

**III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23****ANALOG ICs AND APPLICATIONS**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

\*\*\*\*\*

**UNIT-I**

1. a) What is an operational amplifier? Give its symbol and also draw its electrical equivalent circuit. [7M]
- b) Compare ideal and practical OP-AMP parameters. [7M]
- (OR)
2. a) Define the terms: SVRR, Input bias current, Input offset voltage, Gain bandwidth product. [7M]
- b) Explain the IC 741 op-amp block diagram & its features in detail. [7M]

**UNIT-II**

3. a) What are the advantages of instrumentation amplifier? Derive an expression for the transfer function of an instrumentation amplifier. [7M]
- b) For the non-inverting a.c amplifier  $R_{in} = 50 \Omega$ ,  $C_i = 0.1 \mu F$ ,  $R_I = 100 \Omega$ ,  $R_F = 1k\Omega$  and  $R_O = 10 k\Omega$ . Determine the gain and band width of the amplifier. [7M]
- (OR)
4. a) What are the different modes of operation of an active integrator? Explain [7M]
- b) Design a practical integrator circuit to process the sinusoidal input waveform upto 1 kHz and the input amplitude is 10 mV. Assume necessary standard values of resistance. [7M]

**UNIT-III**

5. a) Draw the op-amp circuit configuration of a band-pass filter formed by cascading two pole high-pass filters and a two pole low-pass filter, and derive the expression for centre frequency  $f_0$ . [7M]
- b) Design a second order Butter-worth low pass filter having a cut-off frequency of 1 kHz. The damping factor is equal to 1.414. [7M]
- (OR)
6. a) Design a Band Pass filter with  $f_c = 1$  kHz,  $Q=3$  and  $A_f = 10$ . Draw the circuit with all the components. [7M]
- b) Explain the Narrow-Band -Reject filter with the help of a circuit diagram. [7M]

**UNIT-IV**

7. a) Draw the pin diagram of 566 VCO IC and list important specifications of 566 VCO IC. [7M]
- b) Design an Astable multivibrator having an output frequency 15 KHz with duty cycle of 40%. [7M]

(OR)

1 of 2



8. a) With the help of neat diagrams explain the operation of Schmitt trigger using 555 timer. [7M]  
b) Derive an expression for the lock-in range of a PLL. [7M]

**UNIT-V**

9. a) Draw the block diagram of inverted R-2R DAC and explain its operation in detail. [7M]  
b) List out the DAC and ADC Specifications and compare them in detail. [7M]

(OR)

10. a) Explain the specifications of DAC & ADC with an example. [7M]  
b) Find the voltage at all nodes 0, 1, 2 ..., and at the output of a 5-bit R-2R ladder DAC. The LSB is 1 and all other bits are equal to '0'. Assume  $V_R = -10V$  and  $R = 10k\Omega$ . [7M]



**III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23**  
**ANALOG ICs AND APPLICATIONS**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

\*\*\*\*\*

**UNIT-I**

1. a) Draw the IC 741 op-amp pin diagram and explain the function of each pin in detail. [7M]  
 b) Discuss briefly about the DC characteristics of an operational amplifier? [7M]

(OR)

2. a) Name the most important parameters of an operational amplifier. What are their ideal values and practical values? [7M]  
 b) What is a voltage regulator? Explain the three-terminal voltage regulator with the help of block diagram? [7M]

**UNIT-II**

3. a) Explain the operation of a practical differentiator. Use relevant expressions, diagrams. [7M]  
 b) Draw the circuit of a voltage to current converter if the load is floating and grounded. Are there any limitations as the size of the load when grounded? [7M]

(OR)

4. a) Using three op-amps draw the circuit diagram of an instrumentation amplifier and derive an expression for the output voltage? [7M]  
 b) Design a single op-amp logarithmic amplifier and derive the relation between the output and input voltage to explain why it is called a logarithmic amplifier? [7M]

**UNIT-III**

5. a) Plot and explain frequency response of [7M]  
 i) Low pass filter                      ii) High pass filter  
 iii) Band pass filter                      iv) Band Reject filter  
 b) With neat circuit diagram explain the operation of 2<sup>nd</sup> order butter worth HPF and derive an expression for voltage gain. [7M]

(OR)

6. a) With suitable circuit diagram explain the operation of 2<sup>nd</sup> order band reject filter. [7M]  
 b) Design a low pass filter with a cutoff frequency of 1kHz and with a pass band gain of 2. [7M]

**UNIT-IV**

7. a) Give the circuit of monostable multivibrator with 555 timer, explain its operation by deriving expression for pulse width. [7M]  
 b) Draw the block diagram of NE/SE565 PLL and explain the operation with the help of waveforms. [7M]

(OR)



8. a) Explain Astable multivibrator circuit using 555. Also derive expression for time period. [7M]  
b) What is meant by VCO? Explain in detail and state the applications of VCO? [7M]

**UNIT-V**

9. a) Define the following terms [7M]  
i) Accuracy ii) Resolution iii) Conversion time iv) Percentage resolution  
b) Draw the circuit of a ladder type DAC for 4 bits and derive expression for output voltage. [7M]
- (OR)
10. a) Which type of DAC is more preferable? Draw the circuit diagram and obtain expression for output voltage for 4-bits? [7M]  
b) Draw the schematic circuit diagram of dual-slope A/D converter and explain its operation. Derive expression for output voltage. [7M]



**III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23**  
**ANALOG ICs AND APPLICATIONS**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

\*\*\*\*\*

**UNIT-I**

1. a) What is an Op-Amp? Draw the functional block diagram of an Op-Amp and explain each block in detail. [7M]  
 b) List out the AC characteristics of an op-amp and discuss about them? [7M]

(OR)

2. a) Define the terms: CMRR, PSRR, SVRR, Input bias current, Input offset voltage, Gain bandwidth product. [7M]  
 b) For an OP-AMP, PSRR is 70dB, CMRR is  $10^5$ , and differential mode gain is  $10^5$ . The output voltage changes by 20V in 4  $\mu$ sec. Calculate: (i) numerical value of PSRR (ii) Common mode gain (iii) Slew rate. [7M]

**UNIT-II**

3. a) Draw the circuit of an op-amp integrator and derive the output expression. [7M]  
 b) Draw and explain the operation of a square wave generator. [7M]
- (OR)
4. a) Construct a logarithmic amplifier with op-amp and derive the expression for the output voltage. [7M]  
 b) Draw the circuit diagram of a monostable multivibrator using op-amp, derive the expression for its frequency of oscillation. [7M]

**UNIT-III**

5. a) Design a first order band pass filter with lower cutoff frequency of 100Hz and a higher cutoff frequency of 1KHz. The pass band gain should be 4. Calculate the 'Q' of the filter. [7M]  
 b) Write brief notes on band pass, band reject and all pass filters. [7M]

(OR)

6. a) With suitable circuit diagram explain the operation of Narrow band pass filter (NBPF) and give the necessary design expression. [7M]  
 b) Using an op-amp, design a second order low-pass filter with a cutoff frequency of 1KHz. [7M]

**UNIT-IV**

7. a) Draw the circuit of a Schmitt trigger using 555 timer and explain its operation. [7M]  
 b) What are the modes of operation of IC555? Derive the expression of time delay of a monostable multivibrator. [7M]

(OR)



8. a) Explain the functional diagram of a 555 Timer with neat sketch. [7M]  
b) With the help of block diagram explain the operation of a voltage controlled oscillator. [7M]

**UNIT-V**

9. a) Describe the principle of working of an R-2R DAC. What are the minimum and maximum values of gain for it? How can a DAC be used as current-to-voltage converter? [7M]  
b) Draw and explain the block diagram of a counter type ADC and list out its disadvantages. [7M]

(OR)

10. a) Draw the simplified block diagram of a successive approximation ADC and explain its working. [7M]  
b) Draw the circuit diagram of 5-bit inverted R-2R ladder DAC. How many levels are possible in this DAC? What is its resolution if the output range is 0 to 10 V. [7M]



**III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23**  
**ANALOG ICs AND APPLICATIONS**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

\*\*\*\*\*

**UNIT-I**

1. a) Derive CMRR of emitter coupled differential amplifier. What do you mean by difference mode gain? [7M]
  - b) Mention the types of open loop configurations of an Op-Amp. Explain each configuration in detail. [7M]
- (OR)
2. a) Define slew rate of an Op-amp and explain its significance in the dynamic characteristics of an Op-amp. [7M]
  - b) An op-amp has a slew rate of  $2V/\mu s$ . What is the maximum frequency of an output sinusoid of peak value 5V at which the distortion sets in due to the slew rate limitation? [7M]

**UNIT-II**

3. a) Draw the circuit of an ideal integrator and explain its operation. What are the limitations of an ideal integrator? How these limitations can be overcome? [7M]
  - b) Design and explain triangular wave generator using Schmitt trigger and integrator circuit. [7M]
- (OR)
4. a) Draw and explain non-inverting comparator and its input and output wave forms i) if  $V_{ref}$  is Positive ii) if  $V_{ref}$  is Negative. [7M]
  - b) Design a differentiator to differentiate an input signal that varies in frequency from 100Hz to 10KHz. If a sine wave of 1.2V Peak at 10KHz is applied to the differentiator of part, draw its output wave form. [7M]

**UNIT-III**

5. a) Draw a band pass filter circuit with its frequency response curve. Explain its working. [7M]
  - b) Design a second order high pass filter with a cutoff frequency of 2 kHz. [7M]
- (OR)
6. a) Describe the principle of operation of an inverting first order low-pass filter using op-amp and draw its frequency response curve? [7M]
  - b) Design a wide band-pass filter with  $f_L=200Hz$ ,  $f_H=1kHz$  and a pass band gain=4. Draw the frequency response and calculate 'Q' factor for the filter. [7M]



**UNIT-IV**

7. a) Draw the dc voltage versus phase difference characteristic of balanced modulator phase detector of a PLL indicating all important regions. [7M]  
b) With a neat functional diagram, explain the operation of VCO and also derive an expression for free running frequency,  $f_0$ . [7M]

(OR)

8. a) Draw the circuit diagram of a 555 timer connected as an astable multivibrator and explain its operation? [7M]  
b) Using 555 timers, design a monostable multivibrator to produce pulses of width 110 msec. Use a  $1\mu\text{F}$  capacitor? [7M]

**UNIT-V**

9. a) Using a neat sketch, explain the working of a parallel comparator ADC? [7M]  
b) Draw the circuit of a Weighted Resistor DAC and obtain expression for n-bits. [7M]

(OR)

10. a) Explain R-2R ladder DAC for 4-bit operation. The resolution of this DAC is 1mv. If 0000 represents 0 V, determine the output for an input of 1010. [7M]  
b) Explain the operation of Dual-slope ADC with functional diagram. [7M]

