Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U2912

Ph.D. COURSE WORK EXAMINATION, MAY 2024

Electives

Communication Systems

21PCM512- MICROELECTRONICS AND VLSI TECHNOLOGY

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1.	(a)	For a free electron with a velocity of 107 cm/s, what is its de Broglie wavelength? (b) In GaAs, the effective mass of electrons in the conduction band is 0.063 m_0. If they have the same velocity, find the corresponding de Broglie wavelength.	CO3- App	(20)
		Or		
	(b)	A metal, with a work function $\phi_m = 4.2$ V, is deposited on an n-type silicon semiconductor with affinity $\chi = 4.0$ V and $E_g = 1.12$ eV. What is the potential barrier height seen by electrons in the metal moving into the semiconductor?	CO3- App	(20)
2.	(a)	A particular silicon device needs to have an implant of boron with a peak at a depth of 0.3μm and a peak concentration of 10^{17} cm^{-3}. Determine the implant energy and dose that should be used for this process. Find the as – implanted junction depth if the substrate is n-type with a concentration of 10^{15} cm^{-3}.	CO3- App	(20)
		Or		
	(b)	A typical high current implanter operates with an ion beam of 2mA. How long would it take to implant a 150 mm- diameter wafer with O^+ to a dose of $1 * 10^{18} cm^{-2}$?	CO3- App	(20)
3.	(a)	Certain resists have contrast as large as 7. If a positive tone resist has $D_o = 10 mJ/cm^2$ and has $\gamma = 7$. Find D_{100}. For some applications to make a tapered resist profile, that is, a resist edge that is not vertical, but rather rises more slowly from the exposed region. To do this would you a high dose illumination or a low dose illumination? Justify your answer. What limits the exposure?	CO5- Ana	(20)
		Or		

	(b)	A <100>-oriented silicon wafer 150 mm in diameter is 625 μm thick. The wafer has 1000 μm × 1000 μm ICs on it. The IC chips are to be separated by orientation-dependent etching. Describe two methods for doing this and calculate the fraction of the surface area that is lost in these processes.	CO5- Ana	(20)
4.	(a)	Given a switch box, develop an efficient algorithm to find the minimum diameter of rectilinear Steiner trees. The diameter of a tree is the maximum distance between any two of its vertices	CO5- Ana	(20)
		Or		
	(b)	Prove that for n = 3, single trunk Steiner tree is indeed an optimal rectilinear Steiner tree.	CO5- Ana	(20)
5.	(a)	Describe Landauer- Büttiker Formalism for Conduction in Confined Structures	CO2- U	(20)
		Or		
	(b)	Explain Ballistic Quantum Transport in Semiconductor Nanostructures	CO2- U	(20)