Subject:- Linear Integrated Circuits. (22423)

SYLLABUS

Chapter No.	Name of Unit	Marks With Option
1	Fundamental of Operational Amplifiers	12
2	Applications of Operational Amplifiers	18
3	Linear Applications of Op-Amp.	26
4	Filters and Oscillators.	26
5	Specialized IC Applications.	20
	Total Marks :-	**102**

BOARD THEORY PAPER PATTERN FOR LIC (22423)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Fundamental of Operational Amplifiers
	b)	Applications of Operational Amplifiers
	c)	Filters and Oscillators
	d)	Fundamental of Operational Amplifiers
	e)	Specialized IC Applications.
	f)	Filters and Oscillators
	g)	Filters and Oscillators
Q.2		**Attempt any THREE** **3*4=12**
	a)	Fundamental of Operational Amplifiers
	b)	Filters and Oscillators
	c)	Specialized IC Applications
	d)	Applications of Operational Amplifiers
Q.3		**Attempt any THREE** **3*4=12**
	a)	Fundamental of Operational Amplifiers

	b)	Linear Applications of Op-Amp
	c)	Filters and Oscillators
	d)	Specialized IC Applications
Q.4		**Attempt any FOUR** **3*4=12**
	a)	Linear Applications of Op-Amp
	b)	Fundamental of Operational Amplifiers
	c)	Applications of Operational Amplifiers
	d)	Fundamental of Operational Amplifiers
	e)	Specialized IC Applications
Q.5		**Attempt any TWO** **2*6=12**
	a)	Linear Applications of Op-Amp
	b)	Filters and Oscillators
	c)	Linear Applications of Op-Amp
Q.6		**Attempt any TWO** **2*6=12**
	a)	Applications of Operational Amplifiers
	b)	Linear Applications of Op-Amp
	c)	Filters and Oscillators

CLASS TEST - I

PAPER PATTERN

COURSE: - Linear Integrated Circuits (22423)
PROGRAMME: - E&TC Engineering

Syllabus :-

Unit No.	Name of the Unit	Course Outcome (CO)
1	Fundamental of Operational Amplifiers	CO-423.1
2	Applications of Operational Amplifiers	CO-423.2
3	Linear Applications of Op-Amp	CO-423.3

Q.1	Attempt any FOUR4*2=8Marks	Course Outcome (CO)
a)	Fundamental of Operational Amplifiers	CO-423.1
b)	Fundamental of Operational Amplifiers	CO-423.1
c)	Linear Applications of Op-Amp	CO-423.3
d)	Applications of Operational Amplifiers	CO-423.2
e)	Applications of Operational Amplifiers	CO-423.2
f)	Linear Applications of Op-Amp	CO-423.3
Q.2	Attempt any THREE3*4=12 Marks	
a)	Linear Applications of Op-Amp	CO-423.3
b)	Linear Applications of Op-Amp	CO-423.3
c)	Fundamental of Operational Amplifiers	CO-423.1
d)	Fundamental of Operational Amplifiers	CO-423.1
e)	Applications of Operational Amplifiers	CO-423.2
f)	Applications of Operational Amplifiers	CO-423.2

CLASS TEST - II

PAPER PATTERN

COURSE: - Linear Integrated Circuits (22423)
PROGRAMME: - E&TC Engineering

Syllabus :-

Unit	Name of the Unit	Course Outcome(CO)
3	Linear Applications of Op-Amp.	CO-423.3
4	Filters and Oscillators.	CO-423.4
5	Specialized IC Applications.	CO-423.5

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Linear Applications of Op-Amp.	CO-423.3
b)	Filters and Oscillators	CO-423.4
c)	Filters and Oscillators	CO-423.4
d)	Specialized IC Applications.	CO-423.5
e)	Specialized IC Applications.	CO-423.5
f)	Linear Applications of Op-Amp.	CO-423.3
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Linear Applications of Op-Amp.	CO-423.3
b)	Linear Applications of Op-Amp.	CO-423.3
c)	Specialized IC Applications.	CO-423.5
d)	Specialized IC Applications.	CO-423.5
e)	Filters and Oscillators	CO-423.4
f)	Filters and Oscillators	CO-423.4

COURSE OUTCOME (CO)

COURSE: - Linear Integrated Circuits (22423)

PROGRAMME: - E&TC Engineering

CO.NO	Course Outcome
CO-423.1	Use OP-Amp in linear electronic circuits.
CO-423.2	Use Various configurations of OP-Amp for different applications.
CO-423.3	Troubleshoot various linear applications of op-amp for given specifications.
CO-423.4	Maintain Filters and Oscillators used in various electronic circuits.
CO-423.5	Troubleshoot specified applications using various linear ICs.

1. Applications of OP-Amp

Position in Question Paper **Total Marks-12**

Q.1. a) 2-Marks.
Q.1. d) 2-Marks
Q.2. a) 4-Marks.
Q.3. a) 4-Marks.

Descriptive Question

1.What is Op-Amp? State Advantages of OP-Amp.

2. Draw Pin diagram and equivalent Ckt.

3. Define 1. I/P offset Voltage 2. CMRR

4. Define 1. O/P offset voltage 2. SVRR

5. Draw and explain the block diagram of OP-Amp.

6. Draw the ideal and Practical transfer characteristics of Op-amp.

7. State the function of Level shifter block of op-amp.

8. Compare the characteristics values of op-amp IC741 and ideal op-amp.

9. Draw Ideal and Practical Characteristics of Op-amp.

10. Draw and explain the block diagram of op-amp.

11. What is the use of level shifter stage? Draw its circuit diagram.

MCQ Questions:-

(Total number of Question=Marks*3=8*3=24)

Note: Correct answer is marked with **bold.**

1. A differential amplifier ……..
   a) is a part of an Op-amp
   b) has one input and one output
   c) has two outputs
   d) answers (1) and (2)
2. When a differential amplifier is operated single-ended, ……
   a) the output is grounded
   b) one input is grounded and signal is applied to the other
   c) both inputs are connected together
   d) the output is not inverted
3. In differential-mode, …….
   a) opposite polarity signals are applied to the inputs
   b) the gain is one
   c) the outputs are of different amplitudes
   d)only one supply voltage is used
4. In the common mode, ……
   a) both inputs are grounded
   b) the outputs are connected together
   c)an identical signal appears on both the inputs
   d) the output signal are in-phase
5. The common-mode gain is……
   a) very high
   b) very low
   c) always unity
   d) unpredictable
6. The differential gain is ……
   a) very high
   b) very low
   c) dependent on input voltage
   d) about 100
7. If A_{DM} = 3500 and A_{CM} = 0.35, the CMRR is …….
   a) 1225
   b) 10,000
   c) 80 dB
   d) answers (1) and (3)

8. With zero volts on both inputs, an OP-amp ideally should have an output..

a) equal to the positive supply voltage

b) equal to the negative supply voltage

c) equal to zero

d) equal to CMRR

9. Of the values listed, the most realistic value for open-loop voltage gain of an OP-amp is ……

a) 1

b) 2000

c) 80 dB

d) 100,000

10. A certain OP-amp has bias currents of 50 µA. The input offset current is ……..

a)700 nA

b) 99.3 µA

c) 49.7 µA

d) none of these

11. The output of a particular Op-amp increases 8V in 12µs. The slew rate is …….

a) 90 V/µs

b) 0.67 V/µs

c) 1.5 V/µs

d) none of th

12. For an Op-amp with negative feedback, the output is …….

a) equal to the input

b) increased

c) feed back to the inverting input

d) feed back to the noninverting input

13. The use of negative feedback ……

a) reduces the voltage gain of an Op-amp

b) makes the Op-amp oscillate

c) makes linear operation possible

d) answers (1) and (2)

14. A certain noninverting amplifier has R_i of 1 kΩ and R_f of 100 kΩ. The closed-loop voltage gain is ……

a) 100,000

b) 1000

c) 101

d) 100

15. If the feedback resistor is open, the voltage gain …….

a) increases

b) decreases

c) is not affected

d) depends on R_i

16.The Op-amp can amplify

a) a.c. signals only
c) both a.c. and d.c. signals
b) d.c. signals only
d) neither d.c. nor a.c. signals

17.The input offset current equals the …….

a) difference between two base currents
b) average of two base currents
c) collector current divided by current gain
d) none of these

18.The node voltage at the top of the til resistor is closes to …….

a) collector supply voltage
c) emitter supply voltage
b) zero
d) tail current times base

9.The differential voltage gain of a differential amplifier is equal to RC divided by

a) r'_e
c) $2r'_e$
b) $r'_e/2$
d) R_E

20. A common-mode signal is applied to …….

a) the noninverting input
c) both iputs
b) the inverting input
d) top of the tail resistor

21. The common-mode voltage gain is ……

a) smaller than differentail voltage gain
b) equal to differential voltage gain
c) greater than differential voltage gain
d) none of the above

22. The input stage of an Op-amp is usually a …….

a) differential amplifier
c) CE amplifier
b) class B push-pull amplifier
d) amped amplifier

23.Current cannot flow to ground through …….

a) a mechanical ground
c) a virtual ground
b) an a.c. ground
d) an ordinary ground

24.The tail current in a differential amplifier equals …….

a)difference between two emitter currents

b) sum of two emitter currents

c)collector current divided by current gain

d) collector voltage divided by collector resistance

2. Applications of OP-Amp

Position in Question Paper **Total Marks-18**

Q.1. b) 2-Marks.
Q.2. c) 4-Marks.
Q.3. b) 4-Marks.
Q.3. d) 4-Marks.
Q.4. d) 4-Marks.

Descriptive Question

1. Explain Virtual short Concept.

2. Draw and derive the o/p expression for Inverting Adder.

3. Draw and derive the o/p expression for Non-inverting Adder

4. State the need of closed loop configuration for an op-amp.

5. Explain virtual ground concept of op-amp

6. Draw circuit diagram of basic differentiator.

7. Draw the ckt. Diagram of Inverter

8. Draw the ckt. Diagram of unity gain amplifier.

9.Draw the ckt. Diagram of Inverting amplifier, and derive its o/p expression.

10. Draw the ckt. Diagram of Non- Inverting amplifier, and derive its o/p expression.

11. Draw the ckt diagram of basic differentiator and derive its o/p expression

12. Draw the ckt diagram of basic Integrator and Derive e its o/p expression

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold.**

1. The opamp in the Inverting circuit is in _____
   a) Linear region c) Cut-off region
   b) Saturation d) Non-linear region
2. In an Inv Amplifier circuit, the output voltage vo is expressed as a function of __
   a) Input current **c) Source voltage**
   b) Output current d) Source current
3. The other name for Gain is _____
   a) Scaling factor c) Amplifying factor
   b) Output d) Scaling level
4. If VCC = 12V and vs=1mV, then Rf/Rs is _____
   a) >12000 c) 12000
   b) <12000 d) 1
5. In the expression vo= -Avn, A is called _____
   a) Closed loop gain c) Open loop fault
   b) Closed loop fault **d) Open loop gain**
6. The circuits of an inv and Non-Inv amplifying comprises of _ &_ resistors.
   a) 3, 2 c) 2, 2
   b) 2, 3 d) 3, 3
7. The condition for a Non-inv ampl ckt to operate in linear region _
   a) (Rs+Rf)/Rs < │VCC/vg│ c) (Rs+Rf)/Rs > │VCC/vg│
   b) (Rs+Rf)/Rs ≠ │VCC/vg│ d) (Rs+Rf)/Rs = │VCC/vg│
8. If Rs= 3Ω, Rf= 6Ω then the relation bet vo and vg in case of a Non-Inv ckt.
   a) vo= 9vg **c) vo= 3vg**
   b) vo= 6vg d) vo= vg

9.If Rs= 5Ω, Rf= 25Ω and -2.5V ≤ vg ≤ 2.5V. What are the smallest vtgs that could be applied and still have opamp in linear region?

a) ±9V
c) ±6V
b) ±2.5V
d) ±15V

10. If an inv ampl ckt has a gain of 10 and ±15V are used. The values of input for which opamp would be in the linear region?

a) ±1.25
c) ±2.25
b) ±1.5V
d) ±0.5

11. The input applied to an Inverting amplifier is _____

a) Equal to output
c) Not equal to output
b) Equal to Inverted output
d) Output is equal to input

12. For ideal non-inverting operational amplifier

a) Input and output resistances are infinite
b) Input resistance is infinite and output resistance is zero
c) Input resistance is zero and output resistance is infinite
d) Input and output resistances are zero

13. The gain for an ideal non-inverting operational amplifier is (given R2 is the Rf)

a) R2/R1 – 1
c) -R2/R1
b) R2/R1
d) R2/R1 + 1

14.Which of the following is not true for a voltage follower amplifier?

a) Input voltage is equal to output voltage
b) Input resistance is infinite and output resistance is zero
c) It has 100% negative feedback
d) None of the mentioned

15. The other name for Miller Circuit is

a) Non-Inverting Integrator
c) Non-Inverting Differentiator
b) Inverting Integrator
d) Inverting Differentiator

16. The slope of the frequency response of an integrator is

a) Linear with negative slope
c) Exponential increase
b) Linear with positive slope
d) Exponential decrease

17. The integrating transfer function has the value of

a) jωCR
c) 1 / jωCR
b) –jωCR
d) -1 / jωCR

18. The expression for the integration frequency is

a) CR
c) R/C
b) 1/CR
d) C/R

19.. The frequency transfer function of a differentiator is given by

a) jωCR
c) – jωCR
b) 1/jωCR
d) – 1/jωCR

20. The slope of the frequency response of a differentiator is

a) Linear with negative slope
c) Exponential increase
b) Linear with positive slope
d) Exponential decrease

21. The phase in the integrator and differentiator circuit respectively are

a) +90 degrees and +90 degrees
c) -90 degrees and +90 degrees
b) -90 degrees and -90 degrees
d) +90 degrees and -90 degrees

22. The expression for the differentiator time constant is

a) CR
c) R/C
b) 1/CR
d) C/R

23. In which amplifier the output voltage is equal to negative sum of all the inputs?

a) Averaging amplifier
c) Scaling amplifier
b) Summing amplifier
d) All of the mentioned

24.An inv amp with gain 1 have different input voltage: 1.2v,3.2v and 4.2v. Find Vo?

a) 4.2v
c) -4.2v
b) 8.6v
d) -8.6v

25.In which type of amplifier, the input voltage is amplified by a scaling factor

a) Summing amplifier
c) Weighted amplifier
b) Averaging amplifier
d) Differential amplifier

26.An inverting scaling amplifier has three input voltages Va, Vb and Vc.find vo?

a) VO= – {[(RF/Ra)×Va] +[(RF/Rb)×Vb]+[(RF/Rc)×Vc]}
b) VO= – [(RF/Ra)+(RF/Rb)+(RF/Rc)]×[(Va +Vb+Vc)].
c) VO = – {[(Ra/RF)×Va] +[(Rb/RF)×Vb]+[(Rc/RF)×Vc]}
d) None of the mentioned

27. An amplifier in which the output voltage is equal to average of input voltage?

a) Summing amplifier
c) Scaling amplifier
b) Weighting amplifier
d) Averaging amplifier

28.Find out the gain value by which each input of averaging amplifier is amplified ?

a) 0.5 c) 1

b) 0.25 d) 2

29. 3v, 5v and 7v are the 3 input voltage applied to the inv i/p of avg amplifier, Vo?

a) -5v c) -15v

b) -10v d) -20v

30.Which of the following electrical chara is not exhibited by an ideal op-amp?

a) Infinite voltage gain **c) Infinite output resistance**

b) Infinite bandwidth d) Infinite slew rate

31.An ideal op-amp requires infinite bandwidth because

a) Signals can be amplified without attenuation

b) Output common-mode noise voltage is zero

c) Output voltage occurs simultaneously with input voltage changes

d) Output can drive infinite number of device

32.Ideal op-amp has infinite voltage gain because

a) To control the output voltage c) To receive zero noise output voltage

b) To obtain finite o/p voltage d) None of the mentioned

33.Find the output voltage of an ideal op-amp. If V1 and V2 are the two input

a) VO= V1-V2 c) VO= A×(V1+V2)

b) VO= A×(V1-V2) d) VO= V1×V2

34.How will be the output voltage obtained for an ideal op-amp?

a) Amplifies the difference between the two input voltages

b) Amplifies individual voltages input voltages

c) Amplifies products of two input voltage

d) None of the mentioned

35.Which is not the ideal characteristic of an op-amp?

a) Input Resistance –> 0 c) Bandwidth –> ∞

b) Output impedance –> 0 d) Open loop voltage gain –> ∞

36.Find the I/P vtg of an ideal op-amp. It's I/P and o/p are 2v& 12v. (Av=3)

a) 8v c) -4v

b) 4v **d) -2v**

3. Linear Applications of op-Amp

Position in Question Paper **Total Marks-26**

Q.1. c) 2-Marks.
Q.1. d) 2-Marks.
Q.2. d) 4-Marks.
Q.2 e) 4 Marks
Q.3. a) 4-Marks.
Q.5. b) 6-Marks.
Q.4. e) 4-Marks

Descriptive Question

1. State the need of signal conditioning.

2. Draw and explain temperature compensated logarithmic amplifier using op-amp.

3. Draw the circuit diagram of I. A. using three op – amp and write its output equation.

4. Explain current to voltage converter. Write its applications. 24) Draw and explain Window detector.

5.Compare between Schmitt Trigger and Comparator.

6.Define UTP, LTP, Hysteresis with respect to Schmitt trigger

7.Draw the circuit of a V-I converter and derive an expression for the output current in terms of input voltage.

8.Draw the diagram of log amplifier using op-amp. Derive the expression for its output voltage.

9. Draw the sample and hold circuit using op-amp. Explain its working and show input and output waveform.

10. Draw the neat diagram of analog multiplier using log-antilog amplifiers and explain its operation.

11. Draw and explain zero crossing detector with i/p and o/p waveform.

12. Draw and explain Inverting Schmitt Trigger using IC 741. 33) With suitable circuit diagram explain Active peak detector

13. Draw I-V Converter using Op-amp .Derive the expression for its output voltage.

MCQ Questions:-

(Total number of Question=Marks*3= 20*3=60)

Note: Correct answer is marked with **bold.**

1.What are the features of instrumentation amplifier?

a) Low noise
c) Low thermal and time drift
b) High gain accuracy
d) All of the mentioned

2. What instrument is used to amplify output signal of transducer

a) Peaking amplifier
c) Differential amplifier
b) Instrumentation amplifier
d) Bridge amplifier

3.General purpose op-amps are used in applications as

a)Instrumentation amplifier
b) Differential instrumentation amplifier
c) Inverting instrumentation amplifier
d) Non-inverting instrumentation amplifier

4.Voltage to current converter is also called as

a) Current series positive feedback amplifier
b) Voltage series negative feedback amplifier
c) Current series negative feedback amplifier
d) Voltage series positive feedback amplifier

5.Which of the following application uses voltage to current converter?

a) Low voltage dc and ac voltmeter
c) Light emitting diode
b) Diode match finding
d) All of the mentioned

6.The op-amp in low voltage DC voltmeter cannot be nullified due to

a) D'Arsonaval meter movement
c) Selection of switch
b) Offset voltage compensating
d) Gain of amplifier

7.How to modify a low voltage DC voltmeter to low voltage ac voltmeter

a) Add a full wave rectifier in the feedback loop
b) Add a half wave rectifier in the feedback loop
c) Add a square wave rectifier in the feedback loop
d) Add a sine wave rectifier in the feedback loop

8.What is the alternate method to measure the values of non-sinusoidal waveform other than ac voltmeter?

a) Clipper
c) Peak detector
b) Clamper
d) Comparator

9. State the condition satisfied by peak detector for proper operation of circuit.
a) CRd ≤ T/10 and CRL ≥ 10T
c) CRd ≥ T/10 and CRL ≤ 10T
b) CRd ≤ 10T and CRL ≥ T/10
d) CRd ≥ 10T and CRL ≤ T/10

10.The resistor in the peak detector are used to
a) To maintain proper operation
c) To get shaped non-sinusoidal waveform
b) Protect op-amp from damage
d) None of the mentioned

11. How the recovery time of the op-amp is reduced?
a) Diode is connected at the output of amplifier
b) Load resistor
c) Forward biased diode resistor
d) Discharge capacitor

12.In the S/H Ckt, the period during which the voltage across capacitor =i/p vtg
a) Sample period
c) Delay period
b) Hold period
d) Charging period

13.During which period the op-amps output of sample and hold circuits is processed?
a) Delay period
c) Sample period
b) Sample and hold period
d) Hold period

14.Which IC is mostly preferred for sample and hold circuit?
a) µ771
c) LF398
b) IC741
d) µ351

15.Sample and hold circuit are used in__
a) Analog to Digital modulation
c) Pulse position modulation
b) Digital to analog modulation
d) All of the mentioned

16.The value of input and reference voltage a comparator can be named as
a) Voltage follower
c) Schmitt trigger
b) Digital to analog converter
d) Voltage level detector

17.Why clamp diodes are used in comparator?
a) To reduce output offset voltage
c) To reduce input offset current
b) To increase gain of op-amp
d) To protect op-amp from damage

18.How the op-amp comparator should be choosen to get higher speed of operation?
a) Large gain
c) Wider bandwidth
b) High slew rate
d) None of the mentioned

19.How to obtain high rate of accuracy in comparator?

a) Input offset
c) High CMRR
b) High voltage gain
d) All of the mentioned

20. Output voltage swing of the op-amp comparator within specific limits?

a) External resistors or diodes
c) External capacitors or diodes are used
b) External zeners or diodes
d) External inductors or diodes are used

21.Zero crossing detectors is also called as

a) Square to sine wave generator
c) Sine to triangular wave generator
b) Sine to square wave generator
d) All of the mentioned

22.What is the drawback in zero crossing detectors?

a) Low frequency signal and noise at output terminal
b) High frequency signal and noise at input terminal
c) Low frequency signal and noise at input terminal
) High frequency signal and noise at output terminal

23.state a method to overcome the drawback of zero crossing detectors?

a) Increasing input voltage
c) Connect a compensating network
b) Use of positive feedback
d) None of the mentioned

24.Name the comparator that helps to find unknown input.

a) Time marker generator
c) Phase meter
b) Zero crossing detectors
d) Window detector

25.following is used to increase phase angle between different voltages?

a) Phase detector
c) Zero crossing detector
b) Window detector
d) None of the mentioned

26.Which circuit converts irregularly shaped waveform to regular shaped waveforms?

a) Schmitt trigger
c) Comparator
b) Voltage limiter
d) None of the mentioned

27If the threshold voltages are made longer than the noise voltages in schmitt trigger?

a) All the mentioned
c) Reduce the transition
b) Enhance the output signal
d) Eliminate false output transition

28. To a schmitt trigger in non-inverting confi. triangular wave of 1Vp is applied. What will be the output waveform, if the upper and lower threshold voltages are 0.25v?

a) Square waveform
c) Sawtooth waveform
b) Pulse waveform
d) Cannot be determined

29. In which configuration a dead band condition occurs in schmitt trigger__

a) Differential amplifier with positive feedback
b) Voltage follower with positive feedback
c) Comparator with positive feedback
d) None of the mentioned

30.Which of the following functions does the antilog computation required to perform continuously with log-amps?

a) In(x)
b) log(x)
c) Sinh(x)
d) All of the mentioned

31.How to provide saturation current and temperature compensation in log-amp?

a) Applying reference voltage alone to two different log-amps
b) Applying input and reference voltage to same log-amps
c) Applying input and reference voltage to separate log-amps
d) None of the mentioned

32.The input voltage, 6v and reference voltage, 4 v are applied to a log-amp with saturation current and temperature compensation. Find the output voltage of the log-amp?

a) 6.314(kT/q)v
b) 0.597(kT/q)v
c) 0.405(kT/q)v
d) 1.214(kT/q)v

33. An antilog amplifier has a _____ in series with the input.

a) BJT
b) diode
c) diode or BJT
d) resistor

34.A log amplifier may use the _____ junction of a BJT in the feedback loop.

a) base-collector
b) base-emitter
c) emitter-collector
d) emitter-ground

34.Instrumentation amplifiers are normally used to measure

a) small differential signal voltages.
b) signals superimposed on a common-mode voltage often much larger than the
c) both of the above
d) none of the above

35.The log of a number is the

a) base to which the power must be raised to get that number.
b) power to which the base must be raised to get that number.
c) base of that number.
d) power of that number.

36.What is a key characteristic of an instrumentation amplifier?

a) high CMRR c) high output impedance

b) high output offset d) none of the above

37. A basic _____ amplifier is formed by three op-amps and seven resistors.

a) instrumentation c) log

b) isolation d) antilog

38.The voltage gain of a basic instrumentation amplifier is set by a(n)

a)diode. **c) resistor.**

b) capacitor. d) inductor.

39.A log amplifier has _____ in the feedback loop.

a) a diode c) a resistor

b) a BJT **d) either a diode or a BJT**

40.The process known as signal compression is used with a(n) ____ amplifier.

a) log c) instrumentation

b) antilog d) isolation

40. Zero crossing detector circuit plays a crucial role in conversion of input sine wave into a perfect _____at its output.

a) triangular wave c)saw-tooth wave

b) square wave d)pulse wave

41.For reducing the effects of input offset in comparator, what would be the possible value of input offset voltage?

a. Low **c.** High

b. Moderate **d.** None of the above

42.Zero crossing detector circuit plays a crucial role in conversion of input sine wave into a perfect _____at its output.

a) triangular wave c) saw-tooth wave

b)square wave d) pulse wave

43.For an ideal comparator, what should be the value of the response time?

a) Zero c) Infinite

b) Unity d)Unpredictable

44.Which parameter/s is/are used to indicate the speed of a comparator?

a) Response Time **c) Both a and b**

b) Propagation Delay d) None of the above

45.For a temperature controller circuit comprising instrumentation amplifier? which among the following is adopted as a temperature?

a) Thermistor c) Thyristor

b) Sensistor d) Thermocouple

46.Which among the following is/are the requirement/s of an instrumentation amplifier?

a) High slew rate c) High CMRR

b) High input resistance **d) All of the above**

47.Which among the following is a nonlinear application of op-amp?

a) V to I converter **c) Precision rectifier**

b) Comparator **d)** Instrumentation amplifier

48. In a nonlinear op-amp circuit, the

a) Op amp never saturates c) Output shape is the same

b) Feedback never opened d) Op amp may saturate

49. To detect when the input is greater than a particular value, use a

a) Comparator c) Limiter

b) Clamper d) Relaxation oscillator

50. The voltage out of a Schmitt trigger is

a) A low voltage **c) Either a low or a high voltage**

b) A high voltage d) A sine wave

51.If the input is a rectangular pulse, the output of an integrator is a

a) Sine wave **c) Ramp**

b) Square wave d) Rectangular pulse

52.When a large sine wave drives a Schmitt trigger, the output is a

a) Rectangular wave c) Rectified sine wave

b) Triangular wave d)Series of ramps

53.If pulse width decreases and the period stays the same, the duty cycle

a) Decreases c) Increases

b) Stays the same d) Is zero

54.The output of a relaxation oscillator is a

a) Sine wave c) Ramp

b) Square wave d) Spike

55.The input to a peak detector is a triangular wave with a peak-to-peak value of 8 V and an average value of 0. The output is

a) 0
c) 8 V
b) 4 V
d) 16 V

56.The discharging time constant of a peak detector is 10 ms. The lowest frequency you should use is

a.10 Hz
c. 1 kHz
b.100 Hz
d. 10 kHz

57.A comparator with a trip point of zero is sometimes called a

a) Threshold detector
c) Positive limit detector
b) Zero-crossing detector
d) Half-wave detector

58. A Schmitt trigger uses___

a) Positive feedback
c) Compensating capacitors
b) Negative feedback
d) Pullup resistors

59. A window comparator__

a) Has only one usable threshold
b) Uses hysteresis to speed up response
c) Clamps the input positively
d) Detects an input voltage between two limits

60. If the reference voltage is zero, the output of an active positive limiter is

a) Positive
c) Either positive or negative
b) Negative
d) A ramp

4. Filters and Oscillators.

Position in Question Paper **Total Marks-26**

Q.1. e) 2-Marks.
Q.1. f) 2-Marks.
Q.1. g) 2-Marks.
Q.3. c) 4-Marks.
Q.4. a) 4-Marks.
Q.5. b) 6-Marks
Q.6. c) 6-Marks

Descriptive Questions

1. Give the classification of filters.

2. Define Roll of Rate and order of filter.

3. Define Bandwidth and cut off frequency

4. Define Pass band and stop band.

5. Draw ideal frequency response of filters.

6. Draw frequency response of High pass Filter.

7. State the key characteristics of Butterworth response.

8. Explain the term Quality Factor.

9. Write the formula for notch frequency.

10. Classify Oscillators

11. Explain the principle of oscillator with block diagram.

12. Differentiate between first order and second order Filter.

13. State the advantages of active filter over passive filter.

14. Draw and explain first order high pass filter.

15. Draw and explain the ckt. of Wide band pass filter.

16. Draw the circuit and frequency response of notch filter. give expression for notch.

17. Design a band reject filter to reject band of 10kHz to 20kHz.

MCQ Questions:-

(Total number of Question=Marks*3= 18*3=54)

Note: Correct answer is marked with **bold.**

1. Which filter type is called a flat-flat filter?
   a) Causer filter
   c) Chebyshev filter
   b) Butterworth filter
   d) Band-reject filter
2. Which filter performs exactly the opposite to the band-pass filter?
   a) Band-reject filter
   c) Band-elimination filter
   b) Band-stop filter
   d) All of the mentioned
3. Given the lower and higher cut-off frequency of a band-pass filter are 2.5kHz and 10kHz. Determine its bandwidth.
   a) 750 Hz
   c) 75000 Hz
   b) 7500 Hz
   d) None of the mentioned
4. In which filter the o/p and i/p volt are equal in amplitude for all freq?
   a) All-pass filter
   c) Low pass filter
   b) High pass filter
   d) All of the mentioned
5. The gain of the first order low pass filter
   a) Increases at the rate 20dB/dec
   c) Decreases at the rate 20dB/dec
   b) Increases at the rate 40dB/dec
   d) Decreases at the rate 40dB/dec
6. Which among the following has the best stop band response?
   a) Butterworth filter
   c) Cauer filter
   b) Chebyshev filter
   d) All of the mentioned
7. Determine the order of filter used, when the gain increases at the rate of 60dB/decade on the stop band.
   a) Second-order low pass filter
   c) First-order low pass filter
   b) Third-order High pass filter
   d) None of the mentioned
8. Name the filter that has two stop bands?
   a) Band-pass filter
   c) High pass filter
   b) Low pass filter
   d) Band-reject filter
9. An electrical filter is a
   a) Phase-selective circuit
   c) Filter-selective circuit
   b) Frequency-selective circuit
   d) None of the mentioned

10. Filters are classified as
a) Analog or digital
c) Audio or radio frequency
b) Passive or active
d) All of the mentioned

11. Why inductors are not preferred for audio frequency?
a) Large and heavy
c) High input impedance
b) High power dissipation
d) None of the mentioned

12. The problem of passive filters is overcome by using
a) Analog filter
c) LC filter
b) Active filter
d) combination of analog, digital filters

13. What happens if inductors are used in low frequency applications?
a) Enhance inductor usage
c) Degrades inductor performance
b) No losses occurs
d) Low power dissipation

14. Find out the incorrect statement about active and passive filters.
a) Gain is not attenuated in active filter
b) Passive filters are less expensive
c) Active filter does not cause loading of source
d) Passive filters are difficult to tune or adjust

15.What are the most commonly used active filters?
a) All of the mentioned
c) Band pass and Band reject filters
b) Low pass and High pass filters
d) All-pass filters

16. Choose the op-amp that improves the filter performance.
a) µA741
c) LM101A
b) LM318
d) MC34001

17. Ideal response of filter takes place in
a) Pass band,stop band freq
c) Pass band frequency
b) Stop band frequency
d) None of the mentioned

18. Which filter attenuates any frequency outside the pass band?
a) Band-pass filter
c) Band-stop filter
b) Band-reject filter
d) All of the mentioned

19. Narrow band-pass filters are defined as
a) Q < 10
c) Q > 10
b) Q = 10
d) None of the mentioned

20. A band-pass filter has a bandwidth of 250Hz and center frequency of 866Hz. Find the quality factor of the filter?

a) 3.46 c) 4.84

b) 6.42 d) None of the mentioned

21. Find the center frequency of wide band-pass filter

a) fc= √(fh ×fL) c) fc= √(fh -fL)

b) fc= √(fh +fL) d) fc= √(fh /fL)

22. Find out the voltage gain magnitude equation for the wide band-pass filter.

a) AFt×(f/fL)/√[(1+(f/fh)2]×[1+(f/fL)2].

b) AFt/ √{[1+(f/fh)2]×[1+(f/fL)2]}

c) AFt/ √{[1+(f/fh)2]/[1+(f/fL)2]}

d) [AFt/(f/fL)]/ √{[1+(f/fh)2]/[1+(f/fL)2]}

23. When a second order high pass filter and second order low pass sections are cascaded, the resultant filter is a

a) ±80dB/decade band-pass filter c) ±20dB/ decade band-pass filter

b) ±40dB/decade band filter d) None of the mentioned

24. Where total pass band gain is=6, input frequency = 750Hz, FL =200Hz and high cut-off frequency=1khz. Find Gain of WBPF

a) 13.36 dB c) 11.71 dB

b) 12.25 dB **c) 14.837dB**

25. Compute the quality factor of the wide band-pass filter with high and low cut-off frequencies equal to 950Hz and 250Hz.

a) 0.278 **c) 0.696**

b) 0.348 d) 0.994

26. The details of low pass filter sections are given as fh =10kHz, AF= 2 and f=1.2kHz. Find the voltage gain magnitude of first order wide band-pass filter, if the voltage gain magnitude of high pass filter section is 8.32dB.

a) 48.13dB **c) 14.28dB**

b) 10.02dB d) 65.99dB

27. The quality factor of a wide band-pass filter can be

a) 12.6 c) 14.2

b) 9.1 d) 10.9

28. If the gain at center frequency is 10, find the quality factor of narrow BPF.
a) 1
c) 3
b) 2
d) None of the mentioned

29. The advantage of narrow band-pass filter is
a) fc can be changed without changing gain
b) fc can be changed without changing bandwidth
c) fc can be changed without changing resistors
d) All of the mentioned

30. Find the complex equation for the gain of the first order low pass butterworth filter as a function of frequency.
a) AF/[1+j(f/fH)].
c) AF×[1+j(f/fH)].
b) AF/√ [1+j(f/fH)2].
d) None of the mentioned

31. Determine the gain of the first order low pass filter if the phase angle is 59.77 and the pass band gain is 7.
a) 3.5
c) 12
b) 7
d) 1.71

32. In a low pass butterworth filter, the condition at which f=fH is called
a) Cut-off frequency
c) Corner frequency
b) Break frequency
d) All of the mentioned

33. Find the High cut-off frequency if the pass band gain of a filter is 10.
a) 70.7Hz
c) 7.07Hz
b) 7.07kHz
d) 707Hz

34. To change the high cutoff frequency of a filter. It is multiplied by R or C by a ratio of original cut-off frequency known as
a) Gain scaling
c) Magnitude scaling
b) Frequency scaling
d) Phase scaling

35. Using the frequency scaling technique, convert 10kHz cut-off frequency of the low pass filter to a cutoff frequency of 16kHz.C=0.01μF,R=15.9kΩ
a) 6.25kΩ
c) 16kΩ
b) 9.94kΩ
d)1.59kΩ

36. Find the difference in gain magnitude for a filter ,if it is the response for frequencies f1=200Hz and f2=3kHz. Specification: AF=2 and fH=1kHz.
a) 4.28 dB
c) 1.56 dB
b) 5.85 dB
d) None of the mentioned

37. How can a first order low pass filter can be converted into second order LPF
a) By adding LC network
c) By adding RC || LC network
b) By adding RC network
d) None of the mentioned

38. Where pass band gain of the filter is 5, frequency and the high cut-off frequency of the filter are 3000Hz and 1kHz.Find the gain and phase angle of the second order low pass filter?
a) None of the mentioned
c) Gain mag = -5.19dB , φ =71.56o
b) Gain mag = -1.03dB ,φ =63.32
d) Gain mag= -4.94dB , φ =90o

39. A second order LPF is given an input frequency of 30kHz and produce .. a output having phase angle of 79o. Determine the pass band gain of the filter?
a) 11 dB
c) 46.78 dB
b) 89.11 dB
d) None of the mentioned

40. The pass band voltage gain of a second order low pass butterworth filter is
a) 1.586
c) 0.586
b) 8.32
d) 0.707

41. Frequency scaling is done using
a) Standard capacitor
c) Standard resistance
b) Varying capacitor
d) None of the mentioned

42. How is the higher order filters formed?
a) By increasing resistors and capacitors in low pass filter
b) By decreasing resistors and capacitors in low pass filter
c) By inter changing resistors and capacitors in low pass filter
d) All of the mentioned

43. In a first order high pass filter, frequencies higher than low cut-off frequencies are called
a) Stop band frequency
c) Centre band frequency
b) Pass band frequency
d) None of the mentioned

44. Determine the expression for output voltage of first order high pass filter?
a) VO = [1+(RF /R1)]× [(j2πfRC/(1+j2πfRC)] × Vin
b) VO = [-(RF /R1)]× [(j2πfRC/(1+j2πfRC)] × Vin
c) VO = {[1+(RF /R1)]× /[1+j2πfRC] }× Vin
d) None of the mentioned

45. The internal resistor of the second order high pass filter is equal to 10kΩ.,Rf=?

a) 6.9kΩ
c) 10kΩ
b) 5.86kΩ
d) 12.56kΩ

46. Determine voltage gain of second order high pass butterworth filter.
Specifications R3 =R2=33Ω, f=250hz and fL=1khz.

a) -11.78dB
c) -44.19dB
b) -26.51dB
d) None of the mentioned

47. How is the higher order filters formed?

a) Using first order filter
b) Using second order filter
c) Connecting first and second order filter in series
d) Connecting first and second order filter in parallel

48. State the disadvantage of using higher order filters?

a) Complexity
c) Expensive
b) Requires more space
d) All of the mentioned

49. The overall gain of higher order filter is

a) Varying
c) Random
b) Fixed
d) None of the mentioned

50. Find the roll-off rate for 8th order filter

a) -160dB/decade
c) -480dB/decade
b) -320dB/decade
d) -200dB/decade

51. How many types of band elimination filters are present

a) Three
c) Four
b) Two
d) None of the mentioned

52. A narrow band-reject filter is commonly called as

a) Notch filter
c) Delay filter
b) Band step filter
d) All of the mentioned

53. Find the expression for notch-out frequency?

a) fN = 2πRC
c) fN = 1/2π×√(R/C)
b) fN = 2π/RC
d) fN = 1/2ΠIrc

54. The quality factor of passive twin T-network is increased by using

a) Inverting amplifier
c) Voltage follower
b) Non-inverting amplifier
d) Differential amplifier

5. Specialized IC Applications

Position in Question Paper **Total Marks-20**

Q.2. c) 4-Marks.
Q.4. c) 4-Marks.
Q.5. c) 6-Marks.
Q.6. b) 6-Marks.

Descriptive Questions

1. Give the classification of filters.

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4. Define Pass band and stop band.

5. Draw ideal frequency response of filters.

6. Draw frequency response of High pass Filter.

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11. Explain the principle of oscillator with block diagram. 04Marks Questions:

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13. State the advantages of active filter over passive filter.

14. Draw and explain first order high pass filter.

15. Draw and explain the ckt. of Wide band pass filter.

16. Draw the circuit and frequency response of notch filter. give expression

for notch frequency.

17. Design a band reject filter to reject band of 10kHz to 20kHz.

18. Design a wide band pass filter with lower cutoff frequency fL=5kHz and higher cutoff frequency fH=15KHz and pass band gain =2. Assume C=0.05uF, C'=0.01uF. Draw full ckt. diagram for the filter.

19. Draw and explain the working of phase shift Oscillator using IC741. 9) Design a high pass filter at a cut off frequency of 2 kHz with a pass band gain of 2. 10) Design and draw Op-Amp based Wien bridge oscillator for frequency 1kHz.

MCQ Questions:-

(Total number of Question=Marks*3= 12*3=36)

Note: Correct answer is marked with **bold.**

1. Free running multivibrator is also called as__
   a) Stable multivibrator
   c) Square wave oscillator
   b) Voltage control oscillator
   d) Pulse stretcher
2. The output voltage of phase detector is
   a) Phase voltage
   c) Error voltage
   b) Free running voltage
   d) None of the mentioned
3. At which state the phase-locked loop tracks any change in input frequency?
   a) Free running state
   c) Phase locked state
   b) Capture state
   d) All of the mentioned
4. What is the function of low pass filter in phase-locked loop?
   a) Improves low frequency noise
   c) Tracks the voltage changes
   b) Removes high freq noise
   d) Changes the input frequency
5. What is the need to generate corrective control voltage?
   a) To maintain the lock
   c) To shift the VCO frequency
   b) To track the freq change
   d) All of the mentioned
6. At what range the PLL can maintain the lock in the circuit?
   a) Lock in range
   c) Feedback loop range
   b) Input range
   d) None of the mentioned
7. The pull-in time depends on
   a) Initial phase and frequency difference between two sign
   b) Overall loop gain
   c) Loop filter characteristics
   d) All of the mentioned
8. Analog phase detector is often referred as
   a) Full wave detector
   c) Rectifier wave detector
   b) Half wave detector
   d) None of the mentioned
9. What happens when VCO output is 90o out of phase with respect to input signal?
   a) Perfect lock
   c) Shift in phase of comparator
   b) Attenuation
   d) Error signal is removed

10. The maximum dc output voltage in digital phase detector occurs

a) When the phase diff is π/2
c) When the phase difference is 3π/4
b) When the phase diff is π
d) When the phase difference is 2π

11. Which among the following has better capture tracking & locking characteristics?

a) XOR phase detector
c) Analog phase detector
b) Edge trig phase detector
d) All of the mentioned

1. Determine the time period of a monostable 555 multivibrator.

a) T = 0.33RC
c) T = 3RC
b) T = 1.1RC
d) T = RC

12. Overcome mistriggering on the positive pulse edges in the monostable circuit?

a) Connect a RC network at the input
b) Connect an integrator at the input
c) Connect a differentiator at the input
d) Connect a diode at the input

13. A monostable multivibrator has R = 120kΩ and the time delay T = 1000ms calculate the value of C?

a) 0.9μF
c) 7.5μF
b) 1.32μF
d) 2.49μF

14. Which among the following can be used to detect the missing heart beat?

a) Monostable multivibrator
c) Schmitt trigger
b) Astable multivibrator
d) None of the mentioned

15. A 555 timer in monostable application mode can be used for

a) Pulse position modulation
c) Speed control and measurement
b) Frequency shift keying
d) Digital phase detector

16. Free running frequency of Astable multivibrator?

a) f=1.45/(RA+2RB)C
c) f=1.45C/(RA+2RB)
b) f=1.45(RA+2RB)C
d) f=1.45 RA/(RA+RB)

17. Astable multivibrator operating at 150Hz has a discharge time of 2.5m. Find the duty cycle of the circuit.

a) 50%
c) 95.99%
b) 75%
d) 37.5%

18. How to obtain symmetrical waveform in Astable multivibrator?

a) Use clocked RS flip-flop
c) Use clocked D-flip-flop
b) Use clocked JK flip-flop
d) Use clocked T-flip-flop

19.How does a monostable multivibrator used as frequency divider?

a) Using square wave gen. c) Using sawtooth wave generator

b) Using triangular wave gen. d) Using sine wave generator

20. Which device is used for diagnostic purposes and for recording?

a) Low pass filter **c) Voltage Controlled Oscillator**

b) Monolithic PLL d) None of the mentioned

21. Write the equation for time period of VCO?

a) (2×Vcc×CT)/i c) (Vcc×CT×i)/2

b) (Vcc CT)/(2×i) d) (2×Vcc)/(i×CT)

22. Determine the value of current flow in VCO, when the NE566 VCO external timing resistor RT =250Ω and the modulating input voltage Vc=3.25V, Vcc=+5v).

a) 3mA **c) 7mA**

b) 12mA d) 10mA

23. External tuning resistor c) Modulating input voltage

b) External tuning capacitor **d) All of the mentioned**

24. Calculate the value of external timing capacitor, if no modulating input signal is applied to VCO. Consider fo=25 kHz and RT=5 kΩ.

a) 6nF **c) 2nF**

b) 100µF d) 10nF

25. What is the advantage of using filter?

a) High noise immunity c) Provides dynamic range of frequencies

b) Reduce the b.W of PLL d) None of the mentioned

26. Choose the VCO for attaining higher output frequency.

a) NE566 **c) MC4024**

b) SE566 d) All of the mentioned

27. Voltage to frequency conversion factor for VCO is

a) Kv = △Vc/ △fo c) Kv = △fo × △Vc

b) Kv = △fo/△Vc d) Kv = 1/(△fo×△Vc)

28. Calculate the voltage to frequency conversion factor, where fo=155Hz and Vcc=10V.

a) 130 c) 134

b) 124 d) 116

29. Find the equation for change in frequency of VCO?

a)△fo =(2×△Vc)/(RT×CT×V) c) △fo = △Vc/(2×RT×CT×Vcc)

b) △fo =△Vc/(4×RT×CT×V) d) △fo = (4×△Vc)/(RT×CT×Vcc)

30. How to obtain a desired amount of multiplication in frequency multiplier?
a)decreasing the multi factor **c) By selecting proper divide by N-network**
b increasing the input frequency d) None of the mentioned

31. The frequency corresponding to logic 1 state in FSK is called
a) Space frequency c) Both mark and space frequency
b) Mark frequency d) None of the mentioned

32. Find the frequency shift in FSK generator?
a) 230 Hz c) 180 Hz
b) 250 Hz **d) 200 Hz**

33. Which filter to remove the carrier component in the frequency shift keying?
a) Three stage filter c) Single stage filter
b) Two stage filter d) All of the mentioned

34.What kind of input signal, the freq divider can be avoided frequency multiplier?
a) Triangular waveform c) Saw tooth waveform
b) Square waveform d) Sine waveform

35. What must the typical value of n for a frequency multiplication / division?
a) $n \leq 12$ c) $n < 10$
b) $n > 11$ **d) n = 7**

36. Determine the offset frequency of frequency translation,
when the output and input frequency are given as 75kHz and 1000Hz.
a) 35 kHz c) 29 kHz
b) 20 kHz d) 14 kHz