Code : 041401

(2)

B.Tech 4th Semester Exam., 2018

BASIC ELECTRONICS

Time : 3 hours   Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer of the following
(any *seven*) :   2×7=14

   (a) When checking a diode, low resistance readings both ways indicate the diode is

      (i) open

      (ii) satisfactory

      (iii) faulty

      (iv) not the problem

   (b) Which of the following is the correct relationship between I_B and I_E?

      (i) $I_B = \beta I_E$

      (ii) $I_B = I_E$

      (iii) $I_B = (\beta + 1) I_E$

      (iv) $I_E = (\beta + 1) I_B$

   (c) If a 169·7 V half-wave peak has an average voltage of 54 V, what is the average of two full-wave peaks?

      (i) 119·9 V

      (ii) 108·0 V

      (iii) 115·7 V

      (iv) 339·4 V

   (d) The Q-point on a load line may be used to determine

      (i) V_C

      (ii) V_{CC}

      (iii) V_B

      (iv) I_C

(3)

(e) For the BJT to operate in the active (linear) region, the base-emitter junction must be ____ -biased and the base-collector junction must be ____ -biased.

   (i) forward, forward

   (ii) forward, reverse

   (iii) reverse, reverse

   (iv) reverse, forward

(f) What is the level of drain current I_D for gate-to-source voltages V_{GS} less than (more negative than) the pinch-off level?

   (i) Zero ampere

   (ii) I_{DSS}

   (iii) Negative value

   (iv) Undefined

(g) How much times reverse saturation current will increase, if temperature increases 15 °C?

   (i) 2·52

   (ii) 4·62

   (iii) 4·12

   (iv) 2·82

     (Turn Over)

(4)

(h) The total discharge time for the capacitor in a clamper having $C = 0·01$ µF and $R = 500$ kΩ is

   (i) 5 ms

   (ii) 25 ms

   (iii) 2·5 ms

   (iv) 50 ms

(i) How many op-amps are required to implement the equation $V_0 = V_1$?

   (i) 2

   (ii) 3

   (iii) 4

   (iv) 1

(j) A non-inverting closed-loop op-amp circuit generally has a gain factor

   (i) less than one

   (ii) greater than one

   (iii) of zero

   (iv) equal to one

2. (a) Differentiate between an ideal and a practical voltage source. Give their graphical representations and convert 10 V voltage source with its series resistance of 2Ω into its equivalent current source.

     (Continued)

(b) Explain the working of a shunt capacitor filter and derive an approximate expression for ripple factor in half-wave, rectifier with shunt capacitor filter. 7+7=14

3. (a) Compare the differences between JFET and MOSFET and also prove that the transconductance g_m of a JFET is given by

$$g_m = \frac{2}{|V_p|}\sqrt{I_{DS}\,I_{DSS}}$$

(b) Explain the UJT as a relaxation oscillator. 9+5=14

4. (a) Explain Zener and avalanche breakdown in semiconductors.

(b) Define α and β of a transistor. Also derive the relationship between them. 8+6=14

5. (a) Sketch the output characteristics for N-channel JFET with gate-source shorted (i.e., $V_{GS} = 0$). How are ohmic, pinch off and breakdown regions created?

(b) Explain the basic structure and working of a P-channel JFET. 8+6=14

6. (a) Compare the characteristics of CB, CE and CC configurations of a transistor. Draw the circuit of a common-collector

transistor configuration and explain its operation. Also derive the relation between γ and α current amplification factors.

(b) A collector to base circuit has $V_{CB} = 24$ V, $R_B = 180$ kΩ, $R_C = 3 \cdot 3$ kΩ and $V_{CE} = 10$ V. Calculate h_{FE} and determine V_{CE} when a new transistor is replaced having $h_{FE} = 120$. 8+6=14

7. (a) An inverting op-amp has $R_f = 100$ kΩ and $R_1 = 2$ kΩ. Find the voltage gain of the amplifier. Also find the amplifier input resistance, input current and the output voltage if the input voltage is $0 \cdot 1$ V. Assume op-amp to be ideal.

(b) Explain the working of an op-amp as an integrator circuit. 8+6=14

8. (a) Explain a voltage-shunt feedback amplifier with suitable example.

(b) In a transistor circuit, load resistance is 5 kΩ and quiescent current is $1 \cdot 2$ mA. Determine the operating point when the battery voltage $V_{CC} = 12$ V. How will the Q-point change when the load resistance is changed from 5 kΩ to $7 \cdot 5$ kΩ? 6+8=14

(7)

9. (a) Describe the structure, symbol and operation of SCR with the help of suitable diagrams.

(b) In an N-type semiconductor, the Fermi level lies 0·3 eV below the conduction band at 27 °C. If the temperature is increased to 55 °C, find the new position of the Fermi level. 7+7=14