Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 05-06-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3044	**Course Name:** IC Fabrication Technology	
Semester: VI	**Max Marks**: 100	**Weightage**:50%

CO - Levels	CO1	CO2	CO3	CO4
Marks	22	24	26	28

Instructions:

(i) Read all questions carefully and answer accordingly.

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

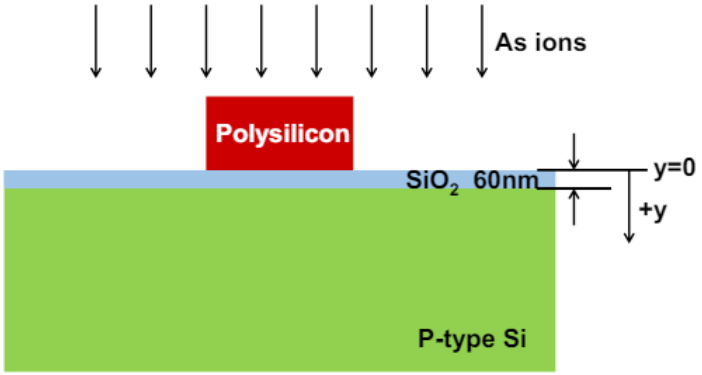
Part A

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

1.	Describe Ion-implantation using required equation.	**2 Marks**	**L1**	**CO3**
2.	What is pattern transfer in IC fabrication, and what are the main techniques used to achieve it?	**2 Marks**	**L1**	**CO4**
3.	The thickness of deposited film is directly proportional to _____ and inversely proportional to _____.	**2 Marks**	**L1**	**CO4**
4.	What are the chemical reactions involved in Vapor Phase Epitaxy (VPE) for silicon growth.	**2 Marks**	**L1**	**CO2**
5.	Deal and Grove model assumes that the oxidation reaction occurs at the interface between the oxidation layer and the substrate materials, rather than between the oxide and the ambient gas. Define the function of τ.	**2 Marks**	**L1**	**CO2**
6.	Distinguish between dry Etching & Wet Etching.	**2 Marks**	**L1**	**CO1**
7.	What is thermal oxidation, and where is it used in IC fabrication?	**2 Marks**	**L1**	**CO3**
8.	Epitaxial growth is broadly defined as the condensation of gas precursors to form a film on a substrate. Write the basic chemical reaction in the epitaxial growth processes of pure silicon.	**2 Marks**	**L1**	**CO3**
9.	Mention the methods of Metallization.	**2 Marks**	**L1**	**CO4**
10.	Why is the slicing process critical in semiconductor wafer fabrication? What factors influence its quality?	**2 Marks**	**L1**	**CO4**

Part B

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

11.	a.	The thickness of a grown oxide layer, which is naturally formed on the surface of a metal, is measured using PHE-103 spectroscopic ellipsometer. Relate the oxide growth rate with respect to thickness using relevant model and equations.	**20 Marks**	**L3**	**CO3**
		Or			
12.	a.	Consider the following cross section that is to be doped with Arsenic using ion implantation to form the source/drain regions. Assume the Si substrate is initially doped with B with a uniform concentration of 10^12 cm-3.  (a) Assume that the SiO2 and polysilicon layers have the same ion stopping power as Si, and that SiO2 thickness is 40 nm. What are the ion implantation dose and energy required to achieve a peak concentration of 10^22 cm-3 of As at the SiO2 and Si interface in the source/drain regions (i.e,y=40nm)? (b) Calculate the junction depth of the source/drain regions.	**20 Marks**	**L3**	**CO3**

13.	a.	In Federal Standard 209 (A to D) of the USA, the number of particles equal to and greater than 0.5mm is measured in one cubic foot of air, and this count is used to classify the cleanroom. Define Clean Room and mention the standards.	**10 Marks**	**L3**	**CO2**
	b.	Summarize the key steps involved in the photoresist process during photolithography in IC fabrication.	**10 Marks**	**L2**	**CO2**
		Or			
14.	a.	Charged atoms or molecules are created via an enormous electric field striving away an electron. This integration process tends to minimize noise in the measurement of the ion current. Identify the process involved. Draw and write the Simple Gaussian expression for implanted profile.	**10 Marks**	**L2**	**CO2**
	b.	The method offfers high resolution because of small wavelength of electrons less than equal to 0.1nm for 10-50eV. 1. Analyze the menthod and mention the advantages of this technique. 2. If diameter of x-ray source is 4.85 mm and the radial distance is given by 5.7mm. Find the ratio of penumbral effect (§) by run out.	**10 Marks**	**L2**	**CO2**

15.	a.	What are the main steps involved in the IC packaging process? Describe the major types of IC design packages.	**10 Marks**	**L3**	**CO4**
	b.	The growth of silicon crystals is the most important technical application of the Cz method. Silicon crystals are grown free of	**10 Marks**	**L3**	**CO4**

		dislocations, with diameters of 100–300 mm and masses up to 300 kg. Discuss the operations performed during silicon crystal growth. What are the precautions that must be taken?			
		Or			
16.	a.	Calculate the electronic stopping power if the wafer lattice atoms are chromium. Assume gallium ions to be targeted to the wafer during ion implantation , the ion velocity is Vo and the wafer atomic density is 6.29. Calculate the electronic stopping power in terms of electron volt/cm^2	**10 Marks**	**L2**	**CO4**
	b.	Explain types of Lithography and their advantages using required examples.	**10 Marks**	**L2**	**CO4**

17.	a.	Suppose you are responsible for a dry oxidation process designed to grow 120 nm of oxide on [100] wafers: a. Suppose that process integration issues require that a temperature of no higher than 900 deg Celcius must be used. What is the time you will use to obtain this thickness? What is the time if steam can be used instead?	**20 Marks**	**L2**	**CO1**
		Or			
18.	**a.**	What is the mechanism of epitaxial growth in semiconductor fabrication, and how does atomic alignment occur during the process?	**10 Marks**	**L3**	**CO1**
	b.	Explain the Vapor Phase Epitaxy (VPE) technique in detail, including its working principle, chemical reactions, and key advantages.	**10 Marks**	**L3**	**CO1**