MANIPAL ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No.									

DEPARTMENT OF SCIENCES, IV SEMESTER M.Sc (Physics)
END SEMESTER EXAMINATIONS, APRIL/MAY 2019

SUBJECT CONDENSED MATTER PHYSICS-II [PHY 5010]
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours   Date:30TH April 2019   MAX. MARKS: 50

Note: (i) Answer **ALL** questions
(ii) Draw diagrams, and write equations wherever necessary

1. (a) Explain how a superconductor can be used to make a magnet and a cryotron.
(b) What are the assumptions in London's theory? Derive the expression for penetration depth and comment on its temperature dependence.
(c) What is Meissner effect? Show that a superconductor is a perfectly diamagnetic material. **[3+5+2]**

2. (a) Explain the terms – intermediate state, surface energy and coherence.
(b) State the assumptions of Ginzburg-Landau theory. Derive the two G.L. equations.
(c) Derive the expression for fluxoid. **[2+5+3]**

3. (a) What is electron lattice interaction? Using this explain the formation of Cooper pairs.
(b) Using BCS theory, show that a bound state exists irrespective of smallness of attractive potential.
(c) Describe Josephson tunneling using pendulum analogy. **[3+5+2]**

4. (a) Describe Landau's theory of phase transition. Discuss superfluidity of He-3.
(b) Using the concept of diffusion, derive the expression for total width of depletion layer.
(c) What is Schottky effect? For a metal-and n-type semiconductor junction, draw the energy level diagrams when no contacts are made and also when the junction is forward biased. **[3+4+3]**

P.T.O.

5. (a) Explain the terms- radiative and non-radiative transitions. Elucidate the working of a diode laser.
(b) With appropriate diagrams, describe the construction and working of a p-n junction solar cell.
(c) An abrupt p^+n junction in Ge is doped with donors and acceptors concentrations of $N_a = 10^{22}/m^3$ and $N_d = 10^{22}/m^3$ respectively. Determine the diffusion potential and space-charge layer width. Given $\varepsilon_r = 16$, $n_i = 2.2 \times 10^{19}/m^3$, $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.

[3+3+4]