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Section C

4. (a) Explain the circuit configuration of C.E. transistor. Define its static and dynamic current amplification factors. Hence derive a relation between I_C, I_B and I_{CEO}. **8**

(b) A transistor has $\alpha = 0.96$ and a collector leakage current I_{co} of 1 μA. Calculate I_c and I_b, if $I_e = 1$ mA. **8**

5. (a) What is D.C. load line ? How is it drawn ? What is the physical significance of this line ? **8**

(b) Explain input and output characteristics of common collector configuration. **8**

Section D

6. (a) What is need of stabilisation in transistors ? Hence explain the working and analytical analysis of a transistor with voltage divider biasing. **8**

Subject Code—52553

B. Sc. EXAMINATION

(Main/Reappear) (Batch 2018 Onwards)

(Third Semester)

PHYSICS

CPL-303

Course–VI

Semiconductor Devices

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

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. All questions carry equal marks.

Section A

1. (a) Draw energy level diagram for P type semiconductor and comment. Why acceptor level is close to Valence Band ? **2**

(b) Draw V-I characteristics of an Ideal Diode. **2**

(c) α Parameter (C. B. current gain) of a transistor is 0.97. Find the value of β for the same transistor. **2**

(d) What is Q-point in transistor characteristics ? What is the significance of Q-point ? **2**

(e) Differentiate between class A and class B amplifier on the basis of Q-point. **2**

(f) Name the devices used for the following operations : **2**

(i) High voltage A.C. to low voltage A.C. converter

(ii) D.C. to A.C. converter.

(g) Why is NPN transistor preferred over PNP transistor ? **2**

(h) Why two Diodes connected back to back cannot act as a transistor ? Write *two* parameters in support of your answer. **2**

Section B

2. (a) Explain the formation of Potential Barrier across an unbiased P-N Junction Diode. Also draw graph for Potential *vs.* distance along the depletion region for Si and Ge diodes. **8**

(b) What is Zener diode ? Differentiate between Zener and Avalanche Breakdown. Also explain the working of Zener Diode as a voltage stabiliser. **8**

3. (a) Derive expressions for the following for a full wave central tap rectifier :

(i) Average value of output current **4**

(ii) R.M.S. value of output current **4**

(iii) Ripple factor. **2**

(b) A load of 6 kΩ is connected across the output of a full wave rectifier. Diodes are having forward resistance of 50 Ω. If peak value of voltage supplied is 300V, find ripple factor. **6**

(b) A certain amplifer has voltage gain of 10 *d*B. If the input signal voltage is 0.3V, what is output voltage ? (Given Antilog (0.5) = 3.16) ? **4**

(c) An amplifier has a voltage gain of 1000 without feedback. The gain reduces to 150 with negative feedback. Find feedback fraction (β) of the amplifier. **4**

7. (a) Explain Barkhausen criteria for sustained oscillations. **4**

(b) The voltage gain of an amplifier is 100. If we apply a negative feedback with β = 0.03, find its new gain. **4**

(c) Explain the circuit and operation of Colpitts oscillator. **8**

Section E

8. (a) Define CMRR for an OP-Amp. What is its physical significance ? **4**

(b) Explain open loop and closed loop gain in inverting mode OP-Amp. **8**

(c) In an inverting amplifier circuit Ri = 2 kΩ, R_f = 6 kΩ. If V_i = 2V, find output voltage and input current. **4**

9. (a) Explain the working of an OP-Amp as (i) Inverting Amplifier (ii) As Integrator. **12**

(b) In a non-inverting amplifier Ri = 4 kΩ, R_f = 10 kΩ. Find the value of voltage gain. **4**