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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION - JULY 2024

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| **Semester :**VII-2020 | **Date :**10-JULY-2024 |
| **Course Code :**ECE3044 | **Time :**1:30pm to 4:30 pm |
| **Course Name :**IC Fabrication Technology | **Max Marks :**100 |
| **Program :**B.Tech | **Weightage :**50% |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | The number of transistors doubles in roughly two years. Identify the law and mention the types of integration of transistors. | (CO 1) | [Knowledge] |
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| 2 | Electronic grade silicon (EGS) is one of the purest materials commonly available. Mention the significance of the seed crystal in the Czochralski process? | (CO 1) | [Knowledge] |
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| 3 | Silicon is the most common material for semiconductors.Mention some properties of silicon-dioxide. | (CO 2) | [Knowledge] |
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| 4 | Oxidation in IC fabrication is a process used to grow sio2  layers on silicon wafers. What is meant by dry and wet oxidation in IC fabrication? | (CO 2) | [Knowledge] |
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| 5 | Monolithic IC consists of both active and passive components. Mention the components that cannot be fabricated in IC. Mention the purpose of metallization. | (CO 3) | [Knowledge] |
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| 6 | Packaging provides physical support and environmental protection. Mention the four basic requirements for packaging. | (CO 4) | [Knowledge] |
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| 7 | IC packaging materials are ceramic and plastic packaging. List the steps involved in assembly of IC. | (CO 4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | 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. | (CO 3) | [Comprehension] |
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| 9 | 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. | (CO 1) | [Comprehension] |
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| 10 | A model elucidating the kinetics of oxide growth has been developed by Deal and Grove.Deals and Grove's model describes the kinetics of silicon oxidation. Derive the expressions for the three different fluxs considering the equilibrium conditions. Also explain applications of Photo-lithography with advantages and disadvantages. | (CO 3) | [Comprehension] |
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| 11 | The package is a case that surrounds the circuit material to protect it from corrosion or physical damage and allow mounting of the electrical contacts connecting it to the printed circuit board (PCB). Explain in detail the package parameters considered in the process of packaging. | (CO 4) | [Comprehension] |
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| 12 | 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 channeling effect and thermal annealing process in Ion implantation. | (CO 4) | [Comprehension] |
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| 13 | 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. | (CO 2) | [Comprehension] |
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| 14 | Ion implantation is a doping method used in semiconductors that introduces impurities into a semiconductor wafer, enabling conductivity. Dopant atoms are added into si in the form of energetic ion beam injection. Explain briefly the ion implantation process with suitable diagram. | (CO 4) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 15 | 1. 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).Czochralski crystal growing technique is a process which converts polycrystalline material to single crystalline material. Explain with a diagram Czochralski crystal growing technique in IC fabrication processss. [10M] | (CO 1)  (CO 2) | [Application] |
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| 16 | i) Packaging is the science and art of establishing the interconnections and provides the suitable operating environment for electrical circuits. Explain in detail the need of packaging and packaging types with some diagrams and advantages.                                 [10M] ii) Processes that deposit metal thin film on wafer surface is given as metallization process. Aluminum is the widely used metal for metallization. Draw the schematic representation and explain with a neat diagram the metallization process. Also explain the problems in metallization.                      [10M] | (CO 4) | [Application] |
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| 17 | 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.  [10M]  ii) Metallization is the process by which the components of the ICs are interconnected by aluminum conductor. Explain the different types of  metallization process and also list some of the metals and alloys used for different metallization applications.                                        [10 M] | (CO 4) | [Application] |
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