3E1641

Roll No. _____ Total No. of Pages : 7

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B. Tech. (Sem. III) (Main/Back) Examination, December - 2017
Applied Elect. & Inst. Engg.
3AI2 Electronic Devices & Circuits (EC, EIC, EE, EX, AI, BM)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) What is the position of the fermi level in an intrinsic semiconductor ? How does its position change when :
(i) donor and
(ii) acceptors are added to the semiconductor ?

5

(b) A sample of Ge is doped to the extent of 10^{14} donor atoms/cm^3 and 5×10^{13} acceptor atoms/cm^3 at 300 K, the resistivity of intrinsic Ge is $60\,\Omega - cm$. If the applied electric field is 2 V/cm, find the total conduction current density. Assume $\mu_p/\mu_n = 1/2$ and $n_i = 2.5 \times 10^{13}/cm^3$ at 300 K. **8**

(c) What is mass action for the carrier concentration ? **3**

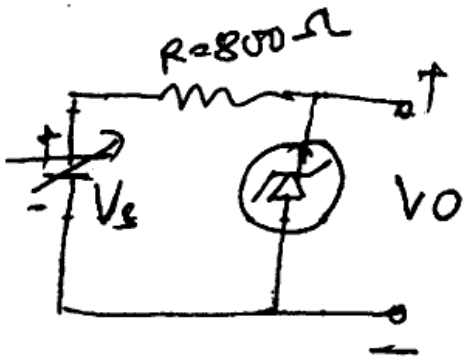
OR

1 (a) What are "Hall effect" and "Hall field" ? Explain briefly the physical origin of the Hall effect. **8**

(b) A rectangular semiconductor specimen, 2 mm wide and 1 mm thick, gives a Hall coefficient of 10^{-2} m^3/c. When a current of 1 mA is passed through the sample, a Hall voltage of 1 mV is developed find the magnetic field and the Hall field. **8**

UNIT - II

2 (a) In the circuit of figure the Zener diode is non ideal, having a knee voltage $V_{zo} = 9V$ and a dynamic resistance $r_z = 5\Omega$. If the supply voltage V_s varies from 15 to 30V, determine the range of variation of the output voltage V_o, also comment on the result.



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(b) (i) What is unijunction transistor ? Give the equivalent circuit.

(ii) Draw and explain its current voltage characteristics.

8

OR

2 (a) The voltage waveform v_i of Figure (a) is applied to the input of the circuit of Figure (b). Show the output voltage V_o waveform and mark the voltage levels.

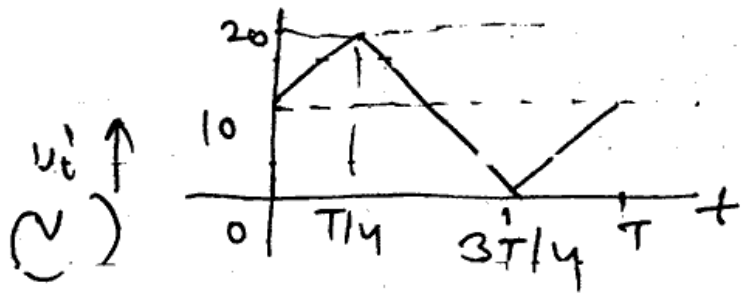


Figure (a)

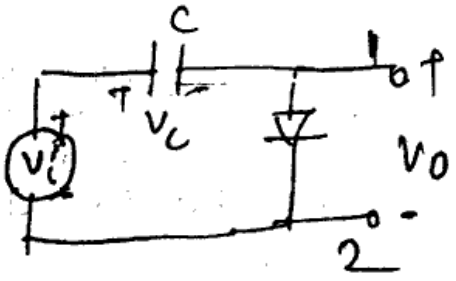


Figure (b)

Find the PIV of the diode, assumed to be ideal.

8

(b) Draw the circuit diagram of a fullwave voltage doubler and explain its operation, how can we construct a voltage trippler ?

8

UNIT - III

3 (a) Draw the circuit diagram of an emitter follower. Why it is called an emitter follower ? Obtain expression for the current gain, input resistance voltage gain and output resistance. **12**

(b) A transistor is operating in the CE mode calculate V_{CE} if $\beta = 125$, $V_{BE} = 0.6\,V$. **4**

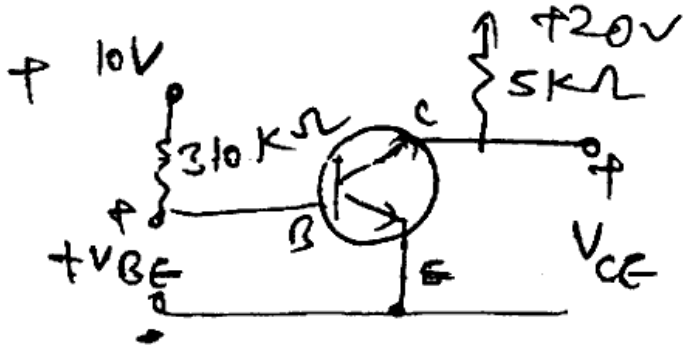
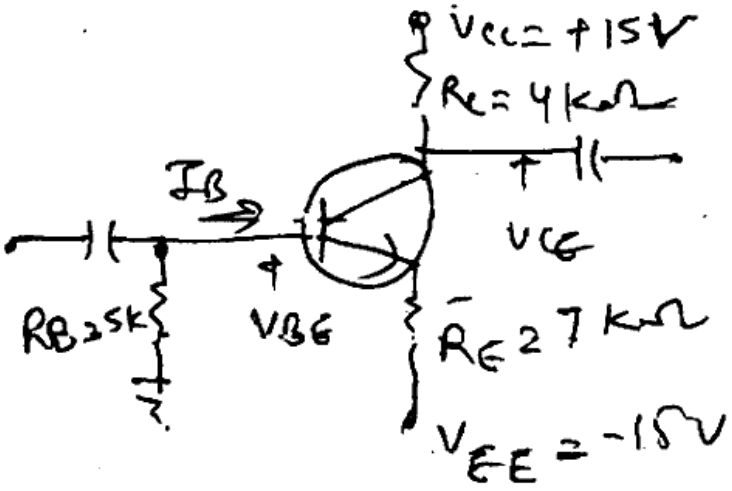


Figure 3(b)

OR

3 (a) In the circuit of figure shown below, $\beta = 99$ and $V_{BE} = 0.7V$. Calculate the quiescent values of I_B, I_C, I_E and V_{CE}. If β is increases by 20% what is the corresponding change in I_C ? **9**



$R_B = 5k\Omega$, $R_E = 7k\Omega$
$R_C = 4k\Omega$
$V_{CC} = +15\,V$
$V_{EE} = -15\,V$

(b) Draw and label the low frequency h-equivalent of CE amplifier and obtain voltage gain.

7

UNIT - IV

4 (a) Derive an expression for the small signal voltage gain of a common source FET amplifier.

8

(b) A n-channel JFET has I_{DSS} = 12 mA and Pinch off voltage V_P = –4V. Find the drain current for V_{GS} = –2V. If the transconductance g_{mo} of a JFET with the same I_{DSS} at V_{GS} = 0 is 4 millimho, find the pinch off voltage.

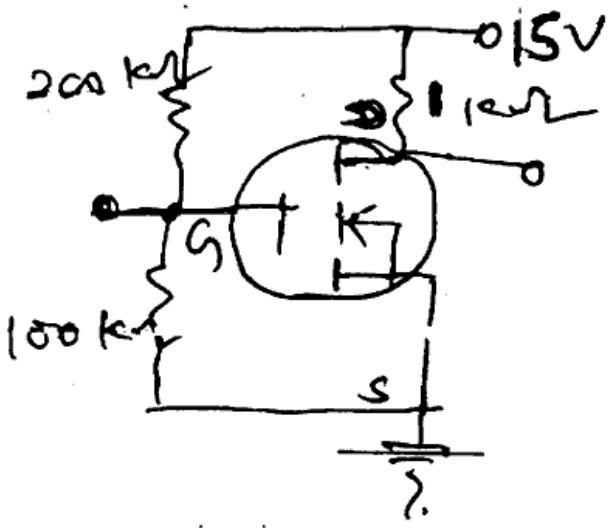
8

OR

4 (a) Sketch the structure of n-channel depletion type MOSFET. Explain how the depletion region is produced in the channel. Can a depletion MOSFET work in the enhancement mode ?

8

(b) An n-channel enhancement mode MOSFET, biased as shown in Fig. operates in the active region. The given parameters are $V_T = 2V$ and $K = 0.5\ mA/V^2$. Calculate I_D, V_{GS} and V_{DS} verify that the operation is indeed in the active region.



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UNIT - V

5 (a) An RC coupled amplifier employs two identical transistors, each having $h_{fe} = 100$, $h_{ie} = 2k\Omega$ and $C_{of} = 2PF$. The coupling capacitor has a capacitance $C = 0.4\ \mu F$. The load resistance for each transistor is $R_L = 8\ k\Omega$. The wiring capacitance $C_W = 10$ PF, calculate the lower and upper half power frequencies.

8

(b) Obtain an expression for the voltage gain of an R-C coupled amplifier in the mid, low and high frequency ranges.

8

OR

5 (a) Draw the circuit diagram of a common source n channel JFET amplifier. Discuss its small signal operation.

10

(b) What is the Darlington connection, compare between an emitter follower and a darlington pair ?

6
