Duration: 3 Hours **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR **[20]**

a Explain the concept of virtual ground & virtual short in Op-Amp IC 741.

b Derive expression of voltage gain for Inverting amplifier

c State and explain Miller's theorem.

d Explain Barkhausen's criterion for sustained oscillations.

e Draw IC 555 timer based monostable multivibrator.

2 a Draw small signal equivalent circuit of dual input balanced output MOSFET differential amplifier. Derive the expression for A_d (Differential mode gain), A_{cm} (Common mode gain), CMRR. **[10]**

b Draw block diagram of OPAMP and explain its characteristics. State its ideal and practical value for 741 IC. **[10]**

3 a Draw the circuit diagram of basic MOSFET differential amplifier and explain its operation. Sketch and explain its DC transfer characteristics. **[10]**

b Describe the general frequency response of an amplifier and define the low, mid and high frequency ranges. Define low cut off and high cut off frequency for the amplifier. **[10]**

4 a Draw the circuit diagram of differentiator using OPAMP and derive the expression of output voltage. State its applications. **[10]**

b Draw the circuit diagram of current to voltage converter and explain its operation. **[10]**

5 a Draw the circuit diagram and explain the operation of zero crossing detector. **[10]**

b For IC 555 timer based astable multivibrator systematically derive all the relevant mathematical expressions for on time period (TON), off time period (TOFF), total time period(T), frequency(fo) & duty cycle(D) **[10]**

6 a For the n channel MOSFET amplifier determine--- **[10]**

i) g_m ii) Unity gain bandwidth, fT

Given: - Kn = 0.25 milliampere/square volts, V_{TN} = 1V, c_{gd} = 0.04 pf, c_{gs} = 0.2pf, V_{GS} = 3volts. Is unity gain bandwidth parameter being dependent on amplifier circuit component values?

b Draw neat circuit diagram and explain the operation of astable multivibrator using IC 555.List specifications of IC555. **[10]**
