(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 131653	**Roll No.**

B.TECH.

Theory Examination (Semester-VI) 2015-16

ADVANCED SEMICONDUCTOR DEVICES

Time : 3 Hours   *Max. Marks : 100*

Section-A

1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short.** **(2×10=20)**

   (a)   The Si energy gap changes monotonically with temperature. What is the basic concept behind this?

   (b)   Draw the energy level diagram of a PN junction.

   (c)   How a junction barrier is developed across an unbiased junction?

   (d)   Make the energy band diagram of a metal and semiconductor junction at equilibrium. Consider Al metal having a large work function and n-type semiconductor.

(e)   Why does current saturate in long channel MOSFET when large drain voltage is applied on drain?

(f)   A pn junction photodiode is operated under photovoltaic condition similar to solar cell and having the similar I-V Characteristics. under illumination. State three major differences between photodiode and solar cell.

(g)   What is kinetic energy of a hole at the top of the valence band?

(h)   Define minority carrier life time.

(i)   What are the different types of degenerate Semiconductors?

(j)   What is meant by IMPATT diode?

Section-B

2.   **Attempt any five questions from this section. (10×5=50)**

(a)   (i)   Explain the recombination of excess carriers in semiconductors. Derive an expression for excess carrier lifetime.

(ii)   Derive an expression for hole and electron diffusion current.

1   (2)   P.T.O.

(b)   Prove that for a linearly graded PN junction the maximum electric field in depletion region is 3/2 times of average electric field.

(c)   Derive the current expression for long base ideal diode.

(d)   Write down the different methods to calculate the barrier height of a Schottky barrier diode.

(e)   Explain the formation of rectifying M-S contact barrier process using Schottky-Mott theory.

(f)   Derive an expression for a saturated drain current of a n-channel MESFET.

(g)   Explain the principle of operation, storage and transfer of charge in basic charge coupled device (CCD).

(h)   Derive an expression for power output and efficiency of a MSM BAITT diode.

Section-C

Attempt any two questions from this section.   (15×2=30)

3.   The donor and acceptor concentration in Si sample is $6×10^{15}$ and $2×10^{15}$ cm^{-3} respectively. Determine the position of Fermi

1   (3)   P.T.O.

Level with recpect to intrinsic energy level Ei at room temperature. Also find out the value and sign of Hall coefficient.

4. Explain the MESGET operation in case of Depletion mode and enhancement mode device. Draw the I-V characteristic also.

5. A hetero-junction is formed between n-type Ge (with $N_d=1.5\times10^{16}$ cm^{-3}) and p-type GaAs (with $N_a=8.5\times10^{15}$ cm^3).

   i. Draw the thermal equilibrium energy band diagram of junction.

   ii. Calculate the buit-in voltage of the junction.