Code: AE25 Subject: PHYSICAL ELECTRONICS AND SOLID STATE

AMIETE – ET (OLD SCHEME)

Time: 3 Hours

DECEMBER 2011

STATE Max. Marks: 100

ROLL NO.

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?

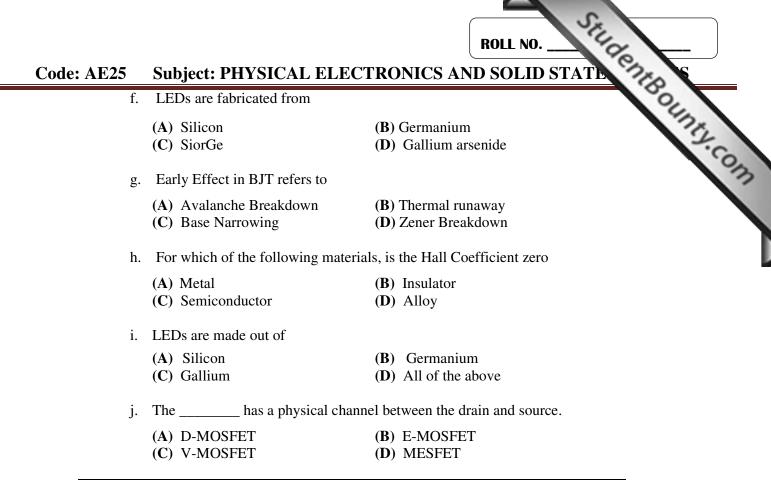
(A) Schottky Diode	(B) Zener Diode
(C) Varactor Diode	(D) Tunnel Diode

e. Which type of special purpose diode has the characteristics of a voltage controlled capacitor?

(A)	Zener Diode	(B)	Schottky Diode
(C)	Varactor Diode	(C)	Tunnel Diode

AE25 / DEC _ 2011

4



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) 10Ω -cm p type material
 - (ii) 10Ω -cm n type material

Also determine the concentration of minority carriers. (Given data μ_p =500 cm²/V-s, μ_n =1300 cm²/V-s, n_i =1.5x10¹⁰ /cm³) (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

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Code: AE25

		ROLL NO.	
: AE2	5	Subject: PHYSICAL ELECTRONICS AND SOLID STATE	STER
Q.5	a.	Discuss the operating principle and some practical applications of charge transfer devices.	а с (8) (8) (8) (8) (8)
	b.	Draw and explain the output characteristics and transfer characteristics of an n channel enhancement MOSFET.	f (8)
Q.6	a.	Explain the working of a Tunnel Diode and also explain how it exhibits negative resistance.	
	b.	Discuss the use of Semiconductor Lasers as an easily controlled source of low power coherent radiation.	f (8)
Q.7	a.	Describe the various steps involved in the formation of a typical monolithic integrated circuit.	l (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.	l (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	

- MOS as a capacitor (iii)
- IMPATT diode (iv) (4×4)

AE25 / DEC _ 2011

2