**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.**

**Q. 1 Attempt any four questions.**

A. Explain the block diagram of general-purpose op-amp [5]

B. What are the limitations of basic differentiator using op amp? Draw the circuit diagram of a practical differentiator and explain how it overcomes the limitations. [5]

C. With the help of a neat circuit diagram, input / output waveforms and transfer characteristics, explain the working of zero crossing detector. [5]

D. Write a note on Pulse Width Modulator using IC 555. [5]

E. Explain working of switching regulator. [5]

F. With a diagram explain how IC 565 can be used as a Phase Locked Loop [5]

**Q. 2** A. Draw a neat circuit diagram of an inverting summing amplifier using op-amp and obtain the expression for its output voltage as $V_O = -(V_1+V_2+V_3)$, where $V_1$, $V_2$, $V_3$ are input voltages. [10]

B. Design a second order high pass Butterworth filter for a cut off frequency of 1 kHz. Sketch its frequency response.
Choose the values of Capacitors = 0.01 µF. [10]

**Q. 3** A. With the help of a circuit diagram, input and output waveforms and voltage transfer characteristics explain the working of an inverting Schmitt trigger. Derive the expressions for the Upper & lower threshold levels. [10]

B. Design an astable multivibrator using IC 555 for an output frequency of 5 kHz and duty cycle of 60%. [10]

**Q. 4** A. Design an op-amp circuit to obtain $V_O = 2V_1 - 5V_2$, where $V_1$ & $V_2$ are input voltages. [10]

B. Design a voltage regulator using IC 723 to give 20 Volts at $I_L$ = 500 mA. [10]

**Q. 5** A. With the help of a diagram explain the working of R C phase shift oscillator using op amp. Derive the expression for its frequency of oscillation.
What are the values of R & C of the frequency determining network if its frequency of oscillation is 5 kHz? [10]

B. What is a precision rectifier? Write the advantages of precision rectifier over normal diode rectifier. Explain full wave precision rectifier with the help of diagram and relevant waveforms. [10]

**Q. 6 Write short notes on: (Attempt any four)**

A. Closed loop Inverting Amplifier using Op-amp [5]
B. Voltage to Current Converter [5]
C. Peak Detector [5]
D. Monostable Multivibrator using IC 555 [5]
E. Three terminal adjustable voltage regulators [5]
F. IC 566 Voltage Controlled Oscillator (VCO) [5]

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