B.CIVIL ENGG. 1st YEAR 2nd SEM. EXAM. 2017(Old)
BASIC ELECTRONICS ENGINEERING

Time: 3Hrs

Full Marks:100

Answer <u>any ten (10)</u> of the following questions.

1) Answer any five (<u>any 05</u>) briefly. [02x5=10]
   i) Write the relation for Fermi-Dirac Function.
   ii) What is Atomic Energy Level?
   iii) Define orbital angular momentum quantum number.
   iv) What effective mass of an electron?
   v) Define work-function of a metal.
   vi) What is the transformer utilization factor (TUF) in a rectifier?

2) Derive and explain the PIV and PRV ratings of Si and Ge diode. [10]

3) Describe the Energy Band in crystals with appropriate figures and equations. Explain Fermi-Dirac Distribution Function with appropriate figures and equations. [05+05=10]

4) i) What is meant by mobility of carriers? Give an expression for it.
   ii) At 300 K the intrinsic concentration of Si is 1.5×10^{16} m^{-3}. If the electron and the hole mobilities are 0.13 and 0.005 m^2/(V-s) resp., determine the intrinsic resistivity of Si at 300 K. [03+03+04]

5) i) Why is the BJT so called?
   ii) How does the BJT act as an amplifier?
   iii) Define β and α of a BJT and find a relation between them. [02+04+04]

6) i)Prove the following identity and implement it in a logic circuit.
   $$\overline{AB}+\overline{A}+AB=0$$
   ii) Draw a digital full adder circuit. Give the truth table of this circuit. [04+06]

7) i) Subtract 25 from 19 after converting them to binary value.
   ii) Express the OR and AND logic in terms of NAND logic and represent the same with a neat figure. [04+06=10]

8) An electron at rest is accelerated through a potential difference of 100v. Calculate its final kinetic energy in Joules (J) and electron-volts (eV). What is its final velocity? [10]

9) As system of particles obeys Fermi-Dirac distribution function. Show that the probability of vacancy of an energy level ΔE above the Fermi level E_F is the same as the probability of occupancy of an energy level ΔE below E_F. [10]

10) Why the field - effect transistor is called unipolar? Draw schematically the structure of an n-channel JFET and explain the terms source, drain, gate and channel. What is the significance of the term field-effect? Draw the circuit symbol of the JFET.   [10]

11) A diode has a forward resistance of which is 50Ω, supplies power to a load resistance 1200Ω for a 20V (rms) source. Calculate,
    i)   The DC load current. ii)The AC load current. iii)The DC voltage across the diode.
    iv) The DC output power. v) The conversion efficiency. vi) The % regulation.   [10]

12) i) An npn transistor with $\alpha=0.96$ and negligible I_{CO} carries a base current of 0.2 mA in the active region. Determine the emitter and the collector currents.
ii) A transistor operating in the CE mode draws a constant base current I_B of 30μA. The collector current I_C is found to change from 3.5 mA to 3.7 mA when the collector-emitter voltage V_{CE} changes from 7.5 V to 12.5 V. Calculate the output resistance and β at $V_{CE}=12.5$ V. What is the value of α?   [04+06]