NAN-003-001602 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

March / April - 2017

Physics : Paper - P - 602

(Statistical Mechanics, Solid State Physics & Plasma Physics)

Faculty Code : 003
Subject Code : 001602

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) All questions are compulsory.
(2) Figures on right side indicate marks.
(3) Symbols have their usual meaning.

1 Write very short answer to the following questions : **20**

(1) "Bosons" are the particles which are identical and indistinguishable but having zero or integral spin.
- Is it true or false ?

(2) An interchange of phase points between two cells gives rise to a new macrostate, but microstate for that remains same.
- Do you agree with this statement ?

(3) For the case of Fermi-Dirac statistics, if the distribution of four particles among two cells X and Y is made such that there are three particles in X and one in Y cell. Calculate the thermodynamic probability for this distribution.

(4) According to whom (give name of scientist) , mono-atomic crystal containing n atoms must be considered as a system of $3n$ coupled oscillator ?

(5) In case of M - B statistics, only one particle can be accommodated in a given quantum state or a cell.
- true / false ?

(6) For determination of crystal structure, a radiation of which wavelength must be used, shorter or longer ?

(7) Rotating crystal method is applicable to single crystal specimen only.
- True or false ?

(8) What is value of the transition temperature for mercury below which its resistance becomes extremely small ?

(9) In case of superconductors, if atomic mass of isotopes increases, its critical temperature decreases.
- Do you agree ?

(10) If very high magnetic field is applied to the superconductors, will superconductivity be sustained or destroyed ?

(11) If some impurities like Fe is combined in ZnS, what happened to the photosensitivity of the material -- Does it increased or decreased ?

(12) Due to stress, when dimension of superconductor increases, its transition temperature decreases.
- Is it true or false ?

(13) The ordered arrangement of molecules in the liquid crystalline state is provided by which force ?

(14) All liquid crystals are organic materials composed of rigid, moderately large rod-like molecules having clusters of atoms at the central part of molecules.
- true / false ?

(15) An impurity atom or imperfection in the crystal which is capable of capturing an electron or hole is called a _____.

(16) Pure nematic crystals can be made conducting by doping _____ impurities in them.

(17) Which liquid crystal has twisted structure about the helical axis ?

(18) At the temperature more than boiling point, material exists in the _____ state.

(19) In Bremsstrauhlung radiation spectrum, in the high frequency region, the intensity of radiation is very weak.
- Do you agree ?

(20) In presence of electric field, plasma will show properties of dielectric.
- True / false ?

2 Attempt the following :

(a) Write short answers to the following : (any **three**) **6**

(1) What are "fermions" and "boltzons" ?

(2) Give two points of comparison between M-B, B-E and F-D statistics.

(3) Explain influence of impurity and size on superconductivity.

(4) Write limitations of Laue method for crystal structure determination.

(5) Define : "photoconductivity" and "luminescence"

(6) Give names of luminescent crystal solids (Phosphors).

(b) Give answers to the following : (any **three**) **9**

(1) Explain : Macrostates and Microstates.

(2) Derive : The Sterling's theorem.

(3) Give Einstein's theory of specific heat of solids and discuss it for high temperatures.

(4) Explain influence of magnetic field, current strength and frequency on superconductivity.

(5) Describe properties which do not change in superconducting transition.

(6) Give a list of applications of Plasma.

(c) Write in detail : (any **two**) **10**

(1) Derive the distribution law for F - D statistics.

(2) Discuss free electron model for electronic emission.

(3) Explain : Rotating crystal method.

(4) Derive the distribution law for M - B statistics.

(5) Describe Powder-photograph method to determine the structure of a crystal.

3 Attempt the following :

(a) Write short answers to the following : (any **three**) **6**

(1) Explain black body radiation in Plasma.

(2) Explain "critical magnetic field " in case of superconductivity.

(3) What is "larmor frequency" in case of cyclotron radiation ?

(4) Explain Photo-sensitivity.

(5) Write applications of liquid crystals.

(6) What is ionization of atoms and molecules ?

(b) Give answers to the following : (any **three**) **9**

(1) Write a note on Excitation of atoms and molecules in plasma.

(2) Explain Meissner Effect of Flux exclusion.

(3) Discuss the concept of collisions in plasma.

(4) Write a note on Lyotropic liquid crystals.

(5) Describe properties which change in superconductivity transitions.

(6) Explain "Bremsstrauhlung" in case of Plasma.

(c) Write in detail : (any **two**) **10**

(1) Write a note : Plasma oscillations.

(2) Write in detail : Electrical conductivity and Thermal pinch-off in case of Plasma.

(3) Discuss : London's theory for superconductivity.

(4) Write a note : Applications of superconductors in various fields.

(5) Describe the method of production of Plasma in absence of any gas.
