Printed Pages: 2 **NEC302**

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B.TECH.

THEORY EXAMINATION (SEM–III) 2018-19
FUNDAMENTAL OF ELECTRONIC DEVICES

Time: 3 Hours ***Max. Marks: 100***

Note: Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION-A

1. Attempt all of the following questions: (2×10=20)

(a) Find the Miller indices for a plane when the intercepts along axes are 2a, 3b and 2c.
(b) What is Bragg's equation?
(c) What properties of a semiconductor are determined from a Hall Effect?
(d) Why MOSFET is known as IGFET?
(e) What is false triggering?
(f) What are degenerate devices?
(g) Discuss the need for biasing the transistor.
(h) How does negative resistance develop in transit time devices?
(i) What is the effect of negative gate current on a normal SCR?
(j) Describe the short channel effects.

.SECTION-B

2. Attempt any three of the following questions: (10×3 = 30)

(a) Why is the direct and indirect recombination? Derive an expression for minority carrier lifetime.

(b) What do you mean by minority carrier injection and minority carrier extraction? Derive an expression for total current through the diode for either forward or reverse bias.

(c) What is MESFET? Why MESFET is usually made from GaAs or other compound semiconductor materials rather than from silicon? Enumerate the special features of MESFETs.

(d) What are the basic constructional differences between a conventional P-N junction diode and a tunnel diode? Explain briefly the operation and I-V characteristics of tunnel diode.

(e) Explain the construction and working of :

(i) TRIAC

(ii) IGBT

SECTION – C

3. Attempt any one of the following questions: (10×1 = 10)

(a) (i) Copper has FCC structure and its atomic radius is 1.278 A^0. Calculate the density of copper crystal. Given atomic weight of copper = 63.5 and Avogadro's number = 6.023×10^{23}.

(ii) What types of defects are commonly produced in crystals? Discuss briefly each type of defects.

(b) A potential difference of 10 V is applied longitudinally to a rectangular specimen of intrinsic germanium of length 25 mm, width 4 mm and thickness 1.5 mm. Determine at room temperature:

(i) Electron and hole drift velocities **(ii)** The conductivity of intrinsic germanium if intrinsic carrier density is 2.5×10^{19} m^3 and **(iii)** The total current.

4. Attempt any one of following questions: (10×1 = 10)

(a) An N channel JFET has pinch-off voltage of -4.5 and I_{DSS} = 9 Ma. At what voltage of V_{GS} will I_{DS} be equal to 3 mA? What is its g_m at this I_{DS}?

(b) In reference to a bipolar junction transistor, define the following quantities:

(i) The emitter injection efficiency.

(ii) Current transfer ratio.

(iii) Base to collector current amplification factor.

(iv) Early effect.

5. Attempt any one of following questions: (10×1 = 10)

(a) What is transferred electron effect? Describe a device based on this effect with suitable diagram in detail. Also draw its characteristics.

(b) What is photo-detector? Explain the operation of a p-i-n photo-detector. What are the suitable materials for it? How can it made more sensitive to low level intensity of light?

6. Attempt any one of following questions: (10×1= 10)

(a) What do you understand by miller indices? How this is obtained that describes a plane in a crystal?

(b) Define mobility of a charge carrier and show that:

$$\frac{\mu}{D} = \frac{e}{kT}$$

7. Attempt any one of following questions: (10×1 = 10)

(a) Describe the physical mechanism for p-n junction breakdown. Draw a circuit which uses a breakdown diode to regulate the voltage across a load. Explain its operation.

(b) Explain how a MOS transistor can work as a switch as well as an amplifier?