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SEAT No. \_\_\_\_\_

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## SARDAR PATEL UNIVERSITY

M.Sc.(Electronics) ~~III~~ Semester Examination (CBCS)  
 Monday, 18<sup>th</sup> March, 2019 Time : 2.00. PM to 5.00 PM  
 PS04CELE21 – IC Fabrication Technology (70 Marks)

TOTAL MARKS : 70

Note : 1. Answer of all the questions including multiple choice questions should be written in the provided answer book only.

2. Figure to the right indicates maximum marks for the question.

Q.1	Multiple choice questions : One mark each	[8]
a.	The angle between Primary and Secondary identification flat for <111>-n type Silicon wafer is _____. 1. 45° 2. 90° 3. 180° 4. Non of above.	
b.	The _____ planes have the highest density of atoms on the surface, so crystals grow most easily on these planes and oxidation occurs at a higher pace when compared to other crystal planes. 1. <100> 2. <110> 3. <111> 4. Non of above.	
c.	If an epitaxial film is deposited on a substrate of the different composition, the process is called _____. 1. Homoepitaxy 2. Heteroepitaxy 3. Non of Above	
d.	The Czochralski (CZ) process consists of dipping a small _____ into molten silicon and slowly withdrawing the seed while rotating it simultaneously. 1. Single Crystal seed 2. Polycrystalline seed 3. Impurity seed 4. Non of above.	
e.	If the dopant segregates into the oxide (e. g. boron), the bond structure in the silica _____, thereby permitting an enhanced incorporation and diffusivity of the oxidizing species through the oxide, resulting in a larger oxidation rate, 1. Stronger 2. Weakens 3. Remain same 4. Non of above	
f.	For _____ photo-resists, the exposed regions become less soluble. 1. Positive 2. Negative 3. Non of Above	
g.	Ion implantation is a _____ technique for the introduction of impurities (dopants) into semiconductors and offers more flexibility than diffusion. 1. High temperature 2. Low temperature 3. Freezing Temperature 4. Non of Above	
h.	In plasma etching, the chemical etchant is introduced in the _____ phase. 1. Solid 2. Liquid 3. Gas 4. Non of Above	
Q.2	Short questions : Attempt any seven (2 Marks each)	[14]
i.	Why Oxygen is an important element in CZ-Si?	
ii.	What is called Line Defects in Crystal Structure?	
iii.	If a 125-mm diameter wafer is exposed to for 1 minute to an air stream under a laminar-flow condition at 30 m/min, how many dust particles will land on the wafer in a Class 10 clean room? (Assume that in Class 10 room, particle concentration is 350 per m <sup>3</sup> )	

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iv.	List various roles of oxidation process in Silicon.	
v.	List <i>any four</i> desired properties of the metallization for integrated circuits.	
vi.	List the parameters that determine the performance of a lithographic exposure.	
vii	List various methods of Lithographic process in IC fabrication.	
viii	What is Extrensic Diffusion?	
ix	What are advantages of Rapid Thermal Annealing?	
x	Why Silicon is most important Semiconductor Material for Microelectronics Industry?	
Q.3(a)	Discuss Czochralski Crystal Growth method for Electronic Grade Silicon and explain it with necessary diagram.	[6]
(b)	With the help of necessary diagrams, discuss Grinding and polishing steps for Wafer preparation.	[6]
	OR	
(b)	What is epitaxial growth? Discuss Homoepitaxy and Hetroepitaxy. Also Discuss Chemical Vapor Deposition Method to grow epitaxial layer and types of reactor utilized in process.	[6]
Q.4(a)	With the help of necessary diagram, discuss importance of Clean Room in IC Fabrication process.	[6]
(b)	Discuss basic model of oxidation. Also, discuss how the rate of oxidation is orientation dependence.	[6]
	OR	
(b)	What is Photo-resist ? Discuss Positive and Negative Photo-resists with necessary diagrams.	[6]
Q.5(a)	What are the different methods used to introduce controlled amount of impurities in to Silicon? Discuss Diffusion process and derive the Fick's Second Law of Diffusion.	[6]
(b)	Discuss Ion Implantation method to introduce impurities in Silicon.	[6]
	OR	
(b)	Distinguish Wet and Dry Etching. With the help of diagram discuss Reactive Ion Etching process.	[6]
Q.6(a)	What is called Annealing? Discuss Furnace and Rapid Thermal Annealing method with necessary diagrams.	[6]
(b)	Discuss Die Bonding, Wire Bonding and Flip-chip Bonding in Wafer preparation.	[6]
	OR	
(b)	Discuss the Metallization process, Metal Choice and Metal Corrosion in IC Fabrication.	[6]

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