Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 23- 05- 2026 **Time:**09:30am – 12:30pm

School: SOE	**Program:** BTECH-VLSI	
Course Code: ECE2510	**Course Name:** Introduction to Fabrication Technology	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**12**	**12**	**12**	**32**	**32**

Instructions:

(i) ***Read all questions carefully and answer accordingly.***

(ii) ***Do not write anything on the question paper other than roll number.***

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Explain the reason electronic-grade silicon requires high purity for semiconductor device fabrication.	**2 Marks**	**L2**	**CO1**
2.	Define grain boundary and its effect on electrical properties, including its influence on carrier movement, resistivity, and overall material performance.	**2 Marks**	**L1**	**CO1**
3.	Define dry oxidation in semiconductor processing, including the conditions involved and its role in forming high-quality oxide layers for device fabrication.	**2 Marks**	**L1**	**CO2**
4.	Define selectivity in etching processes and its importance in achieving precise material removal, pattern accuracy, and protection of underlying layers	**2 Marks**	**L1**	**CO2**
5.	Define electron beam lithography and its role in high-resolution patterning for advanced semiconductor device fabrication.	**2 Marks**	**L1**	**CO3**

6.	Define anisotropy in semiconductor fabrication and its importance in achieving precise pattern transfer, vertical sidewalls, and high-resolution structures in integrated circuits.	**2 Marks**	**L1**	**CO3**
7.	Discuss the superiority of CVD over PVD in terms of performance and application.	**2 Marks**	**L2**	**CO4**
8.	Explain the concept of Physical Vapor Deposition (PVD) in semiconductor fabrication, including its definition, working principle, common techniques, and significance in VLSI manufacturing.	**2 Marks**	**L2**	**CO4**
9.	Explain Fick's First Law of Diffusion, including its definition, mathematical expression, physical significance, and its role in semiconductor fabrication process	**2 Marks**	**L2**	**CO5**
10.	Define sputtering in thin film deposition, including its working principle, process conditions, and its importance in semiconductor fabrication for producing high-quality films.	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80M**

11.	The Czochralski method is a highly sophisticated crystal growth process governed by thermodynamic driving forces, Explain the Czochralski (CZ) crystal growth method in detail, including the thermodynamic and kinetic principles governing single crystal formation and the techniques used to minimize defects during growth	**10 Marks**	**L2**	**CO1**
	Or			
12.	Clean Room Classification Standards define how clean an environment must be by specifying the maximum allowable number of particles per unit volume of air. Explain clean room classification standards (ISO), wafer cleaning techniques, and the RCA cleaning process in detail, with emphasis on their importance in contamination control during semiconductor manufacturing.	**10 Marks**	**L2**	**CO1**

13.	Optical Lithography is the most widely used patterning technique in semiconductor manufacturing. It uses light to transfer circuit patterns from a mask onto a photosensitive material (photoresist) coated on a silicon wafer. Explain the complete optical lithography process flow, including mask preparation, exposure, development, and photoresist stripping, along with the resolution limits of the process and the methods used to overcome them.	**10 Marks**	**L2**	**CO3**
	Or			

14.	Advanced lithography techniques are required for nanometer-scale patterning. With reference to Electron Beam Lithography (EBL), Explain its operating principle and pattern generation mechanism.	**10 Marks**	**L2**	**CO3**

15.	Oxidation kinetics governs the growth of silicon dioxide layers. With reference to the Deal–Grove oxidation model, Explain the mechanism of oxide growth. Explain oxidation kinetics and growth regions and evaluate how process parameters influence oxide thickness and quality in IC fabrication.	**10 Marks**	**L2**	**CO2**
	Or			
16.	Oxidation (in semiconductor fabrication) is the process of growing a thin layer of silicon dioxide (SiO_2) on a silicon wafer by reacting silicon with oxygen. This oxide layer is essential for insulation, masking, and device reliability in IC manufacturing. Different oxidation techniques are used to tailor oxide properties. With reference to dry and wet oxidation processes, describe their operating principles.	**10 Marks**	**L4**	**CO2**

17.	Semiconductor fabrication involves a series of precisely controlled processes used to create integrated circuits for modern electronic devices. Key techniques such as diffusion, ion implantation, thin-film deposition, and packaging play a crucial role in defining the electrical properties, structural integrity, and performance of semiconductor devices. Understanding these fundamental processes is essential for analyzing how VLSI circuits are manufactured with high accuracy, reliability, and efficiency. Define the following semiconductor fabrication terms with appropriate explanation: (a) diffusion in solids, (b) lateral diffusion, (c) ion implantation, (d) physical vapour deposition (PVD), (e) sputtering, and (f) semiconductor packaging, highlighting their significance in VLSI manufacturing.	**10 Marks**	**L2**	**CO4**
	Or			
18.	Semiconductor fabrication involves a sequence of carefully controlled processing steps. With reference to this statement, describe the complete sequence of basic steps involved in semiconductor fabrication, starting from wafer preparation to device completion. Examine the purpose and outcome of each step and evaluate how process control at each stage influences device performance, yield, and reliability .	**10 Marks**	**L2**	**CO4**

19.	Examine their growth characteristics and oxide quality and evaluate their suitability for various IC fabrication applications using a comparative analysis. Explain the IC packaging process in detail, including the major steps involved such as wafer dicing, die attachment, wire bonding, encapsulation, and testing, and the different types of semiconductor packages used, along with their features, advantages, and applications in modern electronic devices.	**20 Marks**	**L4**	**CO5**
	Or			
20.	Material removal processes play a major role in pattern transfer. With reference to etching techniques, classify different etching processes used in VLSI fabrication. Examine the working principles of Plasma Etching and Reactive Ion Etching (RIE), and evaluate their advantages, limitations, and suitability for advanced technology nodes.	**20 Marks**	**L4**	**CO5**

21.	Thermal evaporation, sputtering, and CVD are widely used thin-film deposition techniques in semiconductor manufacturing. Explain the differences between thermal evaporation, sputtering, and Chemical Vapor Deposition (CVD) techniques in terms of film quality, step coverage, and cost.	**20 Marks**	**L2**	**CO4**
	Or			
22.	Diffusion in solids is the process by which atoms or dopants move inside a solid material due to a concentration gradient. It is widely used in semiconductor fabrication to introduce impurities into silicon. Explain diffusion models in solids in detail, including the fundamental mechanisms of atomic diffusion, the role of concentration gradients and temperature, Fick's first and second laws, and the solutions for constant source and instantaneous source diffusion, along with their significance in semiconductor fabrication processes.	**20 Marks**	**L2**	**CO4**