

AMIETE – ET (OLD SCHEME)

Time: 3 Hours

DECEMBER 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. Which of the following statements is incorrect?
- (A) Doping pure semiconductor materials with small amount of donor impurities produces an n type semiconductor.
(B) Conduction with pure semiconductors is termed as intrinsic conduction.
(C) At room temperature, pure semiconductors make excellent conductors.
(D) The dominant charge carriers in a doped semiconductor are called majority charge carriers
- b. The forward voltage across a conducting silicon diode is about
- (A) 0.3 V (B) 1.7 V
(C) -0.7 V (D) 0.7 V
- c. If a transistor operates at the middle of the dc load line, a decrease in the current gain will move the Q point
- (A) off the load line (B) nowhere
(C) downwards (D) upwards
- d. Which type of special purpose diode is formed by a junction between a metal and layer of semiconductor?
- (A) Schottky Diode (B) Zener Diode
(C) Varactor Diode (D) Tunnel Diode
- e. Which type of special purpose diode has the characteristics of a voltage controlled capacitor?
- (A) Zener Diode (B) Schottky Diode
(C) Varactor Diode (D) Tunnel Diode

Code: AE25 Subject: PHYSICAL ELECTRONICS AND SOLID STATE

- f. LEDs are fabricated from
- (A) Silicon (B) Germanium
(C) Si or Ge (D) Gallium arsenide
- g. Early Effect in BJT refers to
- (A) Avalanche Breakdown (B) Thermal runaway
(C) Base Narrowing (D) Zener Breakdown
- h. For which of the following materials, is the Hall Coefficient zero
- (A) Metal (B) Insulator
(C) Semiconductor (D) Alloy
- i. LEDs are made out of
- (A) Silicon (B) Germanium
(C) Gallium (D) All of the above
- j. The _____ has a physical channel between the drain and source.
- (A) D-MOSFET (B) E-MOSFET
(C) V-MOSFET (D) MESFET

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Give schematic diagrams of Fermi Dirac distribution for intrinsic and extrinsic semiconductors at thermal equilibrium. Explain the variation in Fermi level with temperature in a doped semiconductor. (8)
- b. Find the density of impurity atoms to be added to intrinsic silicon to convert it to
- (i) 10 Ω -cm p type material
(ii) 10 Ω -cm n type material
- Also determine the concentration of minority carriers. (Given data $\mu_p=500$ $\text{cm}^2/\text{V-s}$, $\mu_n=1300$ $\text{cm}^2/\text{V-s}$, $n_i=1.5 \times 10^{10}$ $/\text{cm}^3$) (8)
- Q.3** a. Discuss the two important mechanisms under which a reverse biased p-n junction can breakdown. Mention the differences between them. (8)
- b. Show schematically the effects of forward and reverse bias on a p-n junction. Also give the energy band diagram and the mechanism of particle flow within the junction width. (8)
- Q.4** a. Explain the various mechanisms of the switching cycle in the CE configuration of a Bipolar Junction Transistor. (8)
- b. Explain the following terms in context with BJT
- (i) Emitter Injection Efficiency.
(ii) Kirk Effect (8)

- Q.5** a. Discuss the operating principle and some practical applications of charge transfer devices. (8)
- b. Draw and explain the output characteristics and transfer characteristics of an n channel enhancement MOSFET. (8)
- Q.6** a. Explain the working of a Tunnel Diode and also explain how it exhibits negative resistance. (8)
- b. Discuss the use of Semiconductor Lasers as an easily controlled source of low power coherent radiation. (8)
- Q.7** a. Describe the various steps involved in the formation of a typical monolithic integrated circuit. (8)
- b. Distinguish between Hybrid circuits and Monolithic circuits. (8)
- Q.8** a. What do you understand by the term forbidden gap? Draw energy band diagrams for insulators, conductors and semiconductors. (8)
- b. Find resistivity of intrinsic silicon at 300 K. What will be the change in resistivity if a donor impurity is added to the extent of 1 atom in 10^8 silicon atoms? (8)
- Q.9** Write short notes on the following:
- (i) Heterojunctions
 - (ii) BJT Static Performance Parameters
 - (iii) MOS as a capacitor
 - (iv) IMPATT diode
- (4×4)