

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) Describe Czochraski crystal growth method for the preparation of single crystal silicon with a neat labeled diagram. Obtain the expression for doping distribution as a function of the fraction solidified. **8**

(ii) Draw a labeled diagram for a conventional molecular beam epitaxy (MBE) system and explain the growth of semiconductor with suitable example. **8**

(b) Attempt any **one**:---

(i) Describe in brief Float zone phase epitaxy technique to deposit the thin films. **4**

(ii) Draw a labeled diagram of vapor phase epitaxy with brief explanation. **4**

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

(i) Explain diffusion process in a semiconductor. State Flick's first law of diffusion in a semiconductor and derive the necessary equation. **8**

(ii) Describe in detail ion implantation process. Describe energy loss mechanism of ions after entering into the semiconducting materials. **8**

(b) Attempt any **one**:---

(i) Explain the various defects generated during the growth of epitaxial layered thin films. **4**

(ii) Write a note on metalorganic chemical vapor deposition system. **4**

3. (a) Attempt any **one**:---
- (i) What do you understand by lithography? Draw a schematic diagram of X-ray lithographic system and explain it in detail. **8**
- (ii) Describe the etching process in semiconductor fabrication. Explain basic mechanism of wet chemical etching and with neat labeled diagram, describe wet chemical etching processes for silicon and silicon dioxide. **8**
- (b) Attempt any **one**:---
- (i) Write short note on dry etching process. **4**
- (ii) Draw a schematic diagram of ion beam lithography system. **4**
4. (a) Attempt any **one**:---
- (i) Write note on (a) Integrated-circuit capacitor (b) Integrated circuit resistor. **8**
- (ii) Write down various processes used for the fabrication of integrated circuit (IC) using silicon planar technology. Discuss advantages of integrated circuit over discrete component circuits. **8**
- (b) Attempt any **one**:---
- (i) Write note on simulation. **4**
- (ii) Write note on bipolar technology. **4**
5. Attempt any **four**:---
- (a) Draw a labeled diagram of chemical vapor deposition. **3**
- (b) Write note on reaction kinetics of SiO<sub>2</sub> growth during film formation. **3**
- (c) Write note on oxide masking in semiconductor growth process. **3**
- (d) Write note on optical lithography. **3**
- (e) Write note on plasma etching. **3**
- (f) Describe the necessity of clean room for IC fabrication. **3**
- (g) Give the full form of (a) MOSFET (b) MESFET (c) MISFET (d) MOS (e) CMOS (f) ULSI. **3**
- (h) Write note on fundamental limits of integrated devices. **3**