N.B. : (1) Question No. 1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Assume suitable data wherever required

1. Attempt any four.  
(a) Draw Input and Output characteristics of BJT in common emitter configuration.
(b) Draw small signal hybrid π equivalent circuit for npn transistor.
(c) Explain effect of temperature on JFET and derive equation for zero current drift.
(d) Calculate $I_B$, $I_C$ & $V_{CE}$ for common emitter circuit.

![Circuit Diagram](image1)

(e) Find $I_B$, $I_C$ & $V_{CE}$ for following circuit.

![Circuit Diagram](image2)
2. (a) Draw output waveform for clamper and clipper circuits.

(i)

(ii)

(b) Explain construction & characteristics of n channel Enhancement MOSFET. Draw transfer characteristics & drain characteristics.

3. (a) For JFET-amplifier shown below, Calculate $A_v$, $Z_i$, $Z_o$

(b) For the circuit shown below, calculate $I_{DO}$ & $V_{DSQ}$. It is given that $I_{D(ON)} = 6\ mA$, $V_{G(ON)} = 8V$, $V_{th} = 3V$
4. (a) Explain the working of Wein Bridge Oscillator. Derive the expression for frequency of oscillation for sustained oscillations.
(b) Calculate voltage gain of FET amplifier.

\[ Y_{os} = 40 \mu \text{s} \]
\[ I_{pss} = 8 \text{ mA} \]
\[ V_{os \, off} = -4 \text{V} \]

5. (a) Draw & explain energy band diagram of MOS capacitor operating in
   (i) Accumulation
   (ii) Depletion
   (iii) Inversion mode
(b) Draw emitter follower circuit and derive an expression for voltage gain \( Av \).

6. (a) Draw circuit diagram for phase shift oscillator & derive an expression for frequency of oscillation.
(b) Write short notes on any two.
   (i) Photodiodes
   (ii) LC oscillators
   (iii) Transistor as a switch
   (iv) Schottky diode.