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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SET B**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION - JAN 2024**

**Semester :** Semester VII - 2020

**Course Code :** ECE3044

**Course Name :** IC Fabrication Technology

**Program :** B.Tech.

**Date :** 05-JAN-2024

**Time :** 9:30AM - 12:30 PM

**Max Marks :** 100

**Weightage :** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE QUESTIONS**

**5 X 2M = 10M**

1. Electronic-grade silicon (EGS) is one of the purest materials commonly available. What is the Czochralski method and what is its primary application?  
(CO1) [Knowledge]
2. Oxidation in IC fabrication is a process used to grow silicon dioxide (SiO<sub>2</sub>) layers on silicon wafers. What is meant by "dry" and "wet" oxidation in IC fabrication?  
(CO2) [Knowledge]
3. Monolithic IC consists of both active and passive components. Mention the components that cannot be fabricated in IC. Mention the purpose of metallization.  
(CO3) [Knowledge]
4. IC packaging materials are ceramic and plastic packaging. List the steps involved in assembly of IC.  
(CO4) [Knowledge]
5. Silicon is found in abundance in nature as an oxide in sand and quartz. Why is silicon dioxide used as an insulator in ICs instead of other materials?  
(CO4) [Knowledge]

**PART B**

**ANSWER ALL THE QUESTIONS**

**5 X 10M = 50M**

6. Etching is the process that removes material from the surface. Selective etch transfers IC design image on the photoresist to the surface layer on wafer. Explain in detail the etch terminology.  
(CO1, CO2) [Comprehension]

7. The two methods for introducing impurities into silicon to control the majority carrier type and resistivity of layer are diffusion and ion implantation. Explain with necessary equations Fick's laws of diffusion and analytical solution of Fick's laws.  
(CO3) [Comprehension]
8. Ion implantation equipment typically consists of an ion source, where ions of the desired element are produced. Ion implantation is utilized to form a shallow junction. Explain in detail ion stopping mechanism, projection range and range distribution.  
(CO4) [Comprehension]
9. Ion implantation allows to generate exactly defined doping profiles and to achieve very uniform doping. After the ion implantation, the wafers have to be annealed to remove the damage introduced by the implantation process. Briefly explain the channelling effect and thermal annealing process in Ion implantation.  
(CO4) [Comprehension]
10. Chemical vapor deposition, or CVD, is a commonly used method of creating thin films used in IC manufacturing. CVD is widely used for the efficient growth of low-dimensional materials. With a schematic diagram explain the different steps involved in the process of CVD.  
(CO2) [Comprehension]

### PART C

**ANSWER ALL THE QUESTIONS**

**2 X 20M = 40M**

11. i) The most suitable material for shaping and cutting silicon is industrial grade diamond. Silicon is hard and brittle. Explain in detail different silicon shaping operations involved in manufacturing of the silicon wafers.  
[10M]
- ii). Electron beam (e-beam) lithography offers high resolution than optical lithography because of the small wavelength of the electrons. List advantages and disadvantages of X-ray lithography. Explain the working of e-beam lithography system with a diagram and process involved.  
[10M]
- (CO2, CO1) [Application]
12. i) The primary metallization applications can be divided into three categories: gate, contact, and interconnection. Polysilicon and silicide are frequently used in gates and interconnects in MOS devices. Aluminum and copper are the metals of choice as contact and second-level interconnection to the outside. Explain Some of the desired properties of metallization for integrated circuits.  
[10 M]
- ii) Metallization is the process by which the components of the ICs are interconnected by aluminium conductor. Explain the different types of metallization process and also list some of the metals and alloys used for different metallization applications.  
[10 M]
- (CO4) [Application]