**RY-003-001602**     Seat No. _____

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

## March - 2019

## Physics : Paper - P - 602

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

(2)   "Fermions" are the particles which are identical and indistinguishable but having 1/2 spin. - Is it true or false ?

(3)   In case of B-E statistics, only one particle can be accommodated in a given quantum state or a cell. Is it true or false ?

(4)   In M-B statistics, internal energy of particles at absolute zero temperature is taken as _____.

(5)   According to Debye , mono-atomic crystal containing n atoms must be considered as a system of 3n coupled oscillator. - Do you agree with this statement ?

(6)   For determination of crystal structure, a radiation of shorter wavelength must be used. - Is it true or false ?

(7) Powder-photograph method is used to determine single crystal specimen only. - Is it True or false ?

(8) Write equation that represents Bragg's law.

(9) At which temperature the resistance of mercury becomes extremely small ?

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

(11) If very high magnetic field is applied to the superconductors, its superconductivity will be destroyed. - Is it true or false ?

(12) When the layer of ZnS : Mn is excited by ultra-violet or X-rays, it emits yellow luminescence. - Do you agree ?

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

(14) Define melting point in case of liquid crystals.

(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) Electrical conductivity of Plasma increases with increase in temperature. - Is it true or false ?

(20) In Bremsstrauhlung radiation spectrum, in the low frequency region, the intensity of radiation is very strong. - Do you agree ?

2 Attempt the following :

(A) Write a short answer to the following : (Any **Three**)  6

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

    (2) Using uncertainty principle show that the minimum volume of a cell in a phase space is $h^3$.

(3) How the superconducting properties of metals can be changed ?

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

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

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

(B) Give answer to the following : (Any **Three**)   9

(1) Obtain Stefan-Boltzmann law of energy density using Planck's formula

(2) State and prove the Sterling's approximation.

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

(4) Explain Dulong and Petit law for specific heat of solids.

(5) Describe properties which change in superconducting transition.

(6) Give a list of applications of Plasma.

(C) Write in detail : (Any **Two**)   10

(1) Explain in detail : Distribution law for B-E statistics.

(2) Derive Planck's law for Black body radiation.

(3) Explain : Rotating crystal method.

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

(5) Describe Laue method to determine the structure of a crystal.

**3** Attempt the following :

(A) Write a short answer to the following : (Any **Three**)  **6**

    (1) Discuss cyclotron radiation in Plasma.

    (2) What is ionization of atoms and molecules ?

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

    (4) What is luminescence ?

    (5) Explain Photo-sensitivity.

    (6) Write applications of liquid crystals.

(B) Give answer to the following : (Any **Three**)  **9**

    (1) Discuss Thermal pinch effect 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) Describe the method of production of Plasma in absence of any gas.

    (2) Write a note : Plasma oscillations.

    (3) Explain model of luminescence in sulphide phosphors.

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

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

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