(3 Hours) **[Total Marks: 80]**

N.B.: (1) Question No. 1 is **compulsory**.
(2) Solve any **three** questions from the remaining **five**
(3) **Figures** to the **right** indicate **full** marks
(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 Attempt **any 4** questions

(a) What is the need of negative feedback in op-amp based circuit? **[05]**

(b) What is input offset voltage and output offset voltage of an op-amp? How to measure it practically? **[05]**

(c) With the help of a neat circuit diagram explain the working of Multiplier 534. **[05]**

(d) Give the working principle of switching regulator. **[05]**

(e) Draw mod-10 ripple counter using IC 7490. **[05]**

Q.2 (a) Draw the circuit diagram of a square and triangular waveform generator using op-amps and explain its working with the help of waveforms. For variation in duty cycle what is the modification needed in the circuit. **[10]**

(b) Explain IC 555 as astable multivibrator and hence design an astable multivibrator using IC 555 to obtain 50% duty cycle. **[10]**

Q.3 (a) Design a second order Butterworth high pass filter for cut off frequency of 1 kHz and pass-band gain of AF=2. **[10]**

(b) With the help of a neat circuit diagram explain the working of IC 74163 synchronous 4 bit binary counter. **[10]**

Q.4 (a) Design a voltage regulator using IC 723 to give output voltage V_o = 5 V to 15 V and output current of 2 A. **[10]**

(b) With a neat circuit explain the working of window detector using op-amp. Give its application. **[10]**

Q.5 (a) Draw a neat circuit diagram of *RC* phase shift oscillator using op-amp. Derive its frequency of oscillation. What are the values of *R* and *C* if its frequency of oscillation is 2 kHz? **[10]**

(b) Draw a mod-10 counter using IC 7493. Draw its timing diagram. **[10]**

Q.6 Write a note on: **(Attempt any two)**

a) Instrumentation amplifier. **[10]**

b) Full wave precision rectifier. **[10]**

c) 74181 ALU. **[10]**

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