Q. 1 How does the motion of an electron in a n-type substance differ from the motion of holes in a p-type substance?

Ans. i. Electrons are more mobile than holes.

ii. Electrons move from low potential to high potential i.e. from –ve to +ve terminal. The holes move from high potential to the low potential i.e. from +ve to –ve terminal.

iii. Current produced due to flow of electrons is called electronic current and due to flow of holes is called conventional current.

Q. 2 What is the net charge on a n-type or p-type substance?

Ans. The net charge is zero on a n-type or p-type substance. Net charge only appears when their are excess or deficiency of electrons in an atom. Doping only increases their conductivity and does not create deficiency or excess of electrons. Hence both types are electrically neutral.

Q. 3 The anode of a diode is 0.2 V positive with respect to its cathode. Is it forward biased?

Ans. Yes it is forward bias because anode is at higher potential as compared to the cathode. The p-type of diode is connected with positive terminal of battery and n-type is connected with negative terminal of the battery. This is the condition for forward bias. Hence diode is forward bias under the given condition.

Q. 4 Why charge carriers are not present in the depletion region?

Ans. Since free electrons in the n-region diffuse into the p-region near the junction. As a result of this diffusion no charge carriers are found in the depletion region.

Q. 5 What is the effect of forward and reverse biasing of a diode on the width of depletion region?

Ans. In forward biasing, the charge carriers are pushed towards the junction by the battery. Hence width of depletion region decreases. In reverse biasing, the charge carriers are pulled away from the junction by the opposite terminals of the battery. Therefore width of depletion region decreases.

Q. 6 Why ordinary silicon diodes do not emit light?

Ans. The ordinary silicon diodes have low value of forward bias potential as compared to LED, so visible light do not emit.

$E = hf,\ f = E / h$

$\lambda = c / f = c \times h / E$ [E = 0.7 eV For silicon]

$= 3 \times 108 \times 6.63 \times 10^{-34} = 1.776 \times 10^{-6}$ m

Photons emitted from Si having $\lambda = 1.776 \times 10^{-6}$ > visible light ($\lambda = 10^{-7}$m)

So they lie in infrared region and not visible.

Q. 7 Why a photo diode is operated in reverse biased state?

Ans. Photo diode is used to detect the light. In reverse biased condition, the current is negligible small and can not be detected. But when light falls on p-n junction then current increases with intensity of light which can be easily detected.

Q. 8 Why is the base current in a transistor very small?

Ans. i. Since the base is extremely thin ~ 10^{-6} m, so very few electrons manage to recombine with holes and escape out of the base.

ii. Most of the electrons due to high V_{CC}, cross the base and enter the collector making the collector current large and base current small.

iii. The impurity concentration in the base is less due which base current remains less.

Q. 9 What is the biasing requirement of the junctions of a transistor for its normal operation? Explain how these requirements are met in a common emitter amplifier?

Ans. For normal operation of the transistor, the input junction is forward biased and output junction is reverse biased. For common-emitter amplifier, the emitter is common between base and collector. Therefore, the emitter-base junction is forward biased and collector- base junction is reverse biased.

Q.10 What is the principle of virtual ground? Apply it to find the gain of an inverting amplifier.

Ans. Since the open loop gain of the amplifier is very high (10^5) so when non-inverting input terminal (+) is grounded, then same voltage appears at the inverting terminal (-). Therefore potential difference between the two input terminals is approximately zero i.e.

$V_+ - V_- \approx 0$ or $V_+ \approx V_-$

So V_- is virtually at ground potential. This is called principal of virtual ground.

(For second part see long question in the book.)

Q. 11 The inputs of a gate are 1 and 0, Identify the gate if its output is (a) 0, (b) 1

Ans. a) NOR gate or AND gate or XNOR gate

b) OR gate, or NAND gate or XOR gate.

Q. 12 Tick (√) the correct answer

(i) A diode characteristic curve is a plot between

(a) current and time (b) voltage and time

(c) voltage and current (d) forward voltage and reverse voltage

(ii) The colour of light emitted by a LED depends on

(a) its forward bias (b) its reverse bias

(c) the amount of forward current **(d) the type of semi-conductor material used**

(iii) In a half-wave rectifier the diode conducts during

a. both halves of the input cycle

b. a portion of the positive half of the input cycle

c. a portion of the negative half of the input cycle

d. one half of the input cycle

(iv) In a bridge rectifier of Fig. Q.18.1 when V is positive at point B with respect to point A, which diodes are ON.

a. D2 and D4 b. D1 and D3

c. D2 and D3 d. D1 and D4

(v) The common emitter current amplification factor β is given by

a. I_C / I_E b. I_C / I_B c. I_E / I_B d. I_B / I_E

(vi) Truth table of logic function

a. summarizes its output values

b. tabulates all its input conditions only

c. display all its input/output possibilities

d. is not based on logic algebra

(vii) The output of a two inputs OR gate is 0 only when its

a. both inputs are 0 b. either input is 1

c. both inputs are 1 d. either input is 0

(viii) A two inputs NAND gate with inputs A and B has an output 0 if

a. A is 0 b. B is 0

c. both A and B are zero d. both A and B are 1

(ix) The truth table shown below is for

a. XNOR gate

b. OR gate

c. AND gate

d. NAND gate

Ans. i) c—voltage and current

ii) d—the type of semi-conductor material used

iii) b—a portion of the positive half of the input cycle

iv) a—D_2 and D_4

v) b—I_C / I_B

vi) c—display all its input/output possibilities

vii) a—both inputs are 0

viii) d—both A and B are 1

ix) a—XNOR gate