

# 22423

**21222**

**3 Hours / 70 Marks**

Seat No. 

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15 minutes extra for each hour

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- 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.

P.T.O.

2. Attempt any THREE of the following:

12

- State the difference between open loop and closed loop configuration of OP-AMP (any four points).
- Draw a circuit diagram of V-I converter of floating load. Derive expression for its output.
- Sketch the Timer IC 555 based monostable multivibrator with suitable value of R and C for pulse width.

Refer Fig. No. 1 .

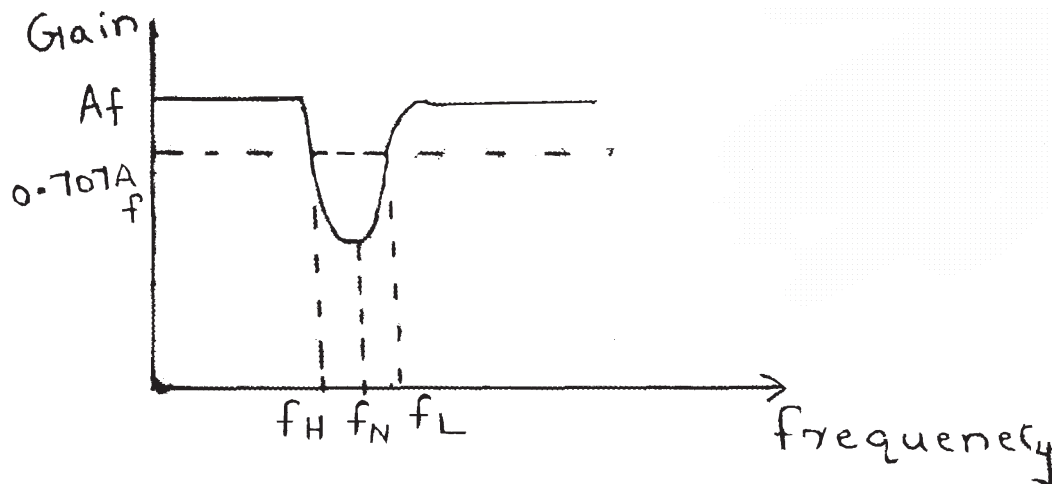
 $t_p = 1 \text{ msec.}$ Fig. No. 1.

- Explain virtual ground concept. In which basic amplifier virtual ground is present.

3. Attempt any THREE of the following:

12

- If  $R_1 = 2 \text{ k}\Omega$ ,  $R_F = 100 \text{ k}\Omega$ ,  $V_{CC} = \pm 15 \text{ V}$  and rms input voltage  $V_i = 20 \text{ mV}$ . Calculate the output voltage in inverting and non-inverting mode.
- Explain the operation of window detector with neat sketch and its input and output waveforms.
- Identify and draw the Op-Amp based filter circuit to fulfill following frequency response. Refer Fig. No. 2.

Fig. No. 2.

- Draw the block diagram of PLL and state the function of each block.

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  $R_1 = 5.6\text{k}\Omega$ ,  $R_2 = 2.7\text{k}\Omega$  and  $C = 0.1\ \mu\text{F}$ . 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.

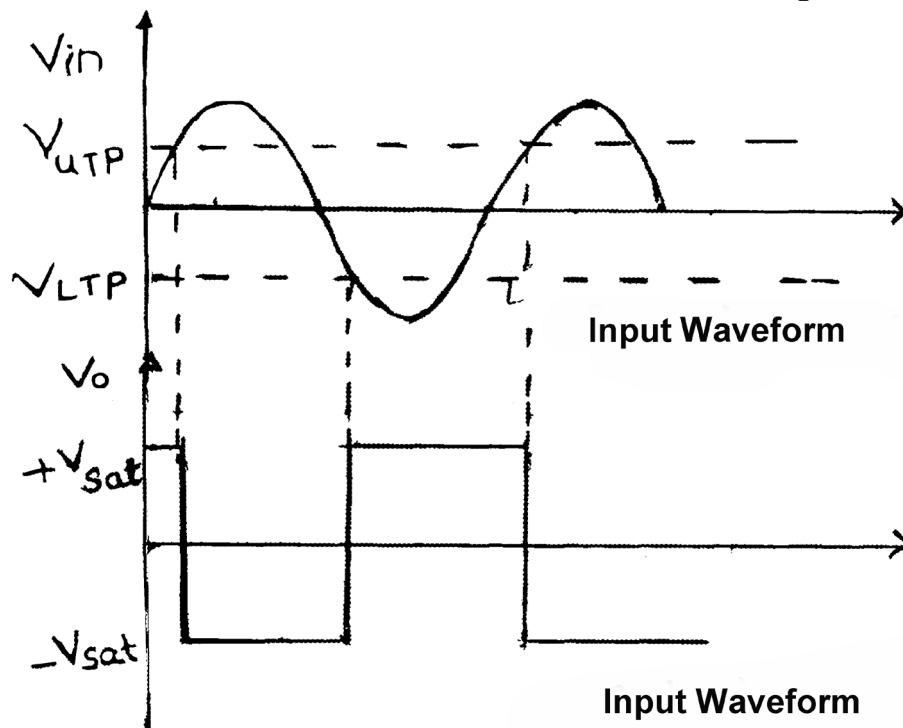


Fig. No. 3

P.T.O.

- 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.
- Inverting amplifier with gain 5
  - Positive peak detector
  - Active integrator
  - Non-inverting zero crossing detector
  - Non-inverting unity gain amplifier
  - Active differentiator

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

**12**

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

$$V_0 = -R_F C_1 \frac{d}{dt}(V_{in})$$

- 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 1.6KHz. Sketch the designed circuit and its frequency response.
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