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

1. Question No.1 is compulsory.
2. Answer any **three** from remaining questions.
3. **Figures** to the right indicate full marks.
4. Assume suitable data if required.

Q1. Attempt any four.

a   Explain the effect of temperature of on VI characteristics of a PN junction diode.   05

b   What are the important parameters of a JFET? How these parameters are determined graphically?   05

c   What is Early effect? Explain how it affects the BJT characteristics in CB configuration.   05

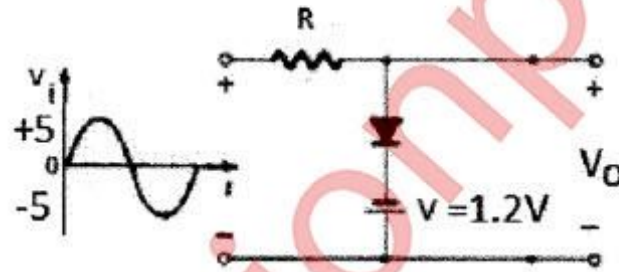d   For the circuit shown in figure.1 draw the output waveform. Assume diode is ideal.   05

Fig.1

e   For the FET shown in figure.2 the drain current equation is   05

$$I_{DQ} = 9\left(1 + \frac{V_{GSQ}}{3}\right)^2 \text{ mA}, \text{ Determine } I_{DQ}, V_{GSQ}, V_{DSQ}, V_D$$

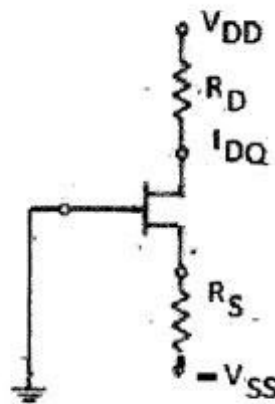$V_{DD}=20V, R_D=2k\Omega, R_S=1.5K\Omega, -V_{SS}=-10V.$

Fig .2

Q2.   **a**   Describe the construction and operation of an N-channel MOSFET in   10
enhancement mode. Draw its characteristics and equivalent circuit of the device.

      b   Describe the different MOSFET biasing techniques .Determine the drain current,   10
drain to source voltage, and Power dissipated in the transistor of CS circuit with
an N-channel E MOSFET shown in figure 3. $R_1 = 30k\Omega$, $R_2 = 20k\Omega$, $R_D =$
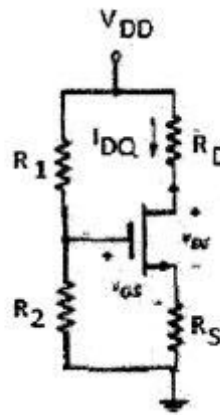$20k\Omega$, $R_S = 0.5k\Omega$, $V_{DD} = 5V, V_{TN} = 1V, k_N = 0.1mA/V2$

Fig.3

Q3.   **a**   Draw input and output characteristics of CE amplifier. Explain graphical analysis to   10
determine parameters.(Zi, Zo, AV, and Ai)

      b   In the Common Emitter configuration with voltage divider bias $I_E = 1mA$ 10
$V_{CE} = 2V$, $R_E = 1k\Omega$ and $\beta = 49$. Determine the values of R_C , R_1 and R_2 such
that the stability factor does not exceed 5. Assume $V_{CC} = 5V$ and $V_{BE} = 0.3V$.

Q4.   **a**   For the amplifier shown in figure.4 analyze and determine   10

      i)   Small-signal hybrid pi parameters of BJT
      ii)   Small-signal voltage gain
      iii)   Input and output impedance.

The circuit parameters are: $R_1 = 56k\Omega$, $R_2 = 12.2k\Omega$, $R_E = 0.4k\Omega$,
$R_C = 2k\Omega, R_L = 10k\Omega$, $V_{CC} = 10V$ and BJT parameters are
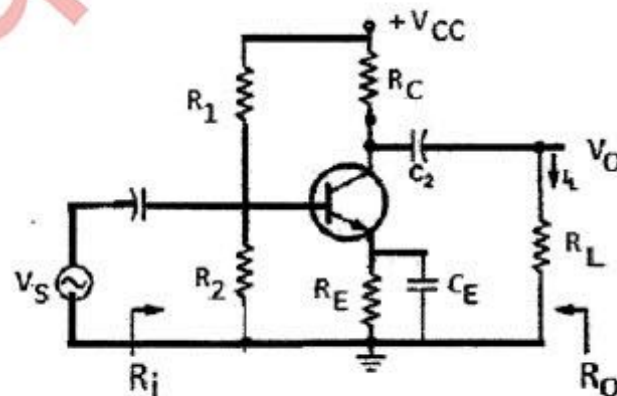$\beta = 100, V_{BE} = 0.7V$

Fig.4

TURN OVER

b   Draw JFET CS amplifier with voltage divider bias and derive the expressions for   10
the voltage gain, input impedance and output impedance.

Q5   a   For the amplifier shown in figure.5 derive the expression for voltage gain, input   10
and output impedance. The parameters of the MOSFET in the circuit shown in fig
.5 are ; $R_G = 1M\Omega$, $V_{DD} = 5V$, $-V_{SS} = -5V$, $V_{TN} = 0.8\,V$, $k_N = 0.85\ mA/V^2$

(i) Determine the values of R_S and R_D such that $I_{DQ}=0.1mA$ and maximum
symmetrical 1V peak sinusoidal signal occurs at output.(ii) Find the small signal
transistor parameters. (iv) Determine the small-signal voltage gain A_v
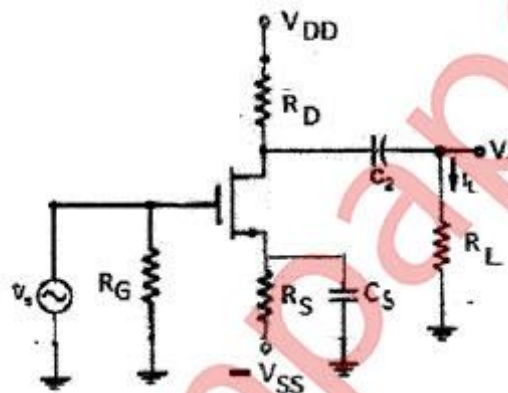

Fig.5

b   Draw the circuit diagram of Wein Bridge Oscillator and derive the expression for   10
the frequency of oscillation and minimum gain required for sustained oscillation

Q6   Write a short note on following   20

a   Twin-T Oscillator.

b   Varactor Diode (Construction and operation)

c   D C load line concept in BJT. Why Q point should be at the middle of DC load line
and fixed?

d   MOS capacitor

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