Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 714206N **Date: 15/02/2012**
Subject Name: Semiconductor Physics
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Discuss different types of MOSFETs and their transfer characteristics.	**07**
	(b)	Discuss the overall effect, when drift, diffusion and recombination occur simultaneously in a semiconductor.	**07**
Q.2	**(a)**	What are the different building blocks used for the construction of devices? Explain each of them	**07**
	(b)	Using Energy band representations, explain conduction mechanism in conductors, semiconductors and insulators.	**07**
		OR	
	(b)	Find the electron and hole concentrations and Fermi level in Silicon at 300K (i) for 1 x 10^{15} Boron atoms/cm^3 and (ii) 3 x 10^{16} Boron atoms/cm^3 and 2.9 x 10^{16} Arsenic atoms/cm^3.	**07**
Q.3	**(a)**	Discuss Quantum Tunneling phenomenon.	**07**
	(b)	How High field transport in n-type GaAs and SiAs are different? Also discuss two-valley model of n-type GaAs.	**07**
		OR	
Q.3	**(a)**	Assuming that an n-type semiconductor is uniformly illuminated, producing a uniform excess generation rate G. Show that in steady state the change in the semiconductor conductivity is given by $\Delta\sigma = q(\mu_n + \mu_p)\tau_p G$	**07**
	(b)	Explain carrier distribution in each region of the Bipolar Junction Transistor.	**07**
Q.4	**(a)**	Explain basic HBT Structures and its energy band diagram.	**07**
	(b)	Discuss Tunneling effect using energy band diagram and explain how it is different from Avalanche multiplication.	**07**
		OR	
Q.4	**(a)**	Compare asymmetric and conventional Thyristors. Also discuss their typical applications.	**07**
	(b)	If the emitter efficiency is very close to unity, show that the common-emitter current gain β_o can be given by $2L_p^2 / W^2$.	**07**
Q.5	**(a)**	What is MOSFET Scaling? Discuss its advantages and its effects on device operation.	**07**
	(b)	Explain the principle of operation of MESFET.	**07**
		OR	
Q.5	**(a)**	What is Schottky Barrier? Discuss why current transport in a Schottky barrier is mainly due to majority carrier.	**07**
	(b)	Discuss floating gate non-volatile memory structure and its equivalent circuit.	**07**

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