Total No. of printed pages = 3

## ECE 181407

28/7/22

Roll No. of candidate ☐☐☐☐☐☐☐☐☐☐

### 2022

### B.Tech. 4th Semester End-Term Examination

### APPLIED ELECTRONICS

### (New Regulation & New Syllabus)

Full Marks – 70                                             Time – Three hours

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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 :                                             $(10 \times 1 = 10)$

    (i)   An intrinsic semiconductor at the absolute zero temperature

        (a)   behaves like an insulator      (b)   has large number of holes
        (c)   has large number of electrons (d)   behaves like conductor

    (ii)  Electron-hole pairs are produced by

        (a)   doping                         (b)   thermal energy
        (c)   ionization                     (d)   Both (a) and (b)

    (iii) The cut in voltage of a Silicon diode is

        (a)   0.2 V                          (b)   0.6 V
        (c)   0.8 V                          (d)   1.0 V

    (iv)  A transistor has an $\alpha$ of 0.975. The value of $\beta$ is

        (a)   43                             (b)   39
        (c)   0.995                          (d)   80

    (v)   A photodiode is a two terminal PN junction operates in

        (a)   reverse bias
        (b)   forward bias
        (c)   both forward and reverse bias
        (d)   None of the above

(vi) A digital circuit that can store only one bit is called

    (a)   register                 (b)   memory

    (c)   flip-flop               (d)   NOR gate

(vii) An XOR function is expressed as

    (a)   $\overline{AB} + AB$            (b)   $\overline{A}B + A\overline{B}$

    (c)   $(\overline{A} + B)(A + \overline{B})$     (d)   $(\overline{A} + \overline{B})(A + B)$

(viii) The robot designed with polar coordinate system has

    (a)   three linear movements

    (b)   three rotational movements

    (c)   two linear and one rotational movement

    (d)   two rotational and one linear movement

(ix) Tachogenerator is used to measure

    (a)   force

    (b)   displacement

    (c)   angular velocity of a rotating shaft

    (d)   temperature

(x) The number of moveable joints in the base, the arm and the end effectors of the robot determines

    (a)   flexibility            (b)   payload capacity

    (c)   degree of freedom      (d)   None of the above

2.   (a)   Differentiate between N-type and P-type semiconductors materials. Name three acceptor and three donor materials for doping of a semiconductor.

                                                  $(3 + 2 = 5)$

   (b)   Explain the generation of holes and electrons in an intrinsic semiconductor.

                                                    (5)

   (c)   Discuss the process of formation of depletion layer at PN junction.   (5)

3.   (a)   Explain the two-breakdown mechanism of a reverse biased diode.   (6)

   (b)   Draw the circuit symbol and also draw the V-I characteristics of a PN junction diode when it is (i) forward biased and (ii) reverse biased.

                                                  $(1 + 5 = 6)$

(c) Determine the range of supply voltage that will maintain Zener diode in break-down state i.e $V_z = 10$ v. Assume R (series resistance) = 330 $\Omega$, $R_L = 1\,K\Omega$) and maximum allowable Zener current $I_{zmax} = 20$ mA. (3)

4. (a) Illustrate with necessary figures, explain the principle of operation of a PNP transistor. (6)

(b) What is Q point? Draw the circuit diagram of an inverting amplifier. Also derive the expression of output voltage. (1 + 4 = 5)

(c) Explain the following terms of an op-amp : (2 + 2 = 4)

(i) CMRR

(ii) Input offset voltage

5. (a) Subtract 14 from 45 using 8 bit 2's complement arithmetic. (4)

(b) Convert the following : (4 × 1 = 4)

(i) $(52)_{10}$ to binary

(ii) $(11011)_2$ to decimal

(iii) $(110101)_2$ to octal

(iv) $(1011011011)_2$ to hexadecimal

(c) Convert the expression $f(A, B, C) = A + ABC$ in standard sop form. Reduce the expression $\Sigma m\ (0, 2, 3, 4, 5, 6)$ using K map and implement it using AOI logic. (2 + 5 = 7)

6. (a) Draw a full adder circuit and explain its operation. (7)

(b) Design a 4:16 decoder from two 3:8 decoder. (3)

(c) Design a 2bit asynchronous up counter using JR flipflop. (5)

7. (a) What is sensor? List the four factors the need to be considered in selecting a sensor. (5)

(b) Explain the working principle of techogenerator. (5)

(c) Illustrate with figures, the three common robotic configurations. (5)

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