MANIPAL UNIVERSITY

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Reg. No.										

DEPARTMENT OF SCIENCES, M.Sc. (PHYSICS)
IV SEMESTER END SEMESTER EXAMINATIONS, APRIL 2017
SUBJECT: CONDENSED MATTER PHYSICS-II [PHY706.2]
(REVISED CREDIT SYSTEM)

Time: 3 Hours Date : 12-06-2017 MAX. MARKS: 50

Note: (i) Answer any five full questions.

(ii) Missing data, if any, may suitably be assumed.

1. Derive Einstein's equation relating mobility and diffusion coefficient.

   The intrinsic carrier density of Ge at room temperature is 2.5×10^{19} /m^3 .It is doped with As atoms with a concentration of one As atom per million atoms of Ge. If the Ge atom density is 4×10^{28} /m^3 , determine the conductivity of the semiconductor. Assume complete ionization of As atoms and take $\mu_n = 0.35 m^2/Vs$.

   The electron concentration in silicon decreases linearly from 10^{16} /cm^3 to 10^{15} /cm^3 over a distance of 0.1cm. The cross sectional area of the sample is $0.05cm^2$ .The electron diffusion coefficient is $25cm^2/s$. Calculate the electron diffusion current. **(5+2+3)**

2. Draw an ideal energy band diagram for an nP hetrojunction and obtain an expression for its built in potential barrier.

   Obtain an expression for the junction capacitance of a p-n junction. **(7+3)**

3. Describe the following two methods of p-n junction formation (i) melt grown (ii) alloying.
   Discuss how silicon is doped with phosphorus and boron using open tube diffusion system. **(6+4)**

4. Draw the energy level diagram for a Schottky diode under (i) no bias (ii) forward bias and (iii) reverse bias conditions. Describe the charge flow under forward bias.
   Discuss the principle of operation of charge coupled device. **(6+4)**

5. Explain the operation of photo detector and obtain an expression for the photocurrent.
   Discuss the principle of working of phototransistor. **(6+4)**

6. Describe principle of operation of a p-n junction solar cell and derive expressions for short circuit current, open circuit voltage. Draw an electrical equivalent circuit of a solar cell.
   Write a note on hetrojunction solar cell. **(7+3)**

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