Total No. of printed pages = 6

ECE 181302

Roll No. of candidate | | | | | | | | | | |

25/2/22 2021

B.Tech. 3rd Semester End-Term Examination

ECE, ETE, PEIE,EEE

SEMICONDUCTOR DEVICES AND CIRCUITS

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions (MCQ/ Fill in the blanks): $(10 \times 1 = 10)$

(i) When we decrease the doping level of the pn diode, the junction breakdown voltage will

(a) increase (b) decrease

(c) become zero (d) have no impact

(ii) A pn diode is a ————————

(a) voltage-controlled resistance

(b) unidirectional switch

(c) bidirectional switch

(d) amplifier

(iii) We have a special purpose diode used for voltage-controlled-capacitance. It is a ————————

(a) Zener diode (b) LED

(c) Photo diode (d) Varactor diode

[Turn over

(iv) ———————— causes tunnelling effect in tunnel diodes.

(v) In a BJT most of the majority carriers from the emitter

(a) Recombine in the base

(b) Recombine in the emitter

(c) Pass through the base region to the collector

(d) None is correct

(vi) The quiescent point is the ————————

(a) Load line

(b) KVL

(c) Transfer characteristic

(d) Intersection point of the network equation and device characteristic

(vii) The transistor in a circuit is biased in order to ensure a ————————

(a) proper direct current

(b) proper alternating current

(c) small base current

(d) large collector current

(viii) An ac signal applied to the BJT amplifier will move the operating point along the

(a) dc load line

(b) ac load line

(c) dc load line and ac load line

(d) Ic axis

(ix) The ac drain resistance of the JFET is

(a) $\frac{\Delta V_{DS}}{\Delta I_D}$ at constant I_{GS}

(b) $\frac{\Delta V_{GS}}{\Delta I_D}$ at constant I_{DS}

(c) $\frac{\Delta V_{DS}}{\Delta I_{GS}}$ at constant I_{DS}

(d) $\frac{\Delta I_D}{\Delta V_{DS}}$ at constant I_{GS}

(x) A transistor can be used as a switch in the

(a) active region

(b) cutoff region

(c) saturation regions

(d) cutoff region and saturation regions.

2. (a) Two diodes with saturation currents I_{S1} and I_{S2} are connected in parallel with their cathodes joined together and connected to grounds. The two anodes are joined together and fed with a constant current I. Find the currents I_{D1} and I_{D2} that flow through the two diodes, and the voltage V_D that appears across their parallel combination.

(b) A junction diode is operated in a circuit in which it is supplied with a constant current I. What is the effect on the forward voltage of the diode if an identical diode is connected in (5)

(i) series

(ii) parallel

3. (a) In Figure 1 cut-in voltage of diode D1 is 0.7 V and that of diode D2 is 6.5 V. If the input voltage V_I = 10 V, determine the value of R1 when the value of $I_{D2} = 2I_{D1}$. Also find the values of V_O, I_{D1}, and I_{D2}. Assume that all diodes are forward-biased.

(10)

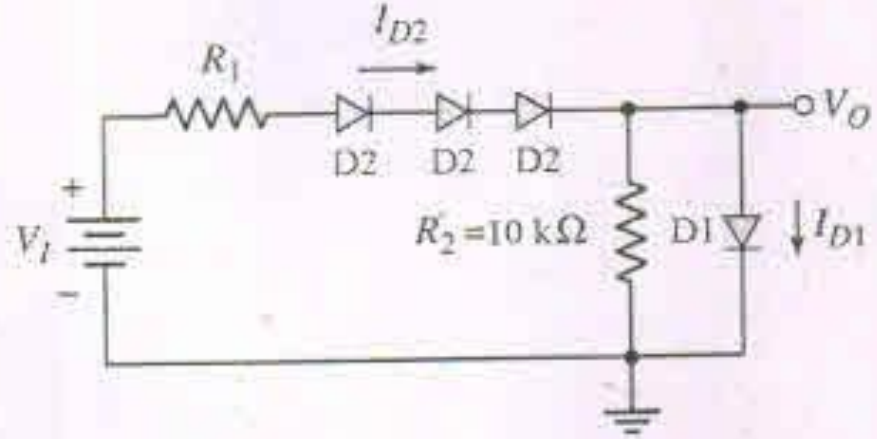

Figure 1

(b) Illustrate the difference between dc load line and ac load line. (5)

4. (a) Determine the output voltage waveform for the diode limiter shown in Figure 2. (8)

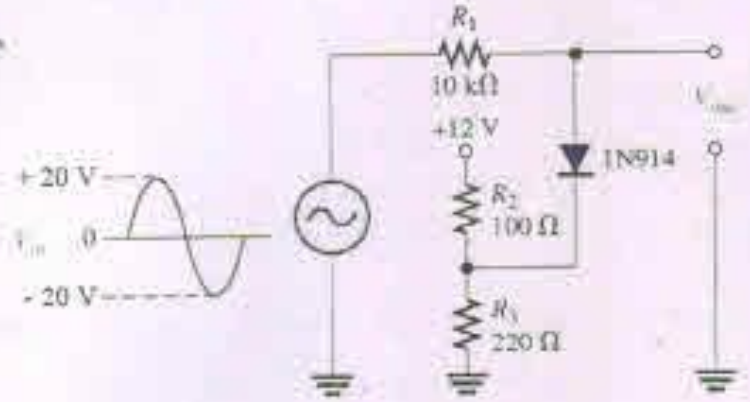

Figure 2

(b) Two 10V Zener diodes are used in the voltage regulator in Fingure.3.The input voltage varies between 10 V and 20 V while the load current varies between 12 mA and 8 mA. The minimum Zener current is 15 mA. Find the value of the variable load R_L. (7)

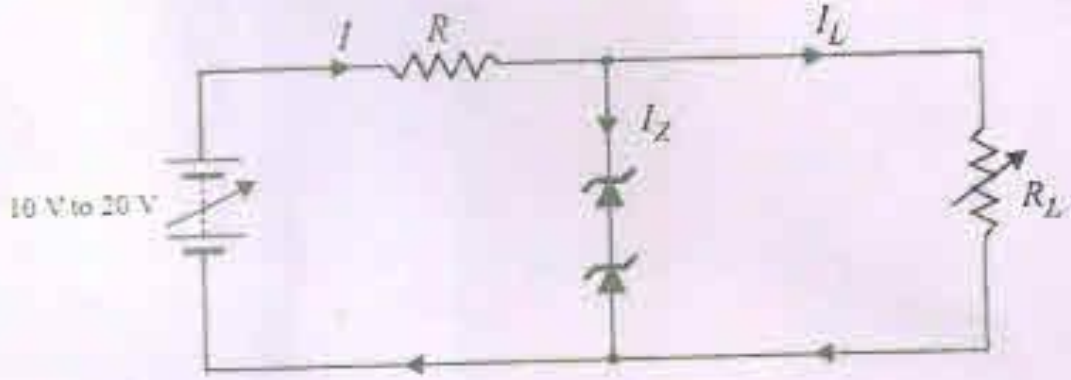

Figure 3.

5. (a) Determine (i) I_i (ii) Z_i (iii) V_o (iv) I_o (v) A_i (vi) V_o for the BJT amplifier in Figure 4. (10)

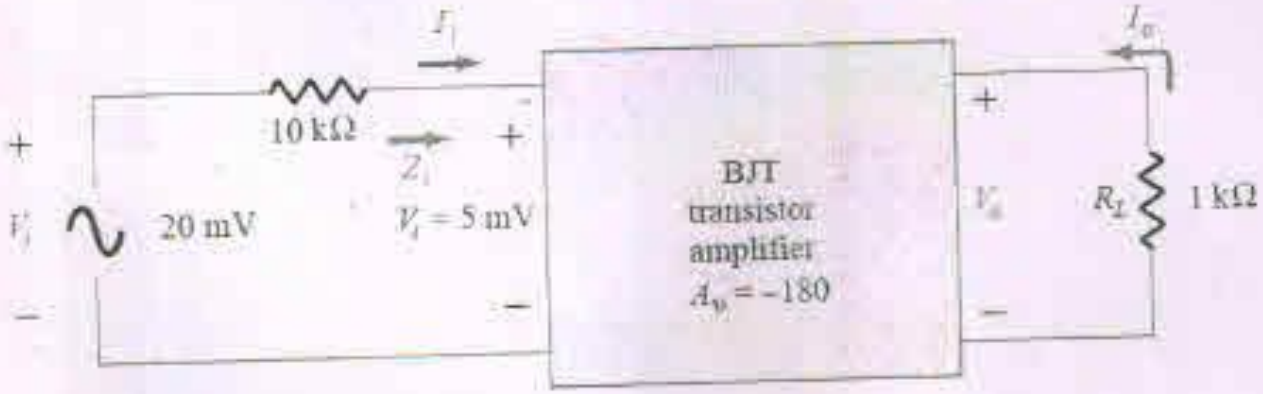

Figure 4

(b) The output (collector voltage) of a biased transistor amplifier is shown in Figure 5. Is the transistor biased too close to cutoff or too close to saturation? (5)

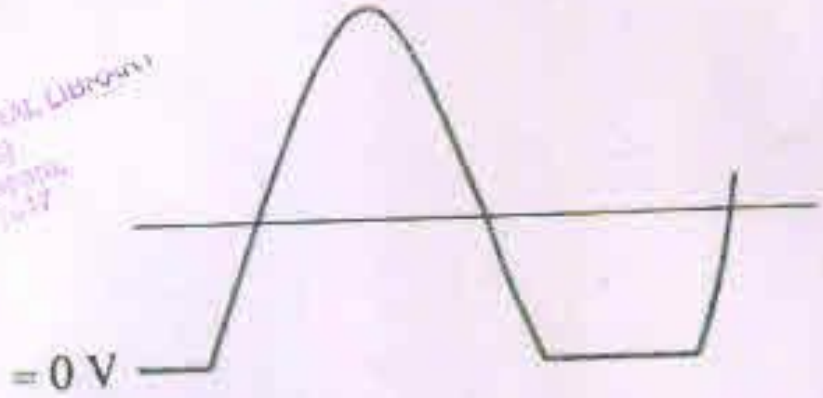

Figure 5

6. (a) Determine A_v and A_i for the network of Figure 6. (10)

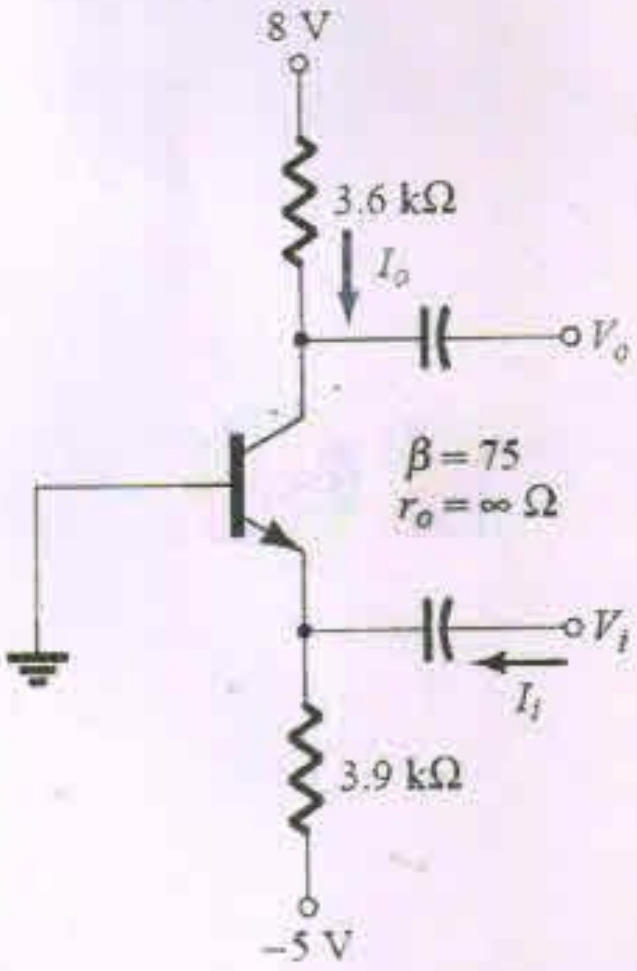

Figure 6

(b) Determine V_{GSQ} and I_{DQ}, V_D and V_C for the network in Figure 7.

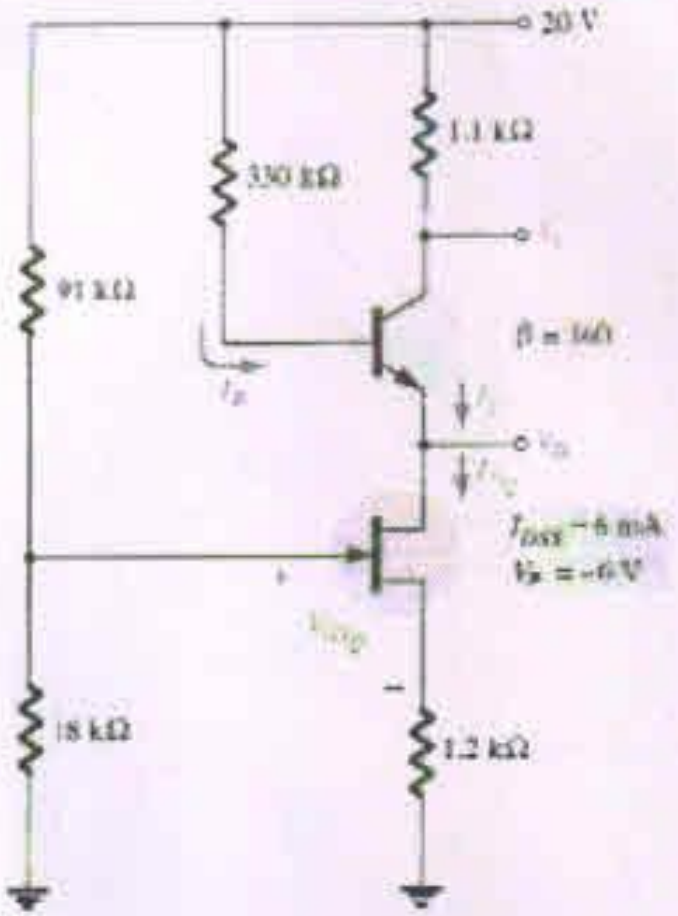

Figure 7.

7. Write short notes on (any *three*) : (15)

(a) MOSFET

(b) Ebers-Moll Model

(c) Hybrid equivalent model

(d) Bridge rectifier.