

**2020**

**ELECTRONICS — HONOURS**

**Paper : CC-5**

**Full Marks : 50**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question no. 1** and **any four** questions from the rest,  
taking at least **one** from **each unit**.

1. Answer **any ten** questions :

1×10

(a) Ge is a/an

(i) indirect band gap semiconductor      (ii) direct band gap semiconductor

(iii) alloy semiconductor      (iv) insulator.

(b) When an intrinsic semiconductor is doped, then it becomes

(i) alloy semiconductor      (ii) compound semiconductor

(iii) extrinsic semiconductor      (iv) elemental semiconductor.

(c)  $np = n_i^2$  is known as

(i) mass action law      (ii) Einstien relation

(iii) current density equation      (iv) continuity equation.

(d) Band gap of 'Si' at 300K is approximately

(i) 0.67V      (ii) 0.67eV

(iii) 1.1eV      (iv) 1.1V

(e) 'As' is a group \_\_\_\_\_ element.

(i) II      (ii) III

(iii) IV      (iv) V

(f) Unit of mobility ( $\mu$ ) is :

(i)  $m^2/(V-s)$       (ii)  $kg/(V-s)$

(iii) V / (m-s)      (iv) None of these.

**Please Turn Over**

- (g)  $\eta$  (in diode I-V equation) is known as
- |                       |                      |
|-----------------------|----------------------|
| (i) form factor       | (ii) ideality factor |
| (iii) feedback factor | (iv) optimum factor. |
- (h) The doping concentration of emitter region of BJT is
- |   |
|---|
| (i) same as base region                             |
| (ii) less than collector region                     |
| (iii) more than base and less than collector region |
| (iv) more than base and collector regions.          |
- (i) The carriers injected into the base of BJT from emitter move through the base region by
- |                  |                  |
|------------------|------------------|
| (i) drift        | (ii) diffusion   |
| (iii) convection | (iv) deposition. |
- (j) The input impedance of FET is \_\_\_\_\_ that of BJT.
- |                |                     |
|----------------|---------------------|
| (i) lower than | (ii) higher than    |
| (iii) same as  | (iv) None of these. |
- (k) In FET, the carriers are transported through the channel by
- |                        |                          |
|------------------------|--------------------------|
| (i) drift process      | (ii) diffusion process   |
| (iii) exchange process | (iv) convection process. |
- (l)  $g_m$  of FET is referred to as
- |                  |                           |
|------------------|---------------------------|
| (i) conductance  | (ii) transconductance     |
| (iii) resistance | (iv) amplification factor |

### Unit - I

2. (a) What is meant by compound semiconductor? Give an example.  
 (b) What is meant by effective mass?  
 (c) How does Fermi level of a semiconductor depend on temperature and doping concentration? Explain with graphs. (1½+½)+2+{(2+1)+(2+1)}
3. (a) What is meant by charge neutrality condition?  
 (b) How does carrier concentration depend on temperature? Explain with a graph.  
 (c) Derive the current density equation involving drift and diffusion processes.  
 (d) How are excess carriers generated in a semiconductor? 2+(2+1)+3+2

4. (a) How is the depletion region formed in a  $p-n$  junction?  
 (b) How is a built-in electric field generated in a  $p-n$  junction?  
 (c) Why diffusion current must cancel out drift current in an unbiased  $p-n$  junction?  
 (d) Derive an expression for built-in potential in a  $p-n$  junction. 2+2+2+4

### Unit - II

5. (a) What is Zener breakdown?  
 (b) Why Zener diode is not suitable for rectification purpose?  
 (c) How can Zener diode be used as a voltage regulator? Explain with a circuit diagram.  
 (d) Differentiate between  $p-n$  junction diode and Zener diode. 2+2+4+2
6. (a) Why is BJT called a bipolar device?  
 (b) What is the origin of the name 'transistor'?  
 (c) Can a BJT be replaced with two  $p-n$  junction diodes? Explain.  
 (d) Draw the current components of a  $p-n-p$  transistor under CB mode. 2+2+2+4

### Unit - III

7. (a) Why is FET called a unipolar device?  
 (b) FET is a voltage controlled device. — Explain.  
 (c) What is meant by pinch-off with respect to a JFET? Why the current is not zero at pinch-off? — Explain with a diagram.  
 (d) Draw the symbol of an  $n$ -channel JFET. 2+2+(2+3)+1
8. (a) Differentiate between BJT and FET.  
 (b) How a channel can be formed in  $p$ -channel enhancement type MOSFET? — Explain with a diagram.  
 (c) An  $n$ -channel depletion mode MOSFET can be used both in depletion and enhancement modes. — Explain with cross-sectional diagrams. 2+(2+1)+(2½+2½)
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