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Total Number of Pages : 01

M.Sc.I  
FPYE1004

10<sup>th</sup> Semester Regular Examination 2018-19

CONDENSED MATTER PHYSICS-II

BRANCH : M.Sc.I(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : F071

Answer Question No.1 which is compulsory and any FIVE from the rest.  
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions : (2 × 10)**
- a) Draw spins directions for ferro-, ferri-, and anti-ferromagnetic substances.
  - b) Beyond Neel temperature, write the expression for magnetic susceptibility.
  - c) What is meant by exchange integral?
  - d) State Curie-Weiss Law.
  - e) Define an Exciton.
  - f) What is meant by magnon?
  - g) Draw the labeled diagram for phonon absorption by an electron.
  - h) What is a Ferroelectric crystal?
  - i) Draw a labeled diagram for a Cooper pair.
  - j) What is meant by F centre?
- Q2 a) Explain Polarization catastrophe for Ferroelectric crystals. (5)**  
**b) Derive Bloch's  $T^{3/2}$  Law. (5)**
- Q3 Apply spin-wave theory to ferromagnetic substances and derive the dispersion relation. (10)**
- Q4 a) Distinguish between Frenkel and Schottky defects (3)**  
**b) Use statistical mechanics to derive an expression for  $n$  in terms of  $N$ ,  $E_v$  and  $T$  where the symbols have their usual meanings. (7)**
- Q5 a) Explain electron-phonon interaction. (3)**  
**b) Derive the 2<sup>nd</sup> quantized form of Hamiltonian for electrons and phonons interaction. (7)**
- Q6 a) Describe the experimental set up for Josephson effect. (3)**  
**b) Give the theory behind D.C. Josephson effect (7)**
- Q7 a) Derive the 0D, 1D and 2D nanostructures. (6)**  
**b) What is the mechanism of colorations of a solid? (4)**
- Q8 Write Notes on any TWO : (5×2)**
- a) Landau diamagnetism
  - b) Second order phase transition.
  - c) SQUID
  - d) Electron-electron attractive interaction due to virtual phonon exchange.