

Time: 2½

Total Marks: 60

**N.B. :** (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Draw neat diagrams wherever necessary.

(4) Symbols have usual meanings unless otherwise stated.

(5) Use of non-programmable calculator is allowed.

1. (a) Attempt any one:---

(i) Sketch the energy band diagram, charge distribution, electric field distribution and potential distribution of an ideal MOS diode. **8**

(ii) Draw a labeled diagram of MOSFET with an appropriate explanation of its current-voltage (I-V) characteristics under ideal conditions and determine the channel conductance and transconductance. **8**

(b) Attempt any one:---

(i) Write note on simulation. **4**

(ii) Write note on a volatile memory devices and its use. **4**

2. (a) Attempt any one:---

(i) Draw a labeled diagram of Tunnel diode and discuss in detail its current-voltage (I-V) characteristics. **8**

(ii) Explain in detail the construction and working of BARITT diode. **8**

(b) Attempt any one:---

(i) Write note on transferred electron devices. **4**

(ii) Draw a schematic diagram and symbol of thyristor. **4**

3. (a) Attempt any one:---

(i) Define photodetectors. Draw a schematic diagram of photoconductor and explain its operation under illumination and illustrate mathematical relation for photocurrent gain. **8**

(ii) What are the fiber materials? Explain fiber optical waveguide and transportation of light signal? Explain any one technique to manufacture the optical fiber. **8**

- (b) Attempt any **one**:---
- (i) Write note on semiconductor solar cell. **4**
  - (ii) Write note on amorphous silicon solar cells. **4**
4. (a) Attempt any **one**:---
- (i) Explain briefly nanomaterials and describe any one method to synthesize semiconductor nanomaterials and state their properties which are different than the bulk materials. **8**
  - (ii) Explain briefly the theory of colloids. How are the metal nanoparticles synthesized by the colloidal method? **8**
- (b) Attempt any **one**:---
- (i) Bulk nanostructured materials **4**
  - (ii) Write note on carbon nanostructures **4**
5. Attempt any **four**:---
- (a) Write short note on buried channel devices. **3**
  - (b) Write note on MOS transistor scaling. **3**
  - (c) Explain in brief bipolar power transistor. **3**
  - (d) Write short note on Gunn diode. **3**
  - (e) Write short note on applications of semiconductor LASER. **3**
  - (f) Write note on liquid crystal display. **3**
  - (g) Write short note on mobility in MODFET quantum well. **3**
  - (h) Applications of nanotechnology in different field. **3**
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