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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2025 - 2026)

Subject: VLSI Technology

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

- (1.1) Ion implantation causes damage that is corrected by: (CO1, K2) 1
- (a) Cooling
- (b) Hydration
- (c) Annealing
- (d) Electropolish
- (1.2) Which material is commonly etched using KOH? (CO1, K2) 1
- (a) Aluminum
- (b) Silicon
- (c) Nitride
- (d) Oxide
- (1.3) Molecular Beam Epitaxy operates at: (CO2, K2) 1
- (a) High vacuum
- (b) Ambient pressure
- (c) High pressure
- (d) Liquid atmosphere
- (1.4) Which gas is commonly used in VPE for silicon growth? (CO2, K2) 1
- (a) SiH₄
- (b) N₂
- (c) CO₂
- (d) O₃
- (1.5) LPCVD advantages include: (CO3, K2) 1

- (a) Low uniformity
 - (b) High uniformity
 - (c) No vacuum required
 - (d) High cost only
- (1.6) SiO₂ mainly acts as: (CO3, K1) 1
- (a) Conductive layer
 - (b) Insulating layer
 - (c) Masking for Si₃N₄
 - (d) Metal
- (1.7) Main drawback of ion implantation is: (CO4, K2) 1
- (a) Precise control
 - (b) Crystal damage
 - (c) Fast processing
 - (d) No heating
- (1.8) Diffused impurity concentration decreases with: (CO4, K2) 1
- (a) Depth
 - (b) Dopant type
 - (c) Anneal
 - (d) Masking
- (1.9) Which metal is most commonly used for CMOS interconnects due to low resistivity? (CO5, K2) 1
- (a) Aluminum
 - (b) Copper
 - (c) Tungsten
 - (d) Titanium
- (1.10) The main drawback of aluminum metallization is: (CO5, K2) 1
- (a) High cost
 - (b) High resistivity
 - (c) Electromigration susceptibility
 - (d) Difficult deposition

2. Attempt all parts:-

- (2.1) List any two clean room classes. (CO1, K2) 2
- (2.2) Define heteroepitaxy. (CO2, K2) 2
- (2.3) What is anisotropic etching? Is it desirable? (CO3, K3) 2
- (2.4) Mention two applications of Ion-Implantation Technique. (CO4, K2) 2
- (2.5) Mention two advantages of Vacuum Deposition. (CO5, K2) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Describe RCA cleaning steps. (CO1, K3) 6
- (3.2) Explain interstitial diffusion with diagram. (CO1, K2) 6

Answer any one of the following:-

- (3.3) Discuss SOI technology with suitable diagram (CO2, K3) 6
- (3.4) What is oxidation ? Differentiate dry vs wet oxidation. (CO2, K3) 6

Answer any one of the following:-

- (3.5) Compare optical lithography and electron beam lithography. (CO3, K4) 6
- (3.6) Explain the deposition process of polysilicon films using CVD. (CO3, K3) 6

Answer any one of the following:-

- (3.7) Explain major process parameters that influence Ion-Implantation Technique. (CO4, K4) 6
- (3.8) Describe Diffusion Profiles with suitable examples. (CO4, K3) 6

Answer any one of the following:-

- (3.9) Analyze major limitations of Vacuum Deposition. (CO5, K4) 6
- (3.10) Describe the process flow of Metallization in detail. (CO5, K3) 6

SECTION-C

50

4. Answer any one of the following:-

- (4.1) Describe safety measures in VLSI fabrication. (CO1, K3) 10
- (4.2) Explain interstitial and substitutional diffusion in detail with suitable diagram. (CO1, K2) 10

5. Answer any one of the following:-

- (5.1) What is Epitaxy ? Explain vapor-phase epitaxy in detail with diagrams. (CO2, K3) 10
- (5.2) Explain SOI technology and its advantages. (CO2, K2) 10

6. Answer any one of the following:-

- (6.1) Explain the working principle of optical lithography with a neat diagram. (CO3, K2) 10
- (6.2) Discuss the principle of chemical vapor deposition (CVD) with suitable diagram. (CO3, K3) 10

7. Answer any one of the following:-

- (7.1) Critically analyze Diffusion Furnace in terms of theory, technology, and limitations. (CO4, K4) 10
- (7.2) Explain Ion-Implantation with neat diagrams and detailed steps. (CO4, K2) 10

8. Answer any one of the following:-

- (8.1) Explain Failure Mechanisms in Metal Interconnects with neat diagrams and detailed steps. (CO5, K2) 10
- (8.2) Explain CMOS Fabrication Steps with neat diagrams and detailed steps. (CO5, K3) 10