Time: 3 hours   **Total Marks: 80**

N.B: 1) Question No.1 is compulsory

    2) Solve any three from the remaining five.

    3) Figures to the right indicate full marks.

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Q. 1	**Attempt any four sub-questions.**	
A.	Explain the block diagram of general-purpose op-amp	[5]
B.	Draw a neat circuit diagram for voltage to current converter. Derive its output current expression.	[5]
C.	With the help of a neat circuit diagram, input / output waveforms and transfer characteristics, explain the working of zero crossing detector (ZCD).	[5]
D.	Explain the functional block diagram of Timer IC 555.	[5]
E.	Design a 50-mA current source using IC 7805. Assume $R_L = 100\ \Omega$	[5]
F.	With the help of a functional block diagram explain the working of Voltage Controlled Oscillator IC 566	[5]

Q. 2 A.	Draw the circuit diagram of a closed loop inverting amplifier using op-amp with a voltage gain of -10. If the supply voltage is $\pm$ 15 V and input signal applied to the circuit is v = 0.5 Sin (2π 1000t) sketch its input and output waveforms. Clearly indicate the peak values of the voltages and time period of the waveforms.	[10]
B.	Design a practical integrator using op-amp to integrate an input signal where lowest desired frequency of Integration is 1 kHz. (Assume $C_F = 0.01\mu F$)	[10]

Q. 3 A.	With the help of a circuit diagram, input and output waveforms and voltage transfer characteristics explain the working of a non-inverting Schmitt trigger. Derive the expressions for the Upper & lower threshold levels.	[10]
B.	Design an astable multivibrator for an output frequency of 5 kHz and duty cycle 75%. (Assume $C_F = 0.01\mu F$)	[10]

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Q. 4 A. Draw the circuit of an instrumentation amplifier using three op-amps. [10]
Derive its output voltage equation. What are its advantages over a
difference amplifier using single op-amp?

B. What is a precision rectifier? Write the advantages of precision rectifier [10]
over normal diode rectifier. Explain half wave precision rectifier with the
help of a diagram input-output waveforms and transfer characteristics.

Q. 5 A. Design an adjustable output voltage regulator using IC 317 to give 10 [10]
Volts at $I_L = 150$ mA. Given $I_{ADJ} = 100$ µA. Choose $R_1 = 240 \, \Omega$

B. What is the basic principle of Sine Wave oscillators? With the help of a [10]
neat diagram explain the working of R C phase shift oscillator using op
amp. Write the expression for its frequency of oscillation. Calculate the
values of R & C if its frequency of oscillation is 1 kHz.

Q. 6 Write short notes on: (Attempt any four)
A. Closed loop Difference Amplifier using Op-amp [5]
B. Practical Differentiator using Op Amp [5]
C. Peak detector using Op Amp [5]
D. Monostable Multivibrator using IC 555 [5]
E. High voltage Low Current Voltage regulator using 723 [5]
F. IC 565 Phase Locked Loop (PLL) [5]

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