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SEAT No. :

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M.Sc.

ELECTRONIC SCIENCE

**EL1UTO-1 : Foundation of Semiconductor Devices
(2008 Pattern) (Semester-I)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of non-programmable calculator is allowed.*

Q1) Attempt Any Two of the following:

[2×8=16]

- a) What is the importance of pure crystal in the manufacturing of silicon devices? Describe any one method to produce electronic grade pure crystal.
- b) What is meant by Fermi-diruc distribution function? How Fermi level is defined for semiconductor? Explain how Fermi level is changed using doping of the impurity in semiconductor.
- c) Explain the construction of MOSFET. How threshold voltage is defined? Elaborate small dimension effects.

Q2) Attempt any two of the following:

[2×8=16]

- a) With the help of energy bond diagram, explain the working of pn junction during forward and reverse biased condition.
- b) Mathematically explain the frequency limitations of the bipolar junction transistor.
- c) Explain basic JFET operation. Draw the I-V characteristics of JFET for small V_{os} values. Explain the pinch-off of JFET.

P.T.O.

Q3) Attempt any four:

[4×4=16]

- a) How lattice planes are represented by Miller indices?
- b) Define effective mass. What is the importance of effective mass in semiconductor.
- c) What is meant by built-in potential in case of pn junction? Why it can not be measured externally?
- d) Write a short note on heterojunction bipolar transistor.
- e) Explain ideal Capacitance-Voltage characteristics of MOS.

Q4) Attempt any four:

[4×4=16]

- a) What is the physical significance of wave function?
- b) How Fermi level is changed with respect to temperature?
- c) Write a short note on photodiode.
- d) With the help of neat diagram explain the operation of SCR.
- e) List the advantages and disadvantages of MOSFET.

Q5) Attempt any four:

[4×4=16]

- a) Calculate the first three energy levels of an infinite potential well. Consider an electron in an infinite potential well of width 5Å.
- b) A sample of silicon is doped with 10^{16} Boron atoms/cm³. The sample dimension are $L = 10^{-1}$ cm, $W = 10^{-2}$ cm, $d = 10^{-3}$ cm, $I_x = 1$ mA and $B_z = 5 \times 10^{-2}$ Tesla. Notations have usual meaning. Determine Hall Voltage and Hall field.
- c) Explain the working of DIAC and its characteristics.
- d) Explain channel length modulation in JFET.
- e) Explain switching characteristics of BJT.

