Scheme – I

Sample Question Paper

Program Name : **Electronics Engineering Programme Group**
Program Code : **DE/EJ/ET/EN/EX/EQ/IE/IS/IC**
Semester : **Fourth**
Course Title : **Linear Integrated Circuits**
Marks : **70**

22423

Time: 3 Hrs.

Instructions:

(1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Preferably, write the answers in sequential order.

Q.1) Attempt any FIVE of the following: - 10 Marks

(a) State ideal and practical value of given parameters for Op-Amp IC 741.
   1) Input offset voltage
   2) CMRR
(b) Draw circuit diagram Op-Amp based basic integrator.
(c) List four specifications of LM 324.
(d) Define following terms related with filter.
   i. Cut - off frequency
   ii. Stop band
(e) State the use of Schmitt trigger.
(f) Draw labeled pin diagram of IC - 555.
(g) State the classification of filters based on frequency response.

Q.2) Attempt any THREE of the following: - 12 Marks

(a) Draw the block diagram of OP-AMP and state the functions of each block.
(b) Draw the input output waveform of inverting zero crossing detector with sine wave input of amplitude $3V_{PP}$.
(c) Describe the operation of multiplier using PLL with the help of block diagram.

(d) Obtain the output voltage for the open loop differential amplifier for V_{in1}=10mV rms, V_{in2}=20mV rms. Assume Op-Amp is 741, voltage swing=±14v. Sketch the output waveform.

Q.3) Attempt any THREE of the following. 12 Marks

(a) Explain the concept of frequency compensation of Op-Amp and offset nulling?

(b) Draw the circuit diagram of Op-Amp based log amplifier and obtain the expression for its output voltage.

(c) Sketch first order Butterworth low pass filter with appropriate component value at a cut-off frequency 10 KHz with pass band gain 2.

(d) Describe the procedure to vary output frequency of IC-555 based voltage controlled oscillator with appropriate sketch

Q.4) Attempt any THREE of the following. 12 Marks

(a) Identify and draw the Op-Amp based circuit to perform below operation. (refer fig1)

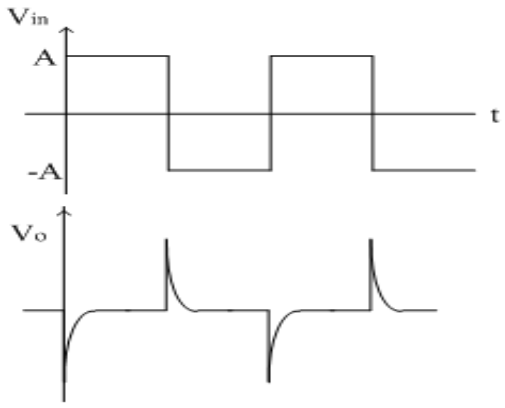


Fig. 1

(b) Explain the procedure to null the offset voltage with appropriate sketch.

(c) For the following equation, sketch the circuit diagram and output waveform for square wave input.

$$V_0 = -\frac{1}{RC}\int_0^t V_{in}\,dt + C$$

(d) Explain the operation of instrumentation amplifier using three Op-Amps with neat sketch.

(e) Sketch IC-555 based monostable multivibrator for pulse width t_p = 10 ms.

Q.5) Attempt any TWO of the following. 12 Marks

(a) If R2 = 150KΩ, R1 = 100KΩ, Vin = 500mV Sine wave, saturation voltage = ±15V, for a Op-Amp based Schmitt trigger. Find Threshold Voltage VUTP, VLTP and hysteresis voltage.

(b) Identify and draw the Op-Amp based filter circuit to fulfill following frequency response(refer fig2)

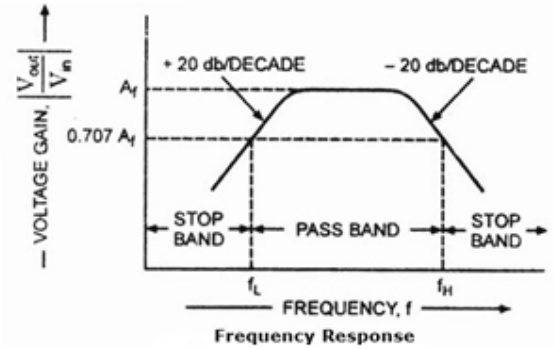


Fig. 2

(c) Sketch output signal along with input signal as sine wave of 2V peak to peak for following Op-Amp based circuits with ideal conditions.

i. Inverting amplifier with gain 5.
ii. Positive peak detector
iii. Active integrator.
iv. Non inverting zero crossing detectors.
v. Non inverting unity gain amplifier.
vi. Active differentiator.

Q.6) Attempt any TWO of the following. 12 Marks

(a) For the given circuit, obtain the output voltage expression.(refer fig3)

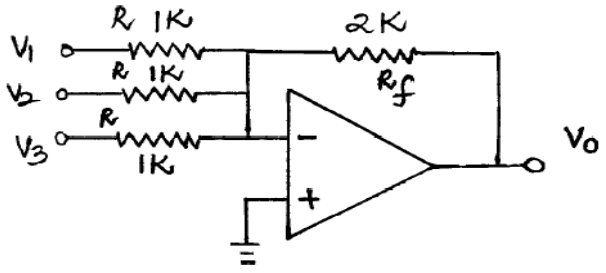


Fig. 3

(b) Explain the operation of sample and hold circuit with neat sketch and its input, output waveform?

(c) Sketch second order Butterworth high pass filter with appropriate component value at a cut-off frequency 10 KHz.

Scheme – I

Sample Test Paper - I

Program Name : **Electronics Engineering Programme Group**
Program Code : **DE/EJ/ET/EN/EX/EQ/IE/IS/IC**
Semester : **Fourth**
Course Title : **Linear Integrated Circuits**
Marks : **20**

22423

Time: 1 Hour

Instructions:

(1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. **08 Marks**

(a) Draw equivalent circuit of Op-Amp
(b) Draw labeled pin diagram of IC 741.
(c) Draw circuit diagram of non-inverting adder with 3 inputs.
(d) Draw input and output waveform, when the sine input signal is applied to the inverting input terminal of Op-Amp.
(e) Draw the circuit diagram of voltage to current converter with grounded load.

Q.2 Attempt any THREE. **12 Marks**

(a) Draw block diagram of Op-Amp. Describe the function of each block in brief.
(b) Draw the circuit diagram of inverting amplifier and obtained its output voltage expression.
(c) Draw the output waveform for sine wave input of amplitude 3Vp-p. (Refer Fig1)

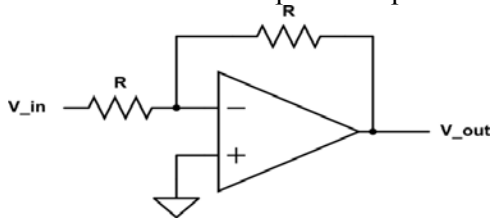


Fig. 1

(d) Explain the working of window detector with neat sketch.

Scheme – I

Sample Test Paper - II

Program Name : **Electronics Engineering Programme Group**
Program Code : **DE/EJ/ET/EN/EX/EQ/IE/IS/IC**
Semester : **Fourth**
Course Title : **Linear Integrated Circuits**
Marks : **20**

22423

Time: 1 Hour

Instructions:

(1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. **08 Marks**

(a) State the importance of hysteresis.
(b) Define following terms related with filter.
  i. Cut - off frequency
  ii. Stop band
(c) Draw ideal and practical response of band reject filter with proper labeling.
(d) Define lock range and capture range of PLL.
(e) Draw labeled pin diagram of IC - 565.

Q.2 Attempt any THREE. **12 Marks**

(a) Draw the diagram of log amplifier using op - amp and obtain expression for its output voltage.
(b) Explain the circuit diagram of Op-Amp based phase shift oscillator with neat sketch.
(c) Sketch Op-Amp based Wein Bridge Oscillator with appropriate value for frequency 1 kHz.
(d) Obtain pulse width of output of IC-555 based monostable multivibrator for c = 0.047μF and R = 56K.

22423

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define the operational amplifier parameters

(i) Slew rate

(ii) Input bias current

b) Draw wien bridge oscillator circuit using IC 741

c) List four specification of IC LM324

d) State the four application of an instrumentation amplifier.

e) State the four advantages of active filter over passive filter.

f) Define roll of rate and order of filter.

g) State the function of following pins of IC 555

(i) Threshhold

(ii) Discharge

Marks

2. Attempt any THREE of the following: **12**

a) Describe the block diagram of op-amp

b) Explain with neat circuit diagram, the significance of virtual ground in an op-amp.

c) Draw the circuit diagram of grounded load type V to I converter and derive expression for its output.

d) Sketch the astable multivibrator using IC 555 and explain it.

3. Attempt any THREE of the following: **12**

a) Describe the basic integrater circuit using op-amp.

b) Compare comparator and schimitt trigger circuit (any four points)

c) Design a first order low pass filter at a cut off frequency 12KHz with pass band gain '2' (Assume C = 0.01μf)

d) Explain the working of IC 555 as a voltage controlled oscillator (VCO)

4. Attempt any THREE of the following: **12**

a) Compare open loop and closed loop of configuration of operational amplifier (any four points)

b) Sketch the circuit diagram of closed loop non-inverting amplifier and derive expression for it's gain.

c) Explain the working of PLL as multiplier using block diagram.

d) Draw the neat circuit diagram of first order highpass filter and explain it's operation.

e) Explain the block diagram of phase locked loop.

Marks

5. Attempt any TWO of the following: **12**

a) Explain the function of sample and hold circuit by using op-amp.

b) Explain the circuit diagram of logarithmic amplifier using op-amp.

c) Sketch the circuit diagram of active wide band reject filter and explain it.

6. Attempt any TWO of the following: **12**

a) Sketch the circuit diagram of closed loop inverting amplifier and obtain output expression.

b) Explain schmitt trigger circuit using Op-amp and how UTP and LTP are calculated.

c) Explain the circuit diagram of phase shift oscillator using op-amp.

22423

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State ideal value of given parameters for Op-Amp IC 741:

(i) Slew rate

(ii) SVRR

(iii) Input bias current

(iv) Gain bandwidth product.

b) Draw circuit diagram of Op- Amp based basic differentiator.

c) State the merits of active filter over passive filter.

d) Define following terms related with filter:

(i) Roll off rate

(ii) Pass band

e) State the function of IC 555.

f) Give classification of filter based on components used.

g) Define order of filter with suitable example.

Marks

2. Attempt any THREE of the following: **12**

a) Draw pin diagram of IC 741 and state the function of each pin.

b) Draw and explain the working of wein bridge oscillator using IC 741.

c) Describe the operation of FM Demodulator using PLL with block diagram.

d) Calculate the output voltage for open loop non inverting amplifier if V_{in} = 10 mv/dc. Also draw input output waveform.

3. Attempt any THREE of the following: **12**

a) Explain virtual ground concept of an op-amp.

b) Draw the circuit diagram of logarithmic amplifier using diodes and obtain the expression for its output voltage.

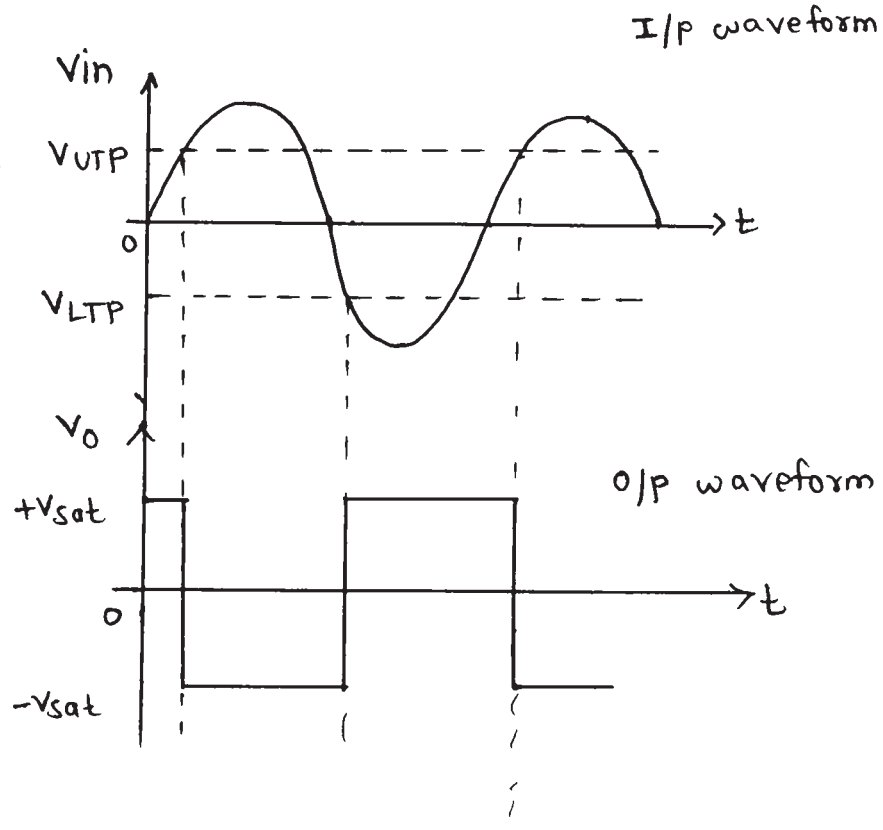
c) Sketch a second order low – pass butter worth filter with higher cut-off frequency of 1.6 kHz and voltage gain of 1.586.

d) Explain the working of voltage controlled oscillator using IC555. Also draw related waveform.

Marks

4. Attempt any <u>THREE</u> of the following: **12**

a) Identify the following waveforms. Label the circuit name and draw the circuit diagram for the same (Refer Fig. No. 1).



<u>Fig. No. 1</u>

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

c) For the following equation sketch the circuit diagram and output waveform for square wave input

$$V_o = R_f C_1 \frac{dV_{in}}{dt}$$

d) Draw voltage to current converter with grounded load and derive the expression.

e) Describe the working of bistable multivibrator with circuit diagram and waveform using IC555.

Marks

5. Attempt any TWO of the following: **12**

a) If $R_1 = 47\Omega$, $R_2 = 27k\Omega$, $V_{out} = 0.5\ V_{pp}$ square wave for op-amp based inverting schmitt trigger circuit with supply voltage $\pm 15V$. Determine threshold voltages V_{UTP}, V_{LTP} and hysteresis voltage V_H. For 741 maximum output voltage swing is $\pm 14V$.

b) Identify and draw the op-amp based filter circuit to fulfill the following frequency response (Refer Fig. No. 2).

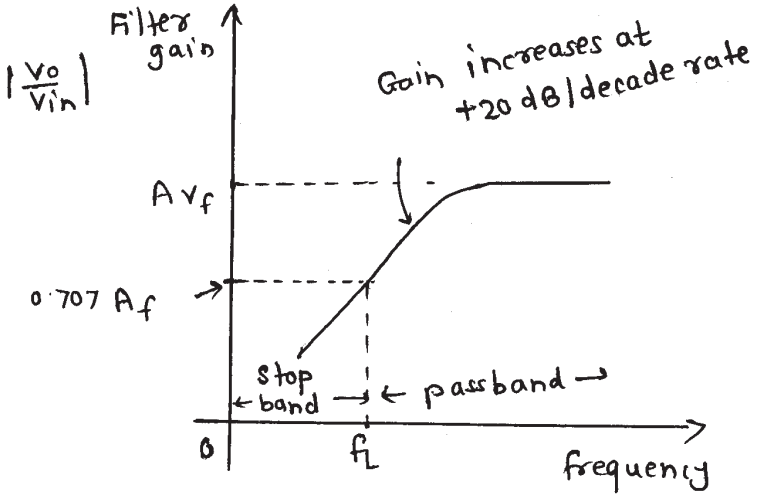


Fig. No. 2

c) Explain working of op-amp as an instrumentation amplifier with neat diagram.

6. Attempt any TWO of the following: **12**

a) Draw the designed circuit for getting output voltage $V_o = +\dfrac{(V_a + V_b + V_c)}{3}$ and suggest modifications for converting into scaling amplifier.

b) Explain working of window detector with neat diagram. Draw input and output waveforms.

c) Design a first order low pass butterworth filter with cut-off frequency of 2 kHz and pass band gain of two. Draw the designed circuit.

22423

12223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define Input offset voltage and Input bias current.

b) Draw the circuit diagram of voltage follower.

c) Draw pin diagram of IC 565.

d) Define cutoff frequency and passband.

e) List two applications of IC LM324.

f) Draw circuit diagram of I to V converter.

g) State two merits of active filters over passive filters.

Marks

2. Attempt any THREE of the following: **12**

a) Describe the operation of PLL as FM demodulator.

b) Sketch first order Butterworth low pass filter with component value at cutoff frequency of 15 kHz with passband gain of 2.

c) In op-amp based Schmitt trigger, $R_2 = 200\Omega$, $R_1 = 50\Omega$ Vin = 500 mV_{PP} sine wave, saturation voltage = ± is v. Determine threshold Voltage V_{UTP} , V_{LTP} .

d) Draw ideal and practical voltage transfer curve of op-amp.

3. Attempt any THREE of the following: **12**

a) Draw block diagram of OPAMP and state function of each block.

b) Draw the circuit of basic differentiator and derive output expression.

c) Draw a neat circuit diagram of analog divider using log-antilog amplifiers and explain its operation.

d) Draw filter circuit for the following response. (Refer Fig. 1)

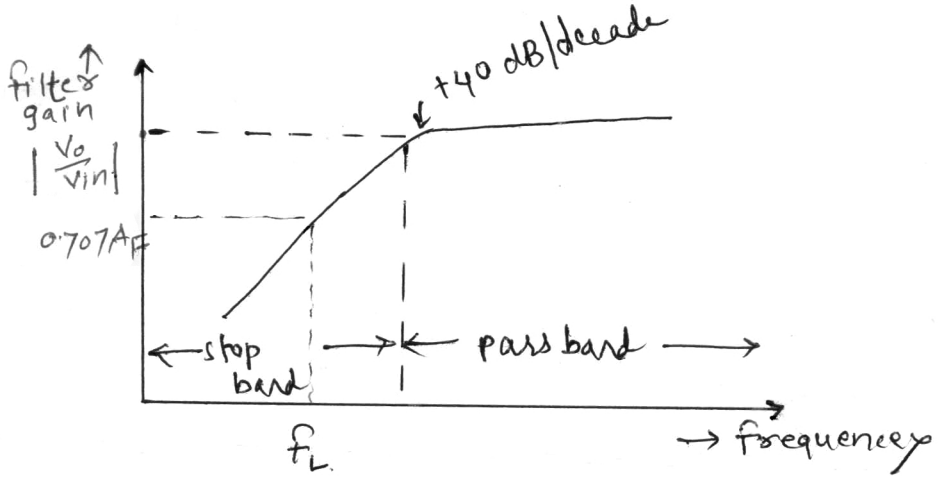


Fig. No. 1

Marks

4. Attempt any THREE of the following: **12**

a) Compare open loop and closed loop configuration.

b) Explain the procedure to null the offset voltage with appropriate diagrams.

c) Design the circuit to get the output voltage.

$V_0 = 3V_1 + 2V_2$ where

V_1 and V_2 are input voltages.

d) Explain phase shift oscillator using IC 741 with neat diagram.

e) Explain the working of astable multivibrator using IC 555.

5. Attempt any TWO of the following: **12**

a) Draw a circuit diagram of V-I converter of floating load. Derive expression for its output. List any two applications.

b) Sketch input and output waveform for 2V peak to peak size wave for Inverting ZCD and active Integrator.

c) Design second order high pass Butterworth filter with higher cutoff frequency of 1.5 kHz. Draw circuit with component values.

6. Attempt any TWO of the following: **12**

a) Calculate output voltage for open loop non-inverting amplifier. If Vin = 10 mv dc, also draw input and output waveform and draw circuit diagram also.

b) Explain operation of Instrumentation amplifier with two op-amp with neat diagram.

Marks

c) From the circuit diagram given in Fig. 2, identify the name of the circuit and calculate cut off frequency and pass band gain.

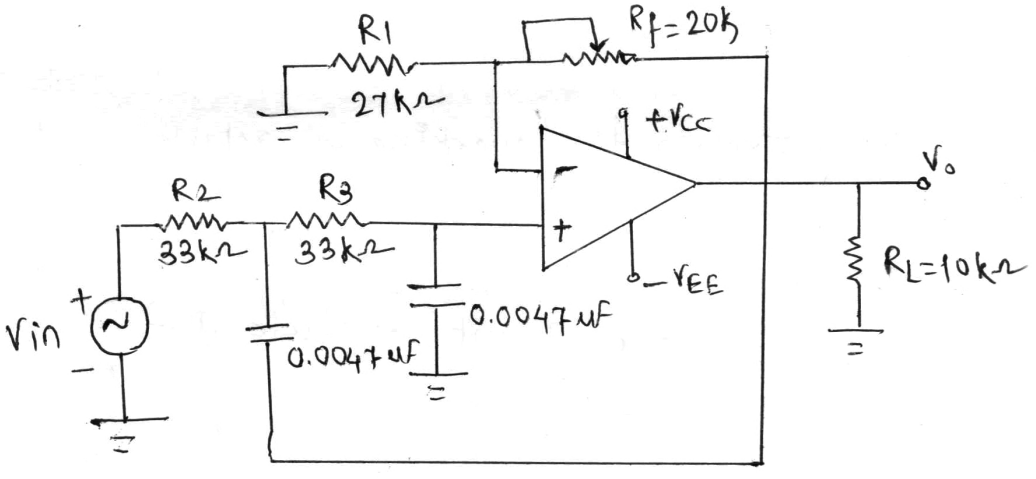


Fig. No. 2

22423

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Figures to the right indicate full marks.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Answer each next main Question on a new page.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State ideal and practical value of given parameters for Op-Amp IC-741

i) Input resistance

ii) Slew rate

b) Sketch the circuit diagram of Op-Amp based differential amplifier in open loop mode.

c) List four specifications of LM 324.

d) List any four merits of active filters over passive filters.

e) Draw sample and hold circuit using op-amp.

f) Define following terms related with phase lock loop (PLL)

i) Lock range

ii) Capture range

g) State the classification of filters based on frequency response.

Marks

2. Attempt any THREE of the following: **12**

a) State the difference between open loop and closed loop configuration of OP-AMP (any four points).

b) Draw a circuit diagram of V-I converter of floating load. Derive expression for its output.

c) Sketch the Timer IC 555 based monostable multivibrator with sutaible value of R and C for pulse width.
Refer Fig. No. 1 .

tp = 1 m sec.

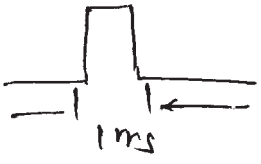


Fig. No. 1.

d) Explain virtual ground concept. In which basic amplifier virtual ground is present.

3. Attempt any THREE of the following: **12**

a) If $R_1 = 2\,k\Omega$, $R_F = 100\,k\Omega$, $V_{CC} = \pm 15V$ and rms input voltage $V_i = 20\,mV$. Calculate the output voltage in inverting and non-inverting mode.

b) Explain the operation of window detector with neat sketch and its input and output waveforms.

c) Identify and draw the Op-Amp based filter circuit to fullfill following frequency response. Refer Fig. No. 2.

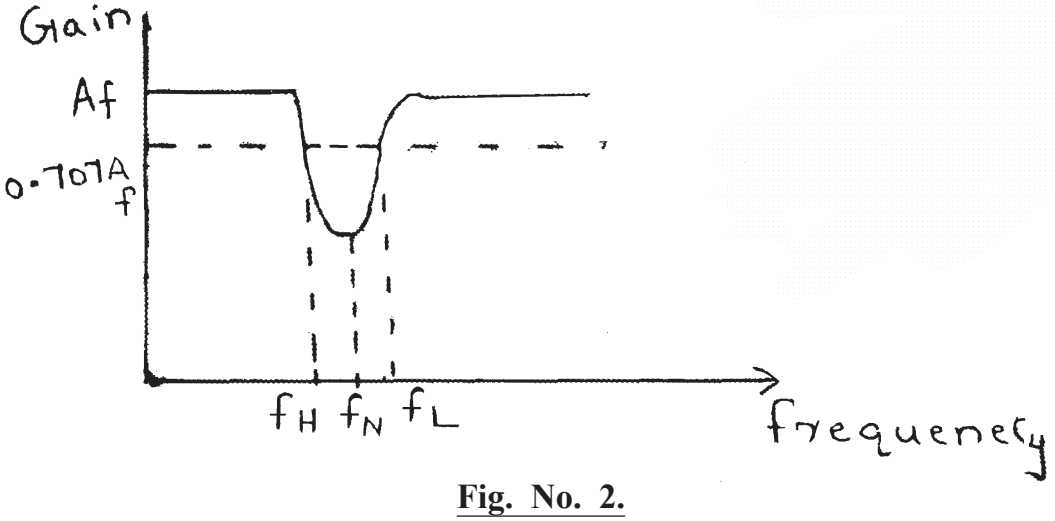


Fig. No. 2.

d) Draw the block diagram of PLL and state the function of each block.

Marks

4. Attempt any THREE of the following: **12**

a) Draw the circuit diagram to generate the following output using op-amps.
$V_0 = 3V_1 + 2V_2 - 4V_3$: V_1, V_2, V_3 are input voltages.

b) Define the following parameters of op-amp
i) Input bias current
ii) Input offset current
iii) Slew rate
iv) CMRR

c) Sketch the diagram of voltage follower. Why it is called voltage follower. State its one application.

d) Sketch the op-amp based Wein Bridge Oscillator for frequency = 1 KHz.

e) For IC 555 configured as astable multivibrator $R_1 = 5.6\,k\Omega$, $R_2 = 2.7\,k\Omega$ and $C = 0.1\ \mu F$. Find the frequency of oscillation and duty cycle. Sketch its output waveforms.

5. Attempt any TWO of the following: **12**

a) Identify waveform shown in Figure No. 3. Name the circuit to obtain the above waveform. Sketch the circuit diagram for it.

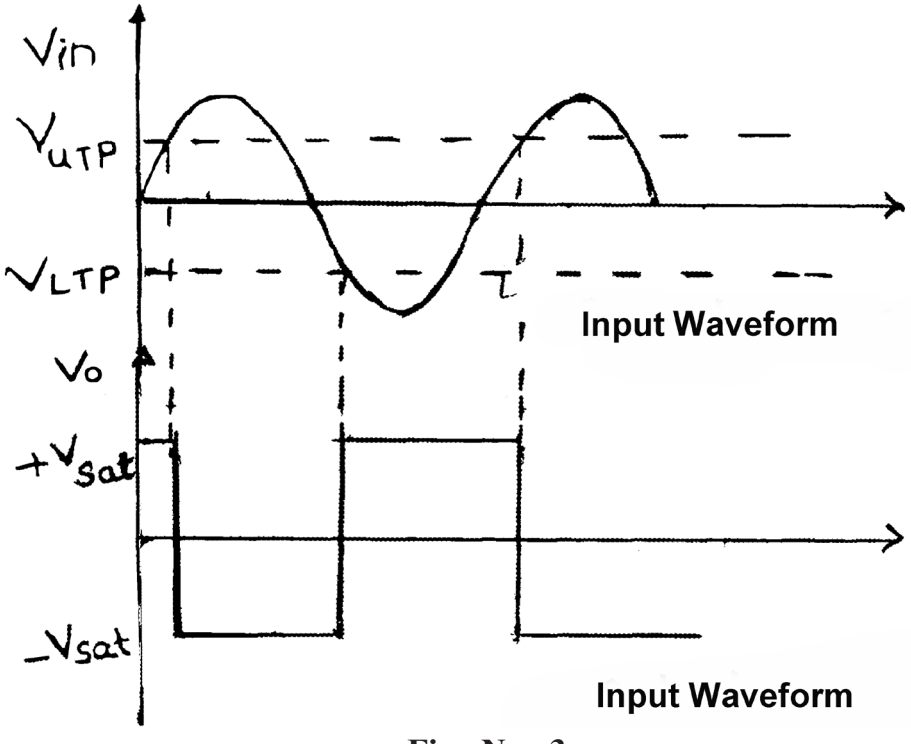


Fig. No. 3

P.T.O.

Marks

b) Design a bandpass filter for F_L = 100 Hz, F_H = 1 KHz and passband gain = 4.

c) Sketch output signal along with input signal as sine wave of 2v peak to peak for following Op-Amp based circuits with ideal conditions.

i) Inverting amplifier with gain 5

ii) Positive peak detector

iii) Active integrator

iv) Non-inverting zero crossing detector

v) Non-inverting unity gain amplifier

vi) Active differentiator

6. Attempt any <u>TWO</u> of the following: **12**

a) For the given equation sketch the circuit diagram and output waveforms for square wave input.

$$V_0 = - R_F \; C_1 \; \frac{d}{dt}(Vin)$$

b) Explain the operation of instrumentation amplifier using three op-amps with neat sketch.

c) Design a second order low pass butter worth filter with a cut-off frequency 1.6 KHz. Sketch the designed circuit and its frequency response.

———

17445

21718

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Define:

1) Slew rate

2) CMRR

(ii) Draw circuit diagram of basic integrator using Op-Amp.

(iii) Draw pin diagram of IC LM-324.

(iv) State the need of signal processing (any two points)

(v) Draw sample and hold circuit using Op-Amp.

(vi) Give classification of filters.

Marks

(vii) Draw circuit diagram of narrow band pass filter using Op-Amp.

(viii) State functions of following pins of : IC 555

1) Threshold

2) Discharge

b) **Attempt any TWO of the following:** **8**

(i) Describe the function of intermediate stage and output stage of Op-Amp with its block diagram.

(ii) State ideal and practical values of any four parameters of Op-Amp.

(iii) Draw the circuit diagram of level-shifting stage of Op-Amp and explain.

2. Attempt any FOUR of the following: **16**

a) Explain the concept of virtual ground and virtual short with reference to Op-Amp.

b) Compare open-loop and closed loop configuration of Op-Amp (any four points)

c) Derive expression for gain of closed loop inverting amplifier.

d) Derive the expression for output of differentiator with neat circuit diagram.

e) Design and draw the circuit for the following operation using Op-Amp. $V_0 = -(V_1 + V_2 + V_3)$

f) Suggest Op-Amp based circuit to convert rectangular to saw-tooth wave and draw the circuit diagram with input and output waveform.

Marks

3. Attempt any FOUR of the following: **16**

a) Explain the operation of instrumentation amplifier using 3 Op-Amps.

b) Draw V-I converters with grounded load and derive expression for its output.

c) State the need of phase detector and draw its circuit diagram.

d) Draw and describe following Op-Amp based operation using log and antilog amplifier. $V_0 = V_1 \times V_2$.

e) Draw circuit diagram and input output waveforms of window detector.

f) Describe the operation of Op-Amp based schmitt trigger with neat circuit diagram.

4. Attempt any FOUR of the following: **16**

a) Draw circuit diagram and input output waveform of ZCDs.

b) Design and draw high pass filter with cut off frequency 2 KHz and passband gain of 2.

c) State merits and demerits of active filters over passive filters (2 each)

d) Explain the operation of wide bandpass filter with the help of neat circuit diagram.

e) Describe Notch filter with neat circuit diagram.

f) Define with respect to filters:

(i) Roll off rate

(ii) BW

(iii) Q-factor

(iv) Stop-band

Marks

5. Attempt any FOUR of the following: **16**

a) Describe the operation of phase-detector and VCO in PLL.

b) Draw neat block diagram of IC 555 and give function of each pin.

c) Describe the operation of touch-plate switch using IC 555 with neat diagram.

d) Explain the operation of frequency divider using IC 555.

e) Draw and describe the block diagram of PLL.

f) Define and state the expression for lock range and capture range of PLL.

6. Attempt any FOUR of the following: **16**

a) Describe VCO using IC 555 with neat circuit diagram.

b) Draw and explain astable multivibrator using IC 741.

c) Design manostable multivibrator with T_P = 1 ms using IC 555.

d) Design wein bridge oscillator for 1 kHz frequency using Op-Amp. Draw designed circuit.

e) Draw and describe operation of bistable multivibrator using Op-Amp.

f) How overall phase shift is achieved in phase shift oscillator using Op-Amp? Draw its circuit diagram.

———

17445

11819

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Define –

(1) CMRR

(2) Input offset voltage

(ii) Draw circuit diagram of basic integrator using op-amp.

(iii) State the need of signal conditioning.

(iv) List any four specification of IC LM324.

(v) Draw voltage to current converter with floating load.

(vi) Define –

(1) Q factor of filter

(2) Roll of rate

(vii) Draw circuit diagram of narrow band pass filter using op-amp.

(viii) Draw pin diagram of IC555.

Marks

b) **Attempt any TWO of the following:** **8**

(i) Draw block diagram of op-amp. Describe the function of input stage and level shifting stage.

(ii) Compare ideal and practical op-amp values w.r.t.

(1) SVRR

(2) Input offset voltage

(3) Input offset current

(4) Slew rate

(iii) Draw dual input unbalanced output differential amplifier. State use of this stage.

2. Attempt any FOUR of the following: **16**

a) Derive the equation of virtual ground concept in op-amp.

b) Derive closed loop Inverting amplifier using op-amp and derive expression for its gain.

c) Design a circuit that convert square wave to triangular wave. Draw input - output waveforms.

d) For unity gain amplifier if V_{in} = +5V. What will be the output voltage? Draw the circuit diagram of unity gain amplifier.

e) Draw basic differentiator. Derive the expression for relation between its input and output.

f) Why offset nulling is required? Explain with circuit diagram.

3. Attempt any FOUR of the following: **16**

a) State the need of peak to peak detector and draw its circuit diagram.

b) Draw and explain circuit diagram of antilog amplifier.

c) Draw and explain V to I converter with grounded load.

d) Draw circuit diagram and input-output waveforms of inverting ZCD and non-inverting ZCD (Zero Crossing Detector)

e) List any four advantages and four applications of instrumentation amplifier.

f) Draw and explain sample and hold circuit using op-amp.

Marks

4. Attempt any FOUR of the following: **16**

a) Give classification of filters on the basis of –

(i) Components used

(ii) Frequency range

(iii) Frequency response

(iv) Nature of passband and stopband

b) Design second order low pass filter to get pass band gain two and cut off frequency 1 KHz.

c) Draw the circuit of wide band pass filter. Draw its frequency response characteristics.

d) Draw notch filter. Explain with characteristics.

e) Draw first order high pass filter and explain with characteristics.

f) Explain why active filter is better than passive filter.

5. Attempt any FOUR of the following: **16**

a) Draw and describe the operation of water level controller using IC555.

b) Draw the block diagram of IC555. State the function of both internal transistors in IC555.

c) Describe with the help of block diagram, the operation of FM demodulator using PLL.

d) Draw P.L.L. transfer curve. Explain –

(i) Capture range

(ii) Lock range

e) Explain how monostable multivibrator can be used as frequency divider.

f) Draw and describe the operation of touch plate switch using IC555.

Marks

6. Attempt any FOUR of the following: **16**

a) Explain the working of IC555 as schmitt trigger. Draw circuit diagram and output waveforms.

b) Draw and describe operation of Bistable multivibrator using op-amp.

c) Design and draw op-amp based wien bridge oscillator for frequency 1 KHz.

d) Explain principle of oscillator with block diagram.

e) Give advantages and disadvantages of wien bridge oscillator.

f) Draw the circuit diagram of phase shift oscillator using IC-741. State any two applications of it.

———

17445

11718

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) State ideal and typical values of

1) slew rate

2) CMRR

(ii) State the need of signal conditioning (two points)

(iii) List specification of IC LM 324.

(iv) Draw circuit diagram of basic differentiator using OP-AMP.

(v) Draw input and output waveform for active integrator for square wave input.

(vi) Define the following wr. to filter:

1) Q factor

2) roll off rate

Marks

(vii) State the applications of PLL.

(viii) Define:

1) Output voltage swing

2) SVRR

b) **Attempt any TWO of the following:** **8**

(i) Draw block diagram of op-amp and describe the functions of constant current source and output stage.

(ii) Draw ideal and practical voltage transfer characteristics of op-amp.

(iii) Draw dual input unbalanced output differential amplifier and state ideal characteristics of op-amp.

2. Attempt any FOUR of the following: **16**

a) Describe virtual ground and virtual short concept with reference to op-amp.

b) Draw closed loop inverting amplifier using op-amp and derive expression for its gain.

c) Draw the circuit diagram and output waveform for sine and square wave input for output voltage.

$$V_0 = -\frac{1}{RC}\int_0^t V_{in}\,dt + C$$

d) Using OP-AMP, draw the circuit of show the output $V_0 = 5(V_1 - 4V_2)$ where V_1 and V_2 are input voltages.

e) If $R_1 = 3\ k\Omega$, $R_F = 120\ k\Omega$, $V_{CC} = \pm 15\ V$ and rms input voltage Vi = 50 mV. Calculate output voltage in inverting and non-inverting Amplifier of op-amp.

f) Draw and explain Basic Integrator using op-amp.

Marks

3. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram of instrumentation amplifier with transducer bridge and describe the operation of it to obtain output voltage.

b) Draw and explain the circuit of V to I converter with floating load.

c) Draw and describe following op-amp based operation using log and antilog amplifier. $V_0 = V_1 \times V_2$

d) Explain working of active negative peak detector with neat circuit and waveforms.

e) Describe the operation of ZCD with neat circuit diagram and waveforms.

f) Draw circuit diagram and input output waveforms of op-amp based Schmitt trigger.

4. Attempt any FOUR of the following: **16**

a) Describe the operation of non-inverting comparator using op-amp with waveforms.

b) Design a first order low pass filter with 10 kH_z cut off frequency and pass band gain 2.

c) State two merits and two demerits of active filters.

d) Classify filters based on

(i) Frequency response

(ii) Components used

(iii) Frequency range

(iv) Nature of pass band and stop band.

e) Draw the second order high pass filter and describe its operation.

f) Draw and explain the circuit of notch (narrow band eject) filter.

Marks

5. Attempt any FOUR of the following: **16**

a) Draw the functional block diagram of Timer IC 555 and explain each block.

b) Draw block diagram and transfer characteristics of PLL.

c) Draw and explain the working of FM demodulator using PLL.

d) Describe the operation of phase detector and role of VCO in PLL.

e) Design an Astable multivibrator using IC 555 timer for a frequency of 2 KHz.

f) Describe the application of IC 555 as touch plate switch with circuit diagram.

6. Attempt any FOUR of the following: **16**

a) Draw a neat circuit diagram of VCO using IC 555 and explain its working.

b) Draw and explain the working of phase shift oscillator using IC 741.

c) Draw the circuit diagram of bistable multivibrator using op-amp and describe its working.

d) Design op-amp based Wein Bridge Oscillator for frequency of 1 KHz.

e) Draw the circuit of astable multivibrator using IC 555 and describe its working.

f) Draw circuit diagram of Schmitt trigger using IC 555.

17445

16172

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) State ideal and typical values of:

1) Slew Rate

2) CMRR

(ii) Draw circuit diagram of non-inverting adder with 3 inputs.

(iii) Draw pin diagram of IC LM 324.

(iv) State the need of signal conditioning and signal processing.

(v) State basic difference between active filter and passive filter.

(vi) Draw the pin diagram of IC 555.

(vii) Define multivibrator and give its classification.

(viii) Classify filters based on frequency response.

Marks

b) **Attempt any <u>TWO</u> of the following:** **8**

(i) Draw block diagram of OPAMP and state the function of DC level shifting stage and output stage.

(ii) Draw dual input balanced output differential amplifier and describe the operation of it.

(iii) Draw ideal and practical voltage transfer characteristics of OP-AMP.

2. Attempt any <u>FOUR</u> of the following: **16**

a) Draw closed loop inverting amplifier using OPAMP and derive expression for it's gain.

b) Compare open loop and closed loop configuration of OP-AMP with respect to :

(i) Circuit diagram

(ii) Gain

(iii) Bandwidth

(iv) Application

c) Describe virtual ground and virtual short concept with reference to OP-AMP.

d) Draw the circuit of basic differentiator. Draw output waveforms for sine and square wave input.

e) If $R_1 = 2K\Omega$, $R_F = 100\ K\Omega$, $V_{cc} = \pm 15V$ and rms input voltage $V_i = 50$ mV. Calculate output voltage in inverting and non inverting mode.

f) Using OPAMP, draw the circuit to show the output $V_0 = 5(V_1 - 4V_2)$ Where V_1 and V_2 are input voltages.

Marks

3. Attempt any FOUR of the following: **16**

a) Describe the operation of instrumentation amplifier using 3 - Op Amps with neat circuit diagram.

b) Draw and explain the circuit of V to I converter with floating load using OP-AMP.

c) Describe the operation of logarithmic amplifier with neat circuit diagram.

d) Describe the operation of OP-AMP based schmitt trigger for sine to square wave conversion with the help of circuit diagram.

e) Explain working of active negative peak detector with neat circuit and waveforms.

f) Draw the circuit of window detector. Describe its operation with waveform.

4. Attempt any FOUR of the following: **16**

a) Write the comparison between comparator and schmitt trigger. (four points)

b) Design first order low pass filter with 1 KHz cut off frequency and pass band gain 3.

c) Draw the second order high pass filter and describe its operation.

d) Draw the circuit and frequency response of wide band reject filter and narrow band reject filter.

e) Draw the circuit diagram of second order high pass Butterworth filter with frequency response. Give expression for cut off frequency and gain.

Marks

f) Draw the circuit diagram of OPAMP based filter circuit which fulfill following response. Refer Figure No. 1.

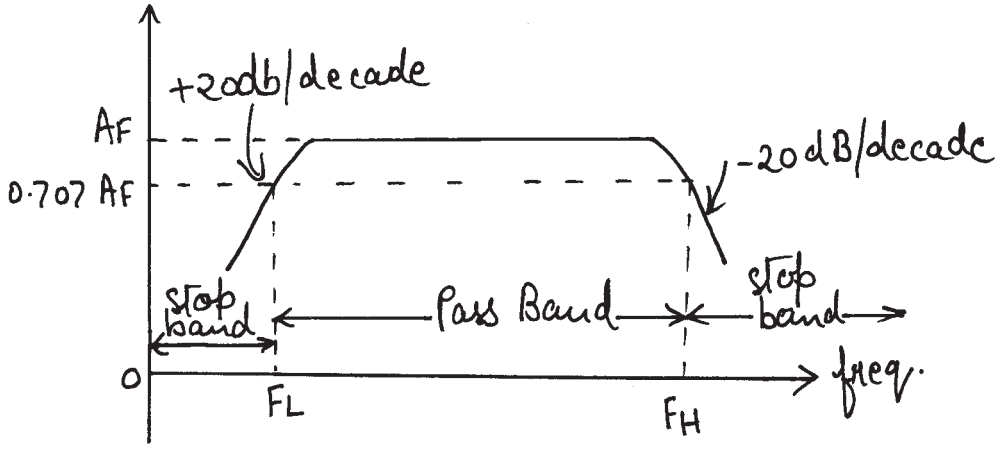


Fig. No. 1

5. Attempt any FOUR of the following: **16**

a) Draw the functional block diagram of timer IC 555. State the function of internal pnp transistor in IC 555.

b) Draw the block diagram of PLL and describe the function of each block.

c) Draw transfer characteristics of PLL. Define:

(i) Lock range and

(ii) Capture range of PLL.

d) Draw the circuit diagram of touch plate switch using IC 555 and describe its operation.

e) Draw and describe the operation of water level controller using IC 555.

f) Describe with the help of block diagram the operation of FM demodulator using PLL.

Marks

6. Attempt any FOUR of the following: **16**

a) Describe the working of voltage controlled oscillator using IC 741.

b) Draw the circuit diagram of Wein bridge oscillator using IC 741 and give expression for frequency of oscillations.

c) Design and draw monostable multtivibrator using IC555 with T_P = 1ms.

d) Draw and describe operation of astable multivibrator using OPAMP.

e) Draw and explain the working of phase shift oscillator using IC 741.

f) Define:

(i) Q factor of filter

(ii) Pass band of filter

Give the relation between roll off rate and order of filter.

17445

16117

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Define:

1) SVRR

2) Slew rate

(ii) Draw practical integrator using op-amp.

(iii) Give applications of Instrumental Amplifier.

(iv) State the need of signal conditioning.

(v) State the use of Schmitt trigger.

(vi) Give classification of filters.

(vii) Define:

1) Roll off rate

2) Bandwidth

(viii) Draw pin diagram of IC 555.

Marks

b) **Attempt any <u>TWO</u> of the following:** **8**

(i) Draw balanced input unbalanced output amplifier. State the use of / need of this stage.

(ii) Compare ideal and practical op-amp values w.r.t.

1) PSRR

2) gain bandwidth product

3) output offset voltage.

4) input bias current.

(iii) What is the need of complementary push-pull amplifier. Draw the circuit and explain.

2. Attempt any <u>FOUR</u> of the following: **16**

a) Derive the equation for virtual ground concept in op-amp.

b) For unity again amplifier if Vin = +2V. What will be the output voltage? Draw the circuit diagram of unity gain amplifier.

c) Design a circuit that gives voltage gain of $\left(1+\frac{2}{3}\right)$.

d) Why offset nulling is required? Explain how is it done by using pin 1 and pin 5 with proper circuit diagram.

e) Design a circuit that convert square wave to spikes. Draw input-output waveforms.

f) Design the circuit to get the output expression $V_o = -(2V_1 + V_2 + 5V_3)$

3. Attempt any <u>FOUR</u> of the following: **16**

a) Draw circuit and derive equation of 2 op-amp instrumentation amplifier.

b) Draw V-I converter with grounded load. Derive the equation for 'VO'

c) Draw temperature compensated log amplifier. State the equation for output voltage 'VO2'.

d) Draw circuit diagram of schmitt trigger using op-amp.

e) Explain antilog amplifier with proper circuit diagram.

f) Draw and explain 7V to 12V window detector.

Marks

4. Attempt any FOUR of the following: **16**

a) Design a comparator to detect -2 volt dc.

b) Design second order low pass filter to get pass band gain 2 and cut off frequence 1 KHz.

c) Design a band reject filter to reject band of 10 KHz to 20 KHz.

d) Draw high pass filter and explain with characteristics.

e) Explain how active filter is better than passive filter.

f) Draw notch filter. Explain with characteristics.

5. Attempt any FOUR of the following: **16**

a) Draw circuit diagram of IC555 as water level controller. Explain its working.

b) Design AMV for 10 KHz frequency and 60% duty cycle.

c) Draw block diagram at IC 555. Explain the use of pin 2 and 6.

d) Explain operation of PLL as multiplier.

e) Explain the operation of VCO (Voltage Controlled Oscillator) block in IC 565.

f) Draw PLL transfer curve. Explain

(i) capture range

(ii) lock range

6. Attempt any FOUR of the following: **16**

a) Draw triangular wave generator. Draw its waveform of it.

b) Give advantages and disadvantages of wien bridge oscillator.

c) Explain working of square wave generator using op-amp, with proper circuit.

d) Explain principle of oscillator with block diagram.

e) Draw and explain bistable multivibrator.

f) Explain working of monostable multivibrator using op-amp.

17445

21314

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(7) Preferably write the answers in sequential order.

Marks

1. a) **Attempt any SIX of the following:** **12**

i) Draw ideal and practical transfer characteristics of op-Amp.

ii) Draw block diagram of op-Amp. State function of each block.

iii) Draw pin diagram of IC LM324.

iv) State functions of following pins of IC555

1) Control

2) Trigger

v) State the function of filter. Draw response of high pass filter.

Marks

vi) Draw inverting zero crossing detector and its waveforms with circuit diagram.

vii) Compare open loop and closed loop configuration on basis of

1) Gain

2) Bandwidth.

viiii) Define sample and hold period with reference to S/H circuit.

b) **Attempt any <u>TWO</u> of the following:** **08**

i) Draw circuit diagram to generate the following output using op-Amp: $V_0 = 3V_1 + 2V_2 - 4V_3$.
V_1, V_2, V_3 are input voltages.

ii) Draw single i/p balanced o/p differential amplifier and define the term balanced o/p and unbalanced o/p.

iii) Draw block diagram of frequency multiplier and describe its working using PLL.

2. Attempt any <u>FOUR</u> of the following: **16**

a) Draw instrumentation amplifier using 3 op-Amps. State its voltage gain equation.

b) Draw closed loop Inverting amplifier and derive expression for voltage gain.

c) State ideal and typical value of the following parameters of IC741.

i) Supply voltage rejection ratio SURR

ii) Common mode rejection ratio (CMRR)

iii) Slew rate

iv) Unity gain bandwidth.

Marks

d) Draw basic integrator and derive the expression for its output voltage.

e) Draw circuit diagram of V-I converter of floating load. Derive expression for its output.

f) Draw circuit diagram of astable M/V using IC555. State its frequency equation, duty cycle, time period.

3. Answer any <u>FOUR</u> of the following: **16**

a) Draw phase shift oscillator using IC741. Explain the function of each component in it. State the equation for o/p frequency.

b) Describe the concept of virtual ground with reference to op-Amp.

c) Draw window detector using op-Amp and give transfer characteristics.

d) Compare comparator and schmitt trigger on basis of

i) Definition

ii) Feedback

iii) Hysteresis

iv) External reference voltage.

e) What do you mean by active filter. State its advantages over passive filters (any two). Define passband and stop band w. r. to filters.

f) Draw and explain operation of phase detector.

Marks

4. Attempt any FOUR of the following: **16**

a) Design second order butterworth high pass filter of cut off frequency 10KHz.

b) Draw block diagram of PLL as a FM demodulator. Explain function of each block.

c) Draw circuit diagram of a logarithmic amplifier. State its equation for output voltage.

d) Compare active integrator and active differentiator on basis of

i) Output voltage

ii) Feedback element

iii) Application in filter.

iv) Gain

e) Draw and explain touch plate switch using IC555.

f) Draw I-V converter using op-Amp. Derive expression for its output voltage.

5. Attempt any FOUR of the following: **16**

a) Draw circuit diagram of op-Amp based filter circuit which provides the following response. Describe its operation. (Refer Figure No. 1)

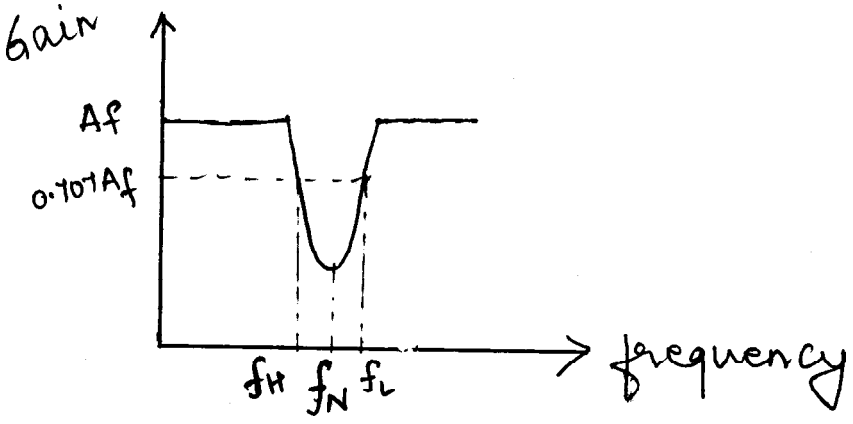


Fig. No. 1

Marks

b) Determine pulse width of monostable M/V using IC555 timer for c = 0.047μF and R = 56K.

c) For the given circuit, obtain the output voltage. (Refer Figure No. 2)

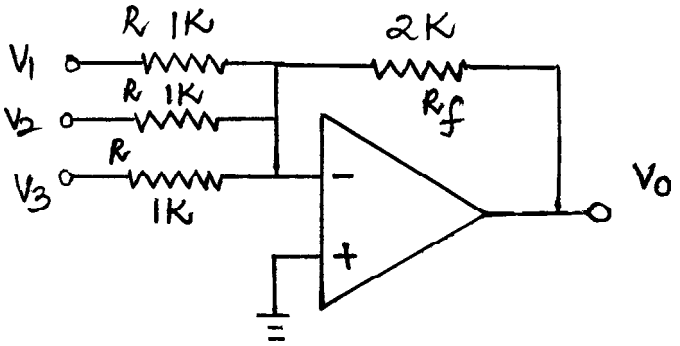


Fig. No. 2

d) Draw and explain operation of wide band filter with help of circuit diagram.

e) Identify the circuit, redraw it. Draw the o/p of the circuit. State how will you obtain it. (Refer Figure No. 3)

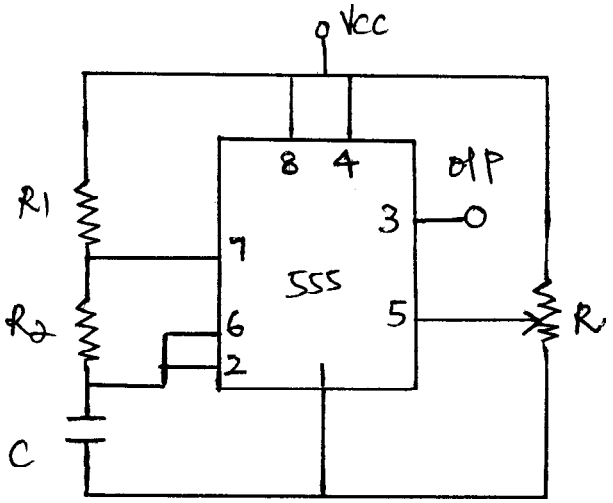


Fig. No. 3

f) State the need of peak to peak detector. Draw circuit diagram.

P.T.O.

Marks

6. Attempt any <u>FOUR</u> of the following: 16

a) Design a circuit to obtain the output voltage $V_0 = 10(V_1 - V_2)$.

b) What is PLL. Explain its operation with a block diagram.

c) Define Multivibrator. State the types of multivibrator. Which M/V can be used as a flipflop. Draw the circuit diagram.

d) Draw circuit diagram of first order low pass filter. Give expression of cut off frequency and gain.

e) For a schmitt trigger with op-Amp find Threshold Voltage V_{UTP} and V_{LTP} when $R_2 = 150K\Omega$, $R_1 = 100K\Omega$, $V_{in} = 500mV$, Sine wave saturation voltage = $\pm 15V$.
Also find hysteresis voltage.

f) Define:

i) Input offset voltage.

ii) Input offset current.

iii) Input bias current.

iv) Output offset voltage.

17445

14115

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) State ideal and typical values of

1) Input offset voltage

2) CMRR

(ii) Draw circuit diagram of subtractor using op amp.

(iii) State the need of signal conditioning and signal processing.

(iv) Draw pin diagram of IC LM 324.

(v) Draw circuit diagram of inverting comparator.

(vi) Define

1) Cut off frequency

2) Roll off rate with reference to filter.

Marks

(vii) State four merits of active filter over passive filter.

(viii) State functions of following pins of IC 555

1) Pin No. 2 Trigger i/p

2) Pin No. 6 Threshold input

b) **Attempt any <u>TWO</u> of the following:** **8**

(i) Draw block diagram of Op amp and describe the function of input stage and DC level shifting stage.

(ii) Define the following parameters of Op amp.

1) Input bias current

2) Input offset current

3) Slew rate

4) CMRR.

(iii) Draw dual input balanced output differential amplifier and describe the operation of it.

2. Attempt any <u>FOUR</u> of the following: **16**

a) Draw open loop inverting and noninverting amplifiers circuit diagrams.

b) Draw closed loop inverting amplifier using Op amp and derive expression for its gain.

c) Compare open loop and closed loop configuration of Op amp on following basis.

(i) Circuit diagram

(ii) Gain

(iii) Bandwidth

(iv) Application.

d) Draw the circuit of basic differentiator and derive the output expression.

e) Design the circuit to get the output expression
$V_0 = -(2V_1 + V_2 + 5V_3)$.

f) Suggest Op amp based circuit to convert square wave to triangular wave. Draw the circuit diagram with input and output waveforms.

Marks

3. Attempt any FOUR of the following: **16**

a) Draw the circuit of V to I converter with floating load and describe its operation.

b) Describe the operation of instrumentation amplifier using two Op amp with neat circuit diagram.

c) Draw the circuit of zero crossing detector. Draw its input and output waveforms.

d) Draw the circuit of window detector. Describe operation of it.

e) Describe the operation of logarithmic amplifier with neat circuit diagram.

f) Describe the working of sample and hold circuit with circuit diagram.

4. Attempt any FOUR of the following: **16**

a) Compare comparator and regenerative comparator (Schmitt trigger) on four points.

b) Design first order low pass filter with 1 KHz cut off frequency and pass band gain 3.

c) Compare active filters and passive filters on four points.

d) Draw the second order high pass filter and describe its operation.

e) Describe the working of band pass filter with neat circuit diagram.

f) Draw the circuit of notch (narrow band reject) filter and describe its operation.

Marks

5. Attempt any FOUR of the following: **16**

a) Draw the functional block diagram of Timer IC 555.
State function of internal resistors of 5kΩ in IC 555.

b) Describe the application of IC 555 as touch plate switch. Draw the circuit diagram of it.

c) Describe the operation of frequency divider using IC 555 with suitable diagram.

d) Draw block diagram of PLL and describe the function of each block.

e) Explain the working of PLL as frequency multiplier.

f) Draw transfer characteristics of PLL. Define

(i) Lock range and

(ii) capture range of PLL.

6. Attempt any FOUR of the following: **16**

a) Draw astable multivibrator using IC 741 and state the formula for calculating frequency of output.

b) Draw circuit diagram of schmitt trigger using IC 555 with its input and output waveforms.

c) Draw and explain the working of phase shift oscillator using IC 741.

d) Describe the working of voltage controlled oscillator using IC 555.

e) Draw the circuit of bistable multivibrator using IC 555 and describe its operation.

f) Describe the working principle of wien bridge oscillator using IC 741.

17445

21415

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Draw input and output waveform, when the input signal is applied to the inverting input terminal of OP-AMP.

(ii) Draw output waveforms for active differentiator for sine and square wave input.

(iii) State the need of signal conditioning and signal processing.

(iv) Draw pin diagram of IC LM324.

(v) Draw the output waveforms of inverting ZCD with sine wave input is $5V_{PP}$

(vi) Classify filters based on frequency response characteristics.

(vii) Give the relation between roll off rate and order of filter.

(viii) Define multivibrator and give its classification.

Marks

b) **Attempt any TWO of the following:** **8**

(i) Define the following parameters of OP-AMP and give their ideal values.

1) CMRR

2) Input offset voltage

3) Slew rate

4) Supply voltage rejection ratio

(ii) Draw the block diagram of OP-AMP. State the function of each block.

(iii) Draw ideal and practical voltage transfer characteristic of OP-AMP.

2. Attempt any FOUR of the following: **16**

a) Compare open loop and closed loop configuration of OP-AMP with respect to input resistance, output resistance, bandwidth and application.

b) Draw the circuit of OP-AMP without feedback in inverting mode. Derive the output voltage.

c) Design a circuit of OP-AMP for the following input and output waveforms. Refer Figure No. 1

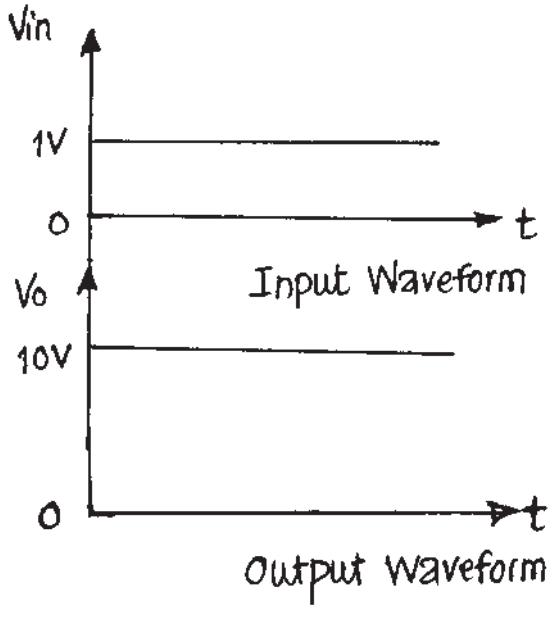


Fig. No. 1

Marks

d) Draw the circuit diagram and output waveform for sine and square wave input for output voltage:

$$V_0 = -\frac{1}{RC}\int_0^t Vindt + C$$

e) Using OP-AMP, draw the circuit to show the output $V_0 = 3(V_1 - 2V_2)$ where V_1 and V_2 are input voltages.

f) If $R_1 = 2\,K\Omega$, $R_F = 100\,K\Omega$, $V_{cc} = \pm 15V$ and rms input voltage, $V_i = 20mV$. Calculate output voltage in inverting and non-inverting mode.

3. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram of instrumentation amplifier using 3 OP-AMPs. Give the expression at the output of each OP-AMP.

b) Draw and explain the circuit of V to I converter with floating load using OP-AMP.

c) Draw the circuit diagram of sample and Hold circuit using OP-AMP.

d) Draw circuit diagram of temperature compensated log amplifier using OP-AMP.

e) Explain working of active negative peak detector with neat circuit and waveforms.

Marks

f) Identify the following waveforms. Label the circuit name and draw the circuit diagram for the same. (Refer Figure No. 2)

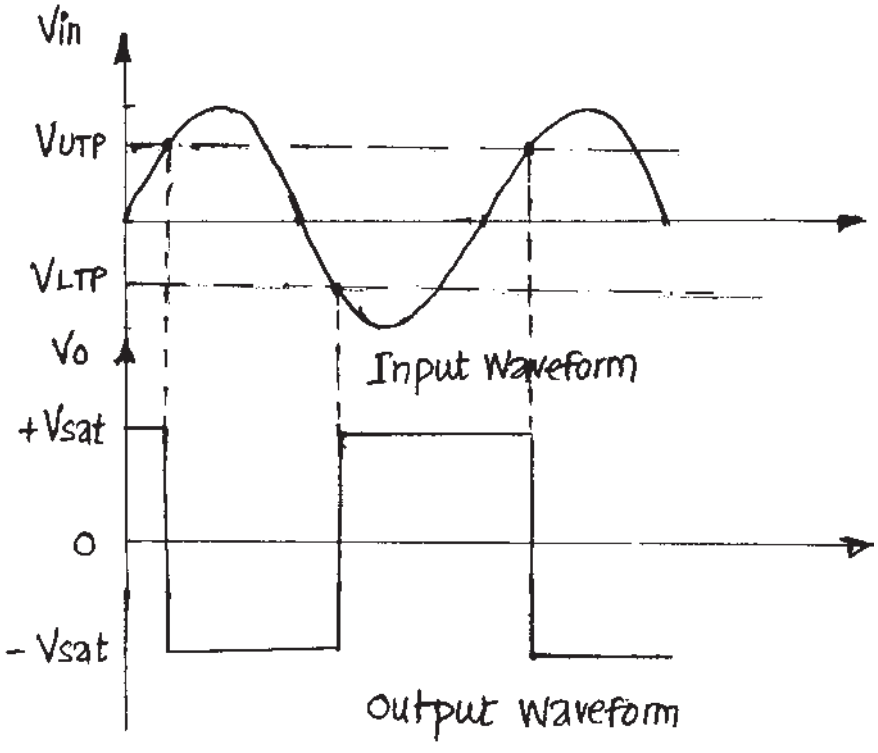


Fig. No. 2

4. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram and waveforms for non-inverting comparator using OP-AMP.

b) Draw the circuit diagram of second order high pass Butterworth filter with frequency response. Give expression for cut-off frequency and gain.

c) Design a first order Butterworth low pass filter for passband gain 2 and cut-off frequency 10 KHz.

Marks

d) State two merits and two demerits of active filters over passive filters.

e) Draw a neat circuit diagram of all pass filter and explain its working.

f) Suggest and draw OP-AMP based filter circuit to fullfill following response. (Refer Figure No. 3)

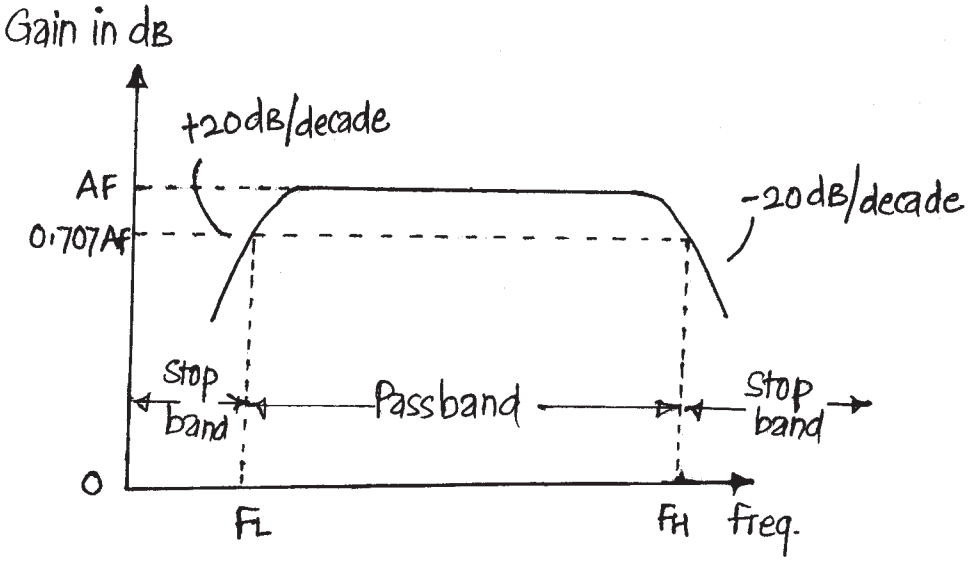


Fig. No. 3

5. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram of touch plate switch using IC 555 and describe its operation.

b) Calculate the value of UTP and LTP for Schmitt trigger using IC 555 if Vcc = 15V.

c) Design monostable multivibrator using IC 555 for pulse width t_p = 10 ms. Draw the designed circuit.

d) Draw and explain block diagram of PLL.

e) Draw and explain the working of FM demodulator using PLL.

f) Draw and explain the circuit diagram of multiplier using PLL.

Marks

6. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram of astable multivibrator using IC 741 and describe its working.

b) Draw the circuit diagram of Wein bridge oscillator using IC 741 and give expression for frequency of oscillation.

c) Draw the circuit diagram and waveforms of bistable multivibrator using IC 555.

d) Draw and explain the circuit diagram of phase shift oscillator using IC 741.

e) Draw the circuit diagram of monostable multivibrator using OP-AMP and describe its working.

f) Draw a neat circuit diagram of VCO using IC 555 and explain its working.

———————

17445

15116

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Preferably, write the answers in sequential order.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Draw equivalent circuit of an op - amp.

(ii) Draw circuit diagram of basic integrator using op - amp.

(iii) State the need of signal conditioning.

(iv) List any four specifications of LM 324.

(v) Draw diagram of non - inverting amplifier.

(vi) Define following terms related with filter.

1) Cut - off frequency

2) Stop band

(vii) Draw ideal and practical response of band reject filter with proper labelling.

(viii) Draw pin diagram of IC - 555.

Marks

b) **Attempt any TWO of the following:** **8**

(i) Define:

1) Supply voltage rejection ratio.

2) Input offset voltage

3) Slew rate

4) Input bias current

(ii) List the ideal characteristics of op - amp with their ideal values (any four).

(iii) Describe the term dual input balanced output differential amplifier and dual input unbalanced output differential amplifier and draw single input unbalanced output differential amplifier.

2. Attempt any FOUR of the following: **16**

a) Compare open loop and close loop configuration on the following basis

(i) Circuit diagram

(ii) Bandwidth

(iii) Gain

(iv) Applications

b) Draw diagram of voltage follower. Why it is called voltage follower? State its one application.

c) Describe the operation of instrumentation amplifier using three op - amp.

d) Draw the diagram of log amplifier using op - amp and derive expression for its output voltage.

e) Draw the circuit diagram of window detector and describe its operation.

f) Design and draw low pass filter with cut - off frequency 1 KHz and passband gain of 2.

Marks

3. Attempt any FOUR of the following: **16**

a) Design and draw the circuit for following operation using op - amp.

$$V_0 = V_1 + V_2 - 2V_3$$

b) Explain the concept of frequency compensation of op - amp and offset nulling.

c) Design the circuit to obtain output voltage $V_0 = -5 (V_1 + V_2)$. Draw the designed circuit.

d) Draw circuit diagram and input output waveforms of inverting ZCD and non-inverting ZCD. (zero crossing detector)

e) Draw circuit diagram of peak detector and explain with input output waveforms.

f) Draw circuit diagram and frequency response of wideband pass filter.

4. Attempt any FOUR of the following: **16**

a) Suggest the op - amp based circuit to perform below operation.

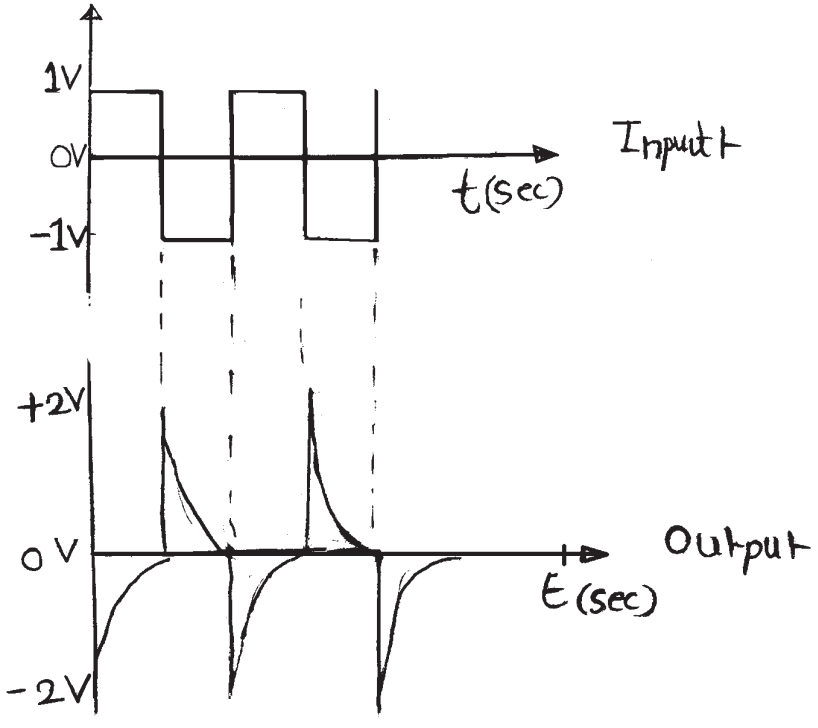


Fig. No. 1

Marks

b) Draw circuit diagram of current to voltage converter and derive the expression for its output.

c) Describe the operation of op - amp based schmitt trigger for sine to square ware conversion with the help of circuit diagram.

d) Suggest and draw op - amp based circuit using butterworth filter to fulfill following response.

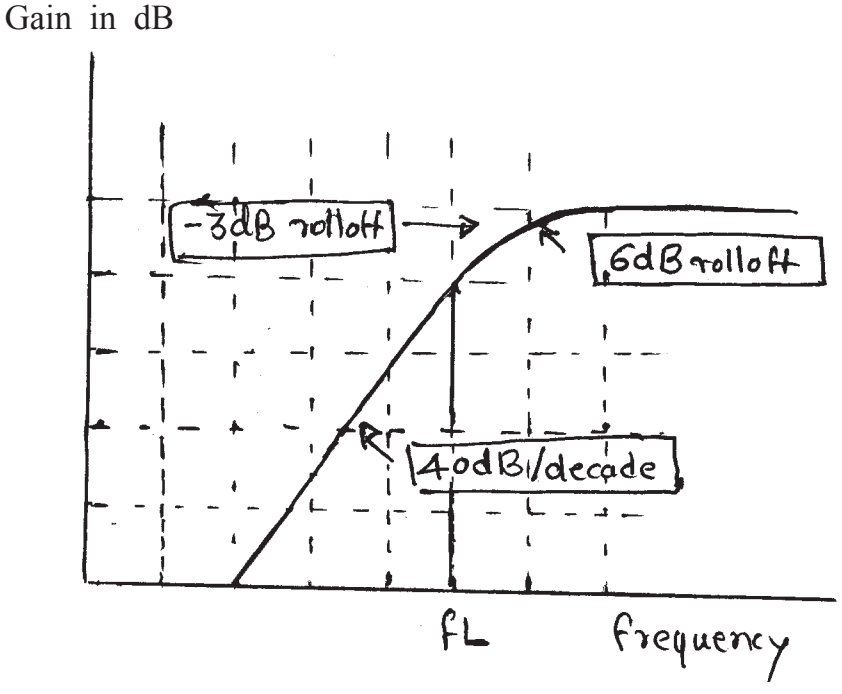


Fig. No. 2

e) Draw circuit diagram of active notch filter. Describe its operation.

f) Classify op - amp filters on following basis.

(i) Component used

(ii) Frequency range

(iii) Frequency response

(iv) Nature of passband and stop band

Marks

5. Attempt any FOUR of the following: **16**

a) Draw and describe the operation of touch plate switch using IC - 555.

b) Draw block diagram of SE 555. State function of both internal transistor in IC - 555.

c) Define and state the expression for lock range and capture range of PLL.

d) Define schmitt trigger. Draw schmitt trigger using IC - 555 Draw its hysterisis diagram.

e) Design and draw op - amp based phase shift oscillator for frequency 200 Hz.

f) For IC 555 configured as astable multivibrator. R_1 = 5.8 KΩ, R_2 = 2.8 KΩ and C = 0.1 μF. Find the frequency of oscillation and duty cycle. Draw output waveforms.

6. Attempt any FOUR of the following: **16**

a) Design and draw monostable multivibrator using IC 555 with T_P = 1 ms.

b) Describe with the help of block diagram the operation of multiplier using PLL.

c) Describe the operation of phase detector and role of vco in PLL.

d) Draw and describe wein bridge oscillator using op - amp.

e) Draw block diagram of vco using IC - 555. Describe how output frequency varies with variation in voltage applied to pin 5 of IC 555.

f) Draw and describe bistable multivibrator using IC - 555.

17445

15162

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) Define:

1) input bias current

2) input offset current

(ii) Draw ideal voltage transfer curve of an op-amp.

(iii) List any four specifications of ICLM 324.

(iv) Draw the circuit diagram of positive peak detector.

(v) Draw voltage to current converter with grounded load.

(vi) Define:

1) roll-off rate

2) order of filter

(vii) Draw circuit of notch filter.

(viii) State functions of following pins of IC555

1) Threshold

2) Discharge

Marks

b) **Attempt any TWO of the following:** **8**

(i) What is the use of level shifter stage? Draw its circuit diagram.

(ii) State ideal values of following parameters of op-amp as well as state typical values of following parameters of op-amp IC741.

(iii) Draw and explain ideal voltage transfer curve of op-amp.

2. Attempt any FOUR of the following: **16**

a) Compare open loop and closed loop configuration of op-amp on following basis.

(i) Circuit diagram

(ii) Gain

(iii) Bandwidth

(iv) Application

b) With neat sketch derive the expression for output voltage of non-inverting averaging amplifier.

c) With neat diagram explain the concept of frequency compensation and offset nulling.

d) Draw neat diagram of active integrator and obtain expression for output voltage.

e) Determine the output voltage for an open-loop differential amplifier with $V_1 = 1.2$ Vdc and $V_2 = 1$Vdc. Assume op-amp as μA741.

f) Construct and draw the circuit to get the output voltage $V_0 = 3V_1 + 2V_2$ where V_1 and V_2 are input voltages.

3. Attempt any FOUR of the following: **16**

a) Draw and explain sample and hold circuit using op-amp.

b) Compare between comparator and schmitt trigger (any four points)

c) State the needs of peak to peak detector and draw its circuit diagram.

d) State need of signal conditioning and signal processing. List any four applications of instrumentation amplifier.

Marks

e) Draw circuit diagram and input and output waveforms of inverting ZCD and non-inverting ZCD (zero crossing detector)

f) Draw and explain voltage to current converter with floating load. List its four applications.

4. Attempt any FOUR of the following: **16**

a) Design and draw low pass filter with cut off frequency 2kHz and passband gain of 2.

b) Design a first order low-pass butterworth filter with a passband gain of 2 and cut-off frequency of 2kHz. Draw the designed circuit.

c) Suggest and draw op-amp based circuit using butterworth filter to fulfill following response (Refer Figure No.1)

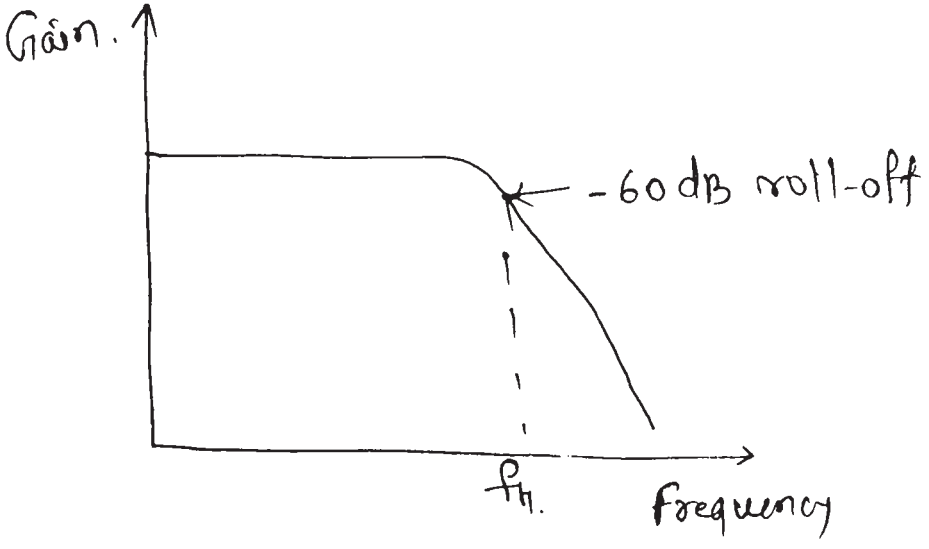


Fig. No. 1

d) Describe the operation of wide bandpass filter with the help of circuit diagram.

e) Draw only circuit of notch filter and write formula for notch frequency f_N.

f) Classify the filters on following basis:

(i) Components used

(ii) Frequency range

(iii) Frequency response

(iv) Nature of passband and stopband

Marks

5. Attempt any FOUR of the following: **16**

a) Describe the operation of phase detector and role of VCO in PLL.

b) Draw and describe the operation of water level controller using IC555.

c) Explain the use of PLL in FM detection.

d) Draw the pin diagram of IC555 and explain the function of various pins.

e) Explain how monostable multivibrator can be used as frequency divider.

f) Draw the transfer characteristics of PLL and explain.

6. Attempt any FOUR of the following: **16**

a) Draw the circuit diagram of square wave generator using IC555. State the purpose of external diode used in the circuit and state expression of its output frequency.

b) Draw the circuit diagram of phase shift oscillator using IC741 state any two applications of it.

c) Draw and describe the operation of astable multivibrator using op-amp.

d) Design and draw Op-Amp based Wein Bridge Oscillator for frequency 1kHz.

e) Explain the working of IC555 as a voltage controlled oscillator (VCO).

f) Explain the working of IC555 as Schmitt trigger. Draw the circuit diagram and sketch the output waveforms.