

**B.E. CIVIL ENGG. 1<sup>st</sup> YEAR 2<sup>nd</sup> SEM. EXAM. 2018(Old)**  
**BASIC ELECTRONICS**

Time: 3Hrs

Full Marks:100

*Answer any ten (10) of the following questions.*

- 1) Answer any five (*any 05*) 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 is effective mass of an electron?
  - v) Define work-function of a metal.
  - vi) What is the transformer utilization factor (TUF) in a rectifier?
  - vii) Draw a diode half wave rectifier circuit.
  - viii) Arrange the three regions of a transistor according to their doping concentration.
  
- 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  $1.5 \times 10^{16} \text{ m}^{-3}$ . If the electron and the hole mobilities are 0.13 and 0.005  $\text{m}^2/(\text{V}\cdot\text{s})$  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  $\beta$  and  $\alpha$  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  $\Delta E$  above the Fermi level  $E_F$  is the same as the probability of occupancy of an energy level  $\Delta E$  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  $50\Omega$ , supplies power to a load resistance  $1200\Omega$  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  $30\mu A$ . 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  $\beta$  at  $V_{CE}=12.5$  V. What is the value of  $\alpha$ ? [05+05]
- 13) (i) Draw the input and output characteristics of a npn BJT amplifier circuit.  
(ii) A transistor in CE mode is connected to supply of 8 V. The voltage drop across a resistance of 800 in the collector circuit is 0.5 V. Determine  $V_{CE}$  and  $I_B$  for  $\alpha=0.96$ . [05+05]