Duration: 3hrs   **[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 reverse bias mode of operation of the P-N junction diode with neat sketch.
  b Explain the operation of the photo diode with neat sketch.
  c Compare or differentiate between clipper & clamper circuits.
  d Derive an expression for the ripple factor (γ) of a full wave bridge type rectifier.
  e Explain the operation of inductor (L) type filter with neat sketch.

2 **a** Describe the working or operation of a center-tapped type full wave rectifier with a neat sketch. Draw the input voltage & output voltage waveforms. **[10]**
  b For any full wave rectifier, derive the output voltage expressions for AC output voltage (V_{rms}) & DC or average (V_{dc}) output voltage. **[10]**

3 **a** With appropriate mathematical analysis, explain the effect of temperature on the P-N junction diode V-I characteristics. **[10]**
  b Explain with the help of neat diagram explain the working of light emitting diode (LED). **[10]**

4 **a** Compare Zener breakdown & avalanche breakdown. Describe the reverse bias characteristics of Zener diode with neat sketch. **[10]**
  b What are memristors ? Explain the operating principle, construction & working of memristors with a neat sketch. **[10]**

5 **a** Compare different biasing circuits of a bipolar junction transistor (BJT). **[10]**
  b Draw circuit diagram and explain the operation of different biasing circuits used for D-MOSFET. **[10]**

6 **a** For the voltage divider bias circuit shown below using N-channel E-MOSFET calculate Q – point where Q = [V_{DS}, I_D]. **[10]**
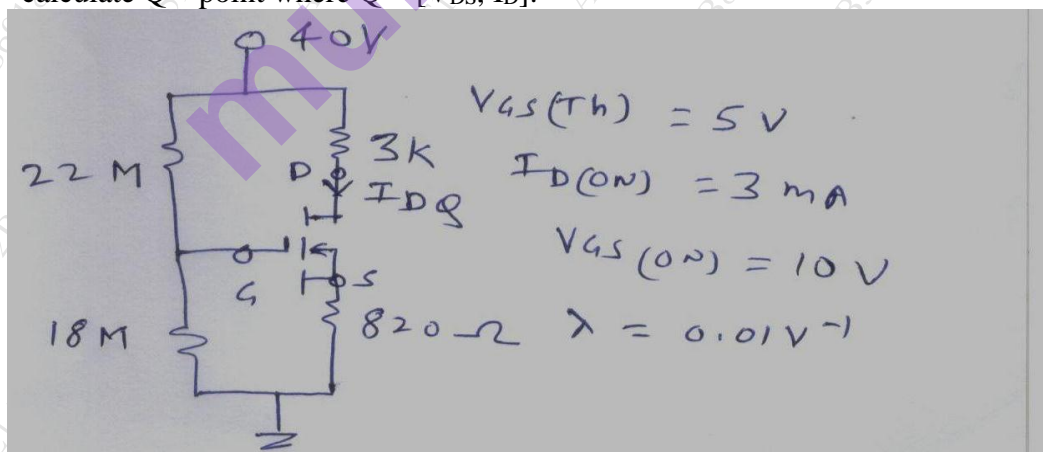
  b For small signal amplifier in common emitter (CE) BJT configuration using voltage divider biasing perform small signal (AC) analysis using the hybrid $-\pi$ model. **[10]**

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