

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**