitor and Metal Oxide Semiconductor capacitor.

13. What is ion implementation?

Ion implementation is a technique used to introduce impurities into a silicon wafer.

14. List the advantages of ion implantation technique.

Ion implantation technique has two important advantages.

- ❖ It is performed at low temperatures, therefore, previously diffused regions have a lesser tendency for lateral spreading.
- ❖ In diffusion process, temperature has to be controlled over a large area inside the oven, whereas in ion implantation technique, accelerating potential and the beam current are electrically controlled from outside.

15. List the various isolation techniques used in ICs.

The various isolation techniques are PN junction isolation, Dielectric isolation.

16. Name the different types of IC packages.

TO – 5 glass metal package, Ceramic flat package, Dual – in- Line package (ceramic or plastic type)

17. What is meant by parasitic capacitance?

The isolation regions or junctions are connected by a signficant barrier, or transition capacitance C_{TS} to the P type substrate, which capacitance can affect the operation of the circuit. Since C_{TS} is an undesirable by-product of the isolation process, it is called the parasitic capacitance.

18. Explain the need for making isolation islands.

Since a number of components are fabricated on the same IC chip, it is necessary to provide electrical isolation between different components and interconnections.

19. What is the undesirable by-product of PN diode isolation?

The undesirable by-product is the presence of transition capacitance at the isolating pn junctions, resulting in an inevitable capacitor coupling between the components & the substrate. This parasitic capacitance limits the performance of the circuit at high frequencies.

20. What is the advantage of using Aluminium in metallization?

(i). It is relatively a good conductor.

(ii) It is easy to deposit aluminium films using vacuum deposition

(iii) Aluminium makes good mechanical bonds with silicon.

(iv) Aluminium forms low resistance, non-rectifying (ohmic) contact with p-type silicon and the heavily doped n-type silicon.

21. List the types of monolithic capacitors.

(i) Junction capacitor (ii) MOS or thin film capacitor

22. What are monolithic ICs?

Monolithic is Single stone. Monolithic ICs are made in a single piece of single crystal silicon

23. State the limitations of IC technology.

(i) Can't be repaired

(ii) Fabrication of Inductors with high values, transformers and chokes is difficult.

UNIT-II CHARACTERISTICS OF OPAMP

1. What do you meant by linear circuits?

Linear circuits are the circuits in which the output signal varies with the input signal in a linear manner.

2. What do you meant by non linear circuits?

Non linear circuits are the circuits in which the output signal does not vary with the input signal.

3. Mention some of the linear applications of op – amps.(Nov/Dec' 2005)

Adder, subtractor, voltage –to- current converter, current –to- voltage converters, instrumentation amplifier, analog computation, power amplifier, etc are some of the Linear op-amp circuits.

4. Mention some of the non – linear applications of op-amps. (Nov/Dec'2005)

Rectifier, peak detector, clipper, clamper, sample and hold circuit, log amplifier, anti –log amplifier, multiplier are some of the non – linear op-amp circuits.

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

The applications of non-linear op-amp are:

- . Industrial instrumentation
- . Communication
- . Signal processing

6. What is an inverting amplifier?

Inverting amplifier is the one in which a signal is applied to the inverting input terminal. The output voltage is fed back to the inverting input terminal through feedback resistance (Rf) - input resistance (R I)

network. The output signal is the amplified form of input signal with a phase shift of 180°

7. What is a non- inverting amplifier?

Non inverting amplifier is the one in which a signal is applied to the non-inverting input terminal and

the output is fed back to the inverting input terminal, the circuit amplifies without inverting the input signal.

8. Give an application of an inverting amplifier.[May/June 2013]

Sign changer is a typical application of an inverting amplifier. It is a special case with Rf= R1 and hence

(V0/Vin) = -1

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9. What is voltage follower? [April/May 2010, May/June 2014]

(OR)

What is an op-amp buffer? Draw the diagram. [Nov/Dec 2010]

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

output voltage is equal to input voltage. This circuit is also called as op-amp buffer.

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

The applications of V-I converter are:

a. Low voltage dc and ac voltmeter

b. L E D

c. Zener diode tester

14. Give applications of voltage to current t converters.

The main applications of voltage to current converter are, LED & Zener diode tester Low voltage AC

& DC voltmeters.

15. Give the schematic of op-amp based current to voltage converter. (April/May 2010)

16. Give the circuit of a voltage to current op-amp converter. [April/May 2011]

There are two circuits available for voltage to current converter

- V to I converter with floating load
- V to I with grounded load.

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17. What is meant by summer (summing amplifier)?

Op-amp may be used to design a circuit whose output is the sum of several input signals. Such a

circuit
is called summing amplifier or summer.
18. Draw the averaging circuit using operational amplifier. [Nov/Dec 2009]
19. What is an instrumentation amplifier?
It is intended for precise, low- level signal amplification where noise, low thermal drift low. An Instrumentation is useful for amplifying low level signals which are obtained by sensing with a transducer in
the measurement of physical quantities like temperature, water flow.
20. What is the need for an instrumentation amplifier? (May/June 2012)
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.
21. What is the major function of instrumentation amplifier?
To amplify the low level output signal of a transducer so that it can drive the indicator or display is the
major function of an instrumentation amplifier.
22. List the features of instrumentation amplifier. (Nov/Dec'2013, April/May 2011,Nov/Dec 2004)
State the characteristics of an instrumentation amplifier. [Nov/Dec 2010,April/May 2005, Nov/Dec 2003]
The characteristics of an instrumentation amplifier are:
a. High gain accuracy
b. High CMRR
c. High gain stability with low temperature co-efficient
d. Low dc offset
e. Low output impedance
f. High input impedance
23. List the applications of instrumentation amplifier.
The applications of instrumentation amplifier are:
1. Temperature indicator
2. Temperature controller
3. Light intensity meter
4. Water flow meter
24. Draw and write the equation for of an integrator using an op-amp. (Nov/Dec'2006, May/June 2009,
Nov/Dec2010), Nov/Dec 2008,April/May 2004)[Nov/Dec 2021]
25. Why integrators are preferred over differentiator in analog computers?(May/June 2009, Nov/Dec 2011)
An analog computer can perform linear operations such as multiplication by constant, addition, subtraction and integration. These operations are sufficient for solving linear differential equations. Linear
differential equations can also be solved directly by using differentiator. But the gain of the differentiator
increases linearly with frequency and it tends to amplify low frequency noise, which may result in false
oscillations. Therefore, integrators are preferred over differentiators in analog computers.
26. Why practical integrators are called Lossy integrators? (Or) What is Lossy integrator?
The gain of an integrator at a low frequency (dc) can be limited to avoid saturation problem if the feedback capacitor is shunted by resistance RF. The parallel combination of RF & CF behaves like practical
capacitor, which dissipates power unlike an ideal capacitor. So, this circuit is called Lossy integrator.
27. What are the limitations of the basic differentiator circuit?
. At high frequency, a differentiator may become unstable and break into oscillations
. The input impedance decreases with increase in frequency, thereby making the circuit sensitive to

high frequency noise.
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28. What are the limitations of an ideal active differentiator?
At high frequency, differentiators may become unstable and break into oscillation. The input impedance i.e. (1/ωC1) decreases with increase in frequency, thereby making the circuit sensitive to high
frequency noise.
29. Write down the condition for good differentiation.
For good differentiation, the time period of the input signal must be greater than or equal to Rf C1 T > R f C1 Where, Rf is the feedback resistance, Cf is the input capacitance
30. Draw the circuit diagram of differentiator and give its output equation.
(April/May 2010,Nov/Dec'2012,Nov/Dec 2009)
31. List the applications of Log amplifiers:
 Analog computation may require functions such as ln x, log x, sin hx etc. These functions can be performed by log amplifiers.
 Log amplifier can perform direct dB display on digital voltmeter and spectrum analyzer.
 Log amplifier can be used to compress the dynamic range of a signal.
32. Draw the circuit of a log amplifier. [April/May 2010]
33. What is an antilog amplifier? [Nov/Dec 2007]
A circuit that performs the mathematical operation of antilog is called as antilog amplifier.It performs the reverse operation of log amplifier. Antilog amplifier is a decoding circuit to convert a logarithmically
encoded signal back to the real signal.
34. What is a comparator? (May/June 2012, Nov/Dec 2011, Nov/Dec2010)
A comparator is a circuit which compares a signal voltage applied at one input of an op-amp with a known reference voltage at the other input. It is an open loop op - amp with only two possible outputs + Vsat and –Vsat
.35. List the types of comparators.
The comparator has two types, they are :
 Inverting comparator
 Non-inverting comparator
36. What is Trip point?
The point at which transfer characteristics of a comparator is a straight line is called Trip point is the input voltage at which the output changes from low to high or vice versa.
37. What are the applications of comparator? (April/May 2008, Nov/Dec 2011, Nov/Dec 2010)
 Zero crossing detectors
 Window detector
 Time marker generator
 Phase meter
 Digital interfacing
 Schmitt trigger
 Oscillators
38. What is a window detector?
A device, usually consisting of a pair of voltage comparators, in which output indicates whether the measured signal is within the voltage range bounded by two different thresholds.
39. What are the characteristics of a comparator?
. Speed of operation
. Accuracy
. Compatibility of the output
40. What is zero crossing detectors? [May/June 2009, Nov/Dec2004]
Zero crossing detectors is one of the application of op-amp comparator. The circuit finds the point at which the input voltage crosses zero or dc level.

UNIT – III ANALOG MULTIPLIER AND PLL
1. List the basic building blocks of PLL.

The basic building blocks of PLL are:
- Phase detector/comparator
- Low pass filter
- Error amplifier
- 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 frequencies namely mark (logic 1) 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.
V0= kvxvy
4. List out the various methods available for performing an analog multiplier.
The following methods are available for analog multiplier,
- Logarithmic summing technique
- Pulse height /width modulation technique
- Variable transconductance technique
- Multiplication using gilbert cell
- Multiplication technique using transconductance technique

5. Mention some areas where PLL is widely used. [Dec 2009]
The PLL principle has been used in applications such as
- FM stereo decoders
- Motor speed control
- Tracking filters
- FM modulation and demodulation
- FSK modulation
- Frequency multiplier
- Frequency synthesis etc.,

6. What are the three stages through which PLL operates?
The stages of PLL operation are,
- Free running
- Capture
- 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]
The expression (or) output of FSK demodulation is $\Delta vf = f2 - f1/ k0$
10. What is free running mode? [May 2010]
- Free running mode is 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. Mention the classification of phase detector.
The phase detector can be classified as:
- Analog phase detector
- Digital phase detector

13. What is a switch type phase detector?
- An electronic switch is opened and closed by the signal coming from VCO.

 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?
 The output voltage Ve 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.
 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.
 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.
Where, Vc is the modulation voltage. fo is the frequency shift.

17. What is the purpose of having a low pass filter in PLL?
The purpose of having a low pass filter in PLL is:
 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. Mention 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. Name a few applications of an analog multiplier. [Nov/Dec 2009] [Apr/May 2017]
Applications of analog multiplier are:
 Frequency doubling.
 Frequency shifting.
 Phase angle detection.
 Squaring.
 Multiplication.
 Division.
 Waveform generation.

20. Define pull time of PLL.
Pull time of a PLL is defined as the total time taken by the PLL to establish lock.

21. What are the functional blocks of PLL? [April/May 2010]
The functional blocks of PLL are,
 Comparator
 Low pass filter.
 Error amplifier.
 Voltage controlled oscillator.

22. Draw the functional block diagram of a PLL.

23. Draw circuit diagram of an AM detector using PLL. [May/June 2009]

24. Mention a few applications of PLL. [Nov/Dec 2009]
The applications of PLL are:
 Frequency multiplication.
 Frequency division.
 AM detection.
 FM detection.
 FSK demodulator.
 Frequency translation.

25. Give the schematic symbol of multiplier.
26. Define multiplier.
 The multipliers are defined as circuits used for multiplying two applied signals.
 Apart from this, multipliers can be used for phase angle detection, frequency doubling and shifting and for demonstrating the principle of amplitude modulation and demodulation.
27. Give the classification of multiplier.
The classification of multipliers is:
 One- quadrant multiplier.
 Two- quadrant multiplier.
 Three - quadrant multiplier.
 Four- quadrant multiplier.
28. List the characteristics of multipliers.
The characteristics of multipliers are:
 Bandwidth.
 Feed through.
 Zero train.
 Quadrant.
 Scale factor.
 Scale-factor train.
 Accuracy.
 Linearity.
29. What is a trans-conductance multiplier?
 Log-amps require the input and reference voltages to be of the same polarity.
 This restricts log-antilog multipliers to one quadrant operation.
 A technique that provides four quadrant multiplication is called trans-conductance multiplier.
30. What is a four quadrant multiplier?
 If both inputs are positive, the IC is said to be a one-quadrant multiplier.
 A two- quadrant multiplier will function properly if one input is held positive and the other is allowed to swing both positive and negative.
 If both inputs are either positive or negative, the IC is called a four quadrant multiplier.
31. List the various multiplier techniques.
The various multiplier techniques are:
 Logarithmic multipliers
 Quarter square multipliers
 Pulse width/height modulation multipliers
 Variable trans-conductance multipliers.
32. What is the range of modulating input voltage applied to a voltage controlled oscillator?
The modulating input voltage ranges from 0.75 Vcc to 1 Vcc.
33. Define VCO.
 The VCO is a free running multivibrator and operates at a set frequency called free running frequency.
 This frequency is determined by an external timing capacitor and an external resistor.
34. List the features of VCO.
The features of VCO are:
 Wide supply voltage range from 10V to 24V.
 Very linear modulation characteristics.
 High temperature stability.
 Excellent power supply rejection.
 10 to 1 frequency range with fixed C.
 The frequency can be controlled by means of a control voltage resistor or capacitor.
35. Give the applications of VCO.
The applications of VCO are:
 FM modulation.
 Signal generation(triangular or square wave)
 Function generation.

 In frequency multipliers.
 Converting low frequency signals such as EEG and ECG into audio frequency range signals.

36. What are the different stages of operation in a PLL?

The different stages of operation in a PLL are,
 Free running range.
 Capture range.
 Locked or tracking range.

37. Define lock-in range. [April/May 2008][Nov/Dec 2015]

The range of frequency over which the PLL can maintain lock with the incoming signal is called the lock-in range.

38. What is meant by capture range of PLL? [April/May 2008][Nov/Dec 2015]

The range of frequency over which the PLL can acquire lock with an input signal is called capture range.

39. Give the types of analog phase detectors and digital phase detectors.

The types of analog phase detectors are as follows:
 Switch type phase detector.
 Balanced modulator type phase detector.

The types of digital phase detectors are as follows:
 X-OR phase detector.
 Flip-flop phase detectors.

40. List the advantages of flip-flop type phase detector over EX-OR phase detector.

The flip flop phase detector has the following advantages over the EX-OR circuit:
 The dc output voltage is linear over 2π radians or 360o
, as opposed to π or 180o
in the case of
EX-OR detector.
 The flip-flop detector exhibits between capture, tracking, and locking characteristics than the EX-OR detector.
 The RS flip-flop works best with low duty cycle (50%) input waveform. However both the types of detectors are sensitive to harmonics of the input signal and change in duty cycle of fi and fo.

41. What should be the phase difference between the input signal and voltage controlled oscillator output to active lock?

Input signal and voltage controlled oscillator should be 90o
out of phase with each other.

42. A PLL has a free running frequency of 500 kHz and bandwidth of the low pass filter is 10 kHz. Will the loop acquire lock for an input signal of 600 kHz? Justify your answer. Assume that the phase detector produces 50 m and difference frequency components.

The phase detector output
fi + fc = 600 kHz + 500 kHz
= 1100 kHz
fi - fc = 600 kHz + 500 kHz
= 100 kHz
As both the components are outside the pass band of low pass filter, the loop will not acquire lock.

43. Give the advantages of variable Transconductance technique.

The advantages of variable Transconductance technique are,
 Good accuracy.
 Economical.
 Simple to integrate into monolithic chip.
 Higher bandwidth.

44. What is companding?

 The combination of words compression and expanding in a communication system is called companding.

 The compression is done in the transmitter and expanding is done in the receiver.

45. What is the purpose of companding?

The purpose of companding is to preserve the signal to noise ratio of the original signal and to avoid nonlinear distortion of the signal when the input amplitude is large.

46. Define scale factor of multiplier.

Scale factor is proportionally constant (k) relating the output voltage and the product of two input voltage.

k = (V0 / V1V2).

47. What is an OTA?

An OTA (Operational Transconductance amplifier) is a voltage-input current output amplifier.

48. Give the applications of OTA.

Some of the applications of OTA are,

 Programmable gain voltage amplifier.
 Sample and hold circuits.
 Programmable resistor or electronically tunable resistor or voltage controlled resistor.
 Current-controlled relaxation oscillator.
 Integrators in audio processing.
 Electronic music synthesis.

49. What is the need for frequency synthesizer? [May/June 2014]

 The frequency synthesizer is used to produce a large number of precise frequencies which are derived from a single reference source of frequency.
 The reference source usually is a crystal oscillator.

50. What are advantages of emitter coupled transistor pair? [April/ May 2011]

The advantages of emitter coupled transistor pair are,

 High current gain
 More stability
 Compact and easily implemented in IC

1. List the applications of NE565. (Nov/Dec2010)

. Frequency multiplier

FM Demodulator is the applications of NE565.

2. Draw the relation between capture range and lock range relationship in PLL (Nov/Dec2010)

3. Draw the pin diagram of IC555 timer (April/May2010)

4. Mention any two applications of multiplier (April/May2010)

The multiplier is used for

1. Frequency shifting
2. Voltage divider

5. Define the capture range of PLL (Nov/Dec2011)

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

6. What are the one, two and four quadrant multiplier (Nov/Dec2011)

In one quadrant multiplier the polarities of both the inputs must always be positive.

A two quadrant multiplier functions properly if one input is held positive and the other is allowed to swing in both positive and negative.

If both the inputs are allowed to swing in both positive and negative directions, the operation is four quadrant multiplier operations.

7. In what way VCO is different from other oscillator (May/June 2012)

1. To adjust the output frequency to match (or perhaps be some exact multiple of) an accurate external reference.
2. Where the oscillator drives equipment that may generate radio-frequency interference, adding a varying voltage to its control input can disperse the interference spectrum to make it less

objectionable. See spread spectrum clock.
8. Mention any two application of IC555 timer in mono stable mode (May/June 2012)
The applications of IC555 timer in mono stable mode are
1. Frequency divider
2. Pulse width modulation
9. In a astable multivibrater using 555 timer RA=6.8K , RB=3.3K ,C=0.1 F calculate the free running frequency.(Nov/Dec 2012) Ans:
10. Why the VCO is called voltage to frequency converter (Nov/Dec 2012)
The VCO provides the lin

ear relationship between the applied voltage and the oscillation

frequency. Applied voltage is called control voltage. The control of frequency with the help of control voltage is also called voltage to frequency conversion. Hence VCO is also called voltage to frequency converter.
11. Define the terms relation to DAC (May/June 2013)
settling time It represents the time it takes for the output to settle within a specified band+-(1/2) LSB of its final value. It depends upon the switching time of the logic circuitry due to internal parasitic capacitances and inductances. Settling time ranges from 100ns to 10μs depending on word length and type of circuit used. conversion time It is the time taken for the D/A converter to produce the analog output for the given binary input signal. It depends on the response time of switches and the output of the Amplifier. D/A converters speed can be defined by this parameter. It is also called as setting time.
12. what is function voltage regulator (May/June 2013)
A regulator circuit is a circuit used after the filter, which not only makes the dc voltagesmooth and almost ripple free but also keeps the dc output voltage constant though input dc voltage varies under certain condition. Thus input to a regulator is an unregulated dc voltage while the output of a regulator is a regulated dc voltage, to which the load is connected.

UNITV
PART-A (Each 2 Marks)
1. How will you increase the output of a general purpose op-amp? (Nov/Dec2010)
A simple method of increasing the output current of a general purpose op-amp is to connect a power booster circuit in series
with the op-amp.
2. Using LM380 draw the circuit for
audio power amplifier.
(Nov/Dec2010)

3.List the important parts of regulated power supply. (April/May2010)
1. Reference voltage circuit
2. Error amplifier
3. Series pass transistor
4.Feedback network
4. What are the advantages of a switch mode power supplies. (April/May2010)
1. Smaller size
2. Lighter weight (from the elimination of low frequency transformers which have a high weight)
3. Lower heat generation due to higher efficiency.
5. What are the disadvantages of linear voltage regulators? (Nov/Dec2011)
The input step down transformer is bulky and expensive because of low line frequency. Because of low line frequency, large values of filter capacitors are required to decrease

the ripple. Efficiency is reduced due to the continuous power dissipation by the transistor as it operates in the linear region.

6. What is isolation amplifier?(Nov/Dec2011)
(Nov/Dec2012)

Isolation amplifiers provide electrical isolation and an electrical safety barrier. They protect data acquisition components from common mode voltages, which are potential differences between instrument ground and signal ground. Instruments that are applied in the presence of a common mode voltage without an isolation barrier allow ground currents to circulate, leading in the best case to a noisy representation of the signal under investigation.

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7. Why do switching regulators have better efficiency then series regulators?(May/June 2012)

In switching regulators, the transistor is operated in cut off region or saturation region. In cut off region, there is no current and hence power dissipation is almost zero. In the saturation region there is negligible voltage drop across it hence the power dissipation is almost zero.

8. What is an optocoupler?(May/June 2012)

The combined package of a LED and a photodiode is called an optocoupler.It is also called an optoisolator or an optically coupled isolator.

9. Name the various protection circuits used for voltage regulators. (Nov/Dec 2012)

1. Constant current limiting
2. Fold back current limiting
3. Over voltage prodection
4. Thermal prodection

10. What is the principle of switch mode power supplies. (May/June 2013)

A switched-mode power supply (switching-mode power supply, SMPS, or switcher) is anelectronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfer's power from a source, like mains power, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power.

11. How many resistors are required in a 12-bit weighted resistor DAC (May/June 2013)

This particular converter is a 4 -bit R- 2 R r e s i s t or ladder network and it differs from the DAC circuit shown in Fig. 10.9 in that it requires only two precision resistance values (R and 2R). The digital input to the DAC is a 4 -bit binary number represented by bits Q 0 , Q1 , Q 2 , and Q. wher e Qo is the LSB and Q3 is the MSB. Each bit in the circuit con trol s a switch between ground and the inverting input of the op -amp.

PART-B(16 MARKS)