Time: 3 hours Max. Marks: 80

**Instructions:**

- Question No. 1 is compulsory
- Solve any 3 questions from the remaining 5
- Figures to the right indicate full marks
- Assume suitable data if necessary and mention the same in the answer sheet

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| **Q1.** | **Attempt any 4** | **Marks** |
| **a)** | List the ideal characteristics of Operational amplifier and give the practical values of Op-Amp IC 741. | **5** |
| **b)** | Draw a neat circuit diagram for voltage to current converter with grounded load Derive its output current expression. | **5** |
| **c)** | Differentiate between Inverting and Non-Inverting Comparator. | **5** |
| **d)** | Explain the functional block diagram of Timer IC 555. | **5** |
| **e)** | With the help of a functional block diagram explain the working of a Three terminal fixed voltage regulator. | **5** |
| **f)** | Draw the block diagram of Voltage Controlled Oscillator and explain its working. | **5** |
| **Q2a)** | Draw a neat circuit of an instrumentation amplifier using 3-Op-Amps & derive its output equation. | **10** |
| **Q2b)** | What are the limitations of an ideal differentiator using op-amp? Draw the circuit diagram of a practical differentiator and explain how it overcomes the limitations. | **10** |
| **Q3a)** | With help of neat circuit diagram and voltage transfer characteristics explain the working of a non-inverting Schmitt trigger. | **10** |
| **Q3b)** | Design an astable multivibrator having an output frequency of 1 kHz with a duty cycle of 50% using IC 555. Assume C = 0.01μF. | **10** |
| **Q4a)** | Design a voltage regulator using 723 to deliver an output voltage of 15 V and load current up to 50 mA. | **10** |
| **Q4b)** | Draw the functional block diagram of IC 565 and explain its application as FSK demodulator. | **10** |
| **Q5a)** | Draw a neat circuit diagram of an inverting summing amplifier using op-amp to 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** |
| **Q5b)** | With the help of a neat diagram explain the working of Wein bridge oscillator using op amp. Derive the expression for its frequency of oscillation. What are the values of R & C if its frequency of oscillation is 5 kHz? | **10** |
| **Q6a)** | With the help of a neat diagram and wave forms at appropriate points in the circuit explain the working of square and triangular waveform generator using op amps. | **10** |
| **Q6b)** | What is Pulse Width Modulation? With the help of a neat circuit diagram and waveforms at trigger input, control voltage pin, across the timing capacitor and at the output, explain the working of IC 555 as Pulse Width Modulator. | **10** |

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