

III B. Tech I Semester Regular/Supplementary Examinations, December -2023**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 the AC performance close loop Characteristics of Op-amp to discuss on the circuit Bandwidth, and slew rate. [7M]
b) Draw and explain the equivalent circuit of an operational amplifier. [7M]
(OR)
2. a) Explain all the DC characteristics of an ideal op-amp with relevant expressions. [7M]
b) Describe the features of 79xx IC series dual power supply. [7M]

UNIT-II

3. a) With a neat sketch explain about voltage to current converter using op-amp. [7M]
b) Explain the function of op-amp as differentiator and draw the waveforms. [7M]
(OR)
4. a) Explain the operation of op-amp current to voltage converter circuit. [7M]
b) Explain the application of op-amp as integrator and differentiator. [7M]

UNIT-III

5. a) If a band pass filter has a lower cut-off frequency $f_L=250\text{Hz}$ and a higher cut-off frequency $f_H = 2500\text{Hz}$, then find its bandwidth and the resonant frequency. [7M]
b) Design a wide-band reject filter having $f_h=400\text{ Hz}$, $f_l=2\text{ kHz}$ and pass band gain of 2. [7M]
(OR)
6. a) Design a wide band reject filter having $f_H=200\text{ Hz}$ and $f_L=1\text{kHz}$. [7M]
b) Design a high pass filter at a cut-off frequency of 1 kHz with a passband gain of 2. [7M]

UNIT-IV

7. a) What is 555 timer? Explain the working of 555 timer as Monostable Multivibrator. [7M]
b) Draw the circuit of a PLL AM detector and explain its operation. [7M]
(OR)
8. a) Briefly explain the use of PLL for the process of FSK demodulation. [7M]
b) Draw and explain the functional diagram of 555 timer. [7M]

UNIT-V

9. a) With a neat circuit diagram, explain the operation of inverted R-2R digital-to-analog converter. [7M]
b) Explain the operation of dual slope analog-to-digital converter. [7M]
(OR)
10. a) Explain the following characteristics of analog-to-digital converter: Resolution, Accuracy, Settling time, Linearity. [7M]
b) Explain the working principle of Successive approximation type analog-to-digital converter. [7M]



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UNIT-I

1. a) List the six characteristics of an ideal op-amp and explain in detail. [7M]
b) Explain in detail the AC characteristics of an ideal op-amp with relevant expressions. [7M]

(OR)

2. a) Use appropriate block diagram, explain the general stages of an op-amp IC. [7M]
b) What is a switching regulator? With a neat block diagram, explain the internal diagram of IC 78XX. [7M]

UNIT-II

3. a) With a neat circuit diagram, explain the working of Schmitt trigger using op-amp. [7M]
b) Draw the circuit of op-amp Monostable multivibrator and obtain expression for pulse width. [7M]

(OR)

4. a) Explain the operating principle of an instrumentation amplifier with a suitable circuit diagram and derive its gain. [7M]
b) What is a comparator? Explain the characteristics of a comparator with a neat diagram. [7M]

UNIT-III

5. a) Design a low pass filter with a cut off frequency of 1 kHz and with a pass band gain of 2. [7M]
b) Design a notch filter so that $f_0=8$ kHz, $Q=10$. Choose $C=500$ pF. [7M]

(OR)

6. a) Design a second order Butterworth LPF having upper cut-off frequency of 1 kHz. [7M]
b) The following specifications are given for a certain wide-band pass filter: $f_L=400$ Hz, $f_H=1$ kHz, and passband gain=1. Calculate the value of Q for the filter. [7M]

UNIT-IV

7. a) Draw the circuit of a Schmitt trigger using 555 timer and explain its operation. [7M]
b) Explain the application of PLL as a frequency multiplier with a neat sketch. [7M]
- (OR)
8. a) With the help of a neat internal function diagram explain the working of IC 555 as a astable multivibrator. [7M]
b) Determine how the IC 565 PLL can be used as a frequency multiplier/divider. [7M]



UNIT-V

9. a) With a neat circuit diagram, explain the operation of weighted resistor digital-to-analog converter. [7M]
b) What is the use of an analog-to-digital converter? Explain the Dual slope type of analog-to-digital converter. [7M]
- (OR)
10. a) Explain the operation of a parallel comparator type analog-to-digital converter with a neat diagram. [7M]
b) Describe the terms settling time and conversion time related to digital-to-analog converters. Determine how many resistors are required in a 12-bit weighted resistor digital-to-analog converter. [7M]

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UNIT-I

1. a) Explain in detail, the DC characteristics of op-amp with the help of neat diagrams. [7M]
b) Describe the principle of a three-terminal 78xx series voltage regulator. [7M]
(OR)
2. a) Determine the output voltage of the differential amplifier having input voltages $V_1=1\text{ mV}$ and $V_2=2\text{ mV}$, the amplifier has a differential gain of 5000 and CMRR of 1000. [7M]
b) Explain the functions of all the basic building blocks of an op-Amp. [7M]

UNIT-II

3. a) Draw the block diagram of four quadrant multiplier and explain its operation in detail. [7M]
b) Sketch the op-amp Integrator circuit and explain the working principle in detail. [7M]
(OR)
4. a) Draw and explain the operation of op-amp triangular wave generator. [7M]
b) With a suitable circuit diagram, explain the operating principle of an instrumentation amplifier and derive its gain. [7M]

UNIT-III

5. a) Discuss the second order high pass filter with its frequency response and design the circuit with the cut-off frequency of 5 kHz. [7M]
b) Draw the circuit of a second order Butterworth low pass filter and explain its operation. [7M]
(OR)
6. a) Design a wide-band pass filter having $f_l=400\text{ Hz}$, $f_h=2\text{ kHz}$ and pass band gain of 4, find the value of Q of the filter. [7M]
b) A low pass Butterworth filter is to be designed to have a 3-dB bandwidth of 200 Hz and an attenuation of 50 dB at 400 Hz. Find the order of the filter. [7M]

UNIT-IV

7. a) In the astable multivibrator using 555 timer, $R_A=2.2\text{ K}\Omega$, $R_B=6.8\text{ K}\Omega$ and $C=0.01\text{ }\mu\text{F}$. Calculate t_{HIGH} , t_{LOW} , free running frequency and Duty cycle. [7M]
b) Explain the use of PLL for FM detection with a neat diagram. [7M]
(OR)
8. a) Draw the circuit diagram of a 555 timer connected for astable multivibrator and explain its operation. [7M]
b) Draw the block diagram of IC 566 VCO and explain its operation. [7M]



UNIT-V

9. a) 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 0-10V. [7M]
b) Explain the operation of counter type analog-to-digital converter with a neat diagram. [7M]
- (OR)
10. a) Illustrate the working principle of dual slope type analog-to-digital converter. Write its advantages and limitations. [7M]
b) Explain the operation of R-2R Ladder type digital-to-analog converter. [7M]

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UNIT-I

1. a) Draw the block diagram of a typical op-amp and explain each block in detail. [7M]
b) Define slew rate, CMRR and PSRR with respect to an op-amp and describe their significance. [7M]

(OR)

2. a) What is slew rate? What is the slew rate if the output voltage of a certain op-amp circuit changes by 24 V in 4 microseconds. [7M]
b) Explain the features and principle of current booster with a neat diagram. [7M]

UNIT-II

3. a) With a neat circuit diagram, explain the working of Sample and Hold circuit using op-amp. [7M]
b) Draw the circuit of antilog amplifier using op-amp and explain its operation. [7M]

(OR)

4. a) Explain the operation of an op-amp square wave generator with a neat diagram. [7M]
b) Draw the circuit of log amplifier using op-amp and explain its operation. [7M]

UNIT-III

5. a) Design a band pass filter so that $f_0=2$ kHz, $Q=20$ and $A_0=10$. Choose $C=1$ μ F. [7M]
b) Design a second order Butterworth HPF with cut-off frequency of 4 kHz and draw the designed circuit. [7M]

(OR)

6. a) Design a second order Butterworth low-pass filter having upper cut-off frequency of 2,1961 kHz. [7M]
b) Explain in detail, the first order low pass Butterworth filter with a neat circuit diagram. [7M]

UNIT-IV

7. a) Draw and explain the functional diagram of 555 timer. [7M]
b) List one application of PLL and then describe the role of PLL in that application. [7M]

(OR)

8. a) Draw the circuit diagram of a 555 timer connected for monostable multivibrator and explain its operation. [7M]
b) Describe the basic building blocks of a PLL. Define capture range and lock-in range of a PLL. [7M]



UNIT-V

9. a) Define Monotonocity with respect to data converters and explain the important digital-to-analog converter specifications. [7M]
b) Explain a R-2R ladder type digital-to-analog converter. [7M]
(OR)
10. a) Explain the working principle of successive approximation type analog-to-digital converter with a neat diagram. [7M]
b) With a neat circuit diagram, explain the operation of weighted resistor digital-to-analog converter. [7M]