



MAN-003-001602 Seat No. _____

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

March / April - 2018

Physics : Paper - PHYS. - 602

(Statistical Mechanics, Solid State Physics & Plasma Physics)
(New Course)

Faculty Code : 003

Subject Code : 001602

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :**
- (1) Symbols and notations have their usual meaning.
 - (2) Total marks of the question is indicated on the right side of the question.
 - (3) Attempt as many questions as instructed in the main question.

1 Write short answers to the following questions : 20

(1 Mark each)

- (1) The MB statistics refers to which type of particles so far as the identity and distinguishability properties of the particles are concerned ?
- (2) With how many coordinates the phase space is denoted ? Which are they ?
- (3) Write the Sterling's formula in mathematical form.
- (4) Write the mathematical expression showing Dulong-Petit law.
- (5) Bosons belong to which branch of statistical mechanics in physics ?
- (6) How $h\nu$ and kT are mathematically related for which the Wein's law is valid ?
- (7) The Powder Diffraction method in X-ray diffraction makes use of fine particles of Crystals known as ?
- (8) Bragg equation is a condition for achieving which type of interference ?

- (9) What is wavelength range in which the X-rays can be put to use for crystal structure determination of crystalline solids by diffraction experiment ?
- (10) Ideally apart from the Bragg positions in the X-ray diffraction pattern which type of interference occur ?
- (11) Write the value of the temperature below which liquid mercury turns in superconducting state.
- (12) What happens to the reflectivity of the material when it gets into superconducting state ?
- (13) Which type of magnetism is shown by the material which is in superconducting state ?
- (14) What is the total charge of a copper pair in terms of electronic charge ?
- (15) Give the mathematical expression showing the conductivity of any material in term of mobility of the charge carriers.
- (16) Photo-sensitivity of the material can be shown by which type of gain ?
- (17) Who gave the theory of PLASMA oscillation ?
- (18) What percentage of matter in the universe is believed to be in PLASMA state ?
- (19) In the MHD method of PLASMA production, what does MHD stands for ?
- (20) Write the names of the types of Liquid Crystals.

2 (a) Write short answers to any three of the followings : **6**
(2 Marks each)

- (1) Give two examples each of the Boltzons, Fennions and Bosons.
- (2) Define in brief the Macro states and Micro states in statistical physics.
- (3) What is Black Body and Black Body radiation? Give explanation in brief.
- (4) What is Debye temperature for solids? Explain briefly.
- (5) Write brief note on Laue's X-ray diffraction pattern.
- (6) Calculate the Bragg's angle (2θ) for the (110) peak of crystals having simple cubic system with lattice parameter $a=10 \text{ \AA}$ and $\lambda=1.54056 \text{ \AA}$

(b) Write answers to any three of the followings : **9**

(3 Marks each)

- (1) Prove that the volume of cell in phase space is $d\tau \geq h^3$.
- (2) Prove that electrons in atoms are indistinguishable particles.
- (3) Write note on Einstein's theory of specific heats of crystalline solids.
- (4) Give comparison between MB statistics, BE statistics and FD statistics.
- (5) Write note on Rotating Crystal diffractometer.
- (6) Derive the mathematical expressions for the inter planner distances d for in terms of Miller indices $(h \ k \ l)$ and lattice parameters a, b, c for cubic system, tetragonal system and orthorhombic system.

(c) Write answer to any **two** of the followings : **10**

(5 Marks each)

- (1) Derive the distribution law for FD statistics.
- (2) Derive the mathematical expression for the Planck's radiation law.
- (3) Explain in detail the X-ray powder diffraction method.
- (4) Derive the classical MB statistical distribution law.
- (5) Write note on Cholesteric Liquid crystals.

- 3 (a) Write short answers to any **three** of the followings : **6**
(2 Marks each)
- (1) What is tunnelling effect and explain it in context of superconductors.
 - (2) Write the properties of the superconductors which do not change in the superconducting state.
 - (3) Explain the state of PLASMA.
 - (4) Explain the absorption in PLASMA.
 - (5) Give examples of the applications of Liquid Crystals
 - (6) Give examples of the photo-conducting materials.
- (b) Write answers to any **three** of the followings : **9**
(3 Marks each)
- (1) Explain the thermodynamics of superconducting state.
 - (2) Write note on the persistent current in superconductor.
 - (3) Derive the equation of London's theory of superconductors.
 - (4) Write note on the Electro-Luminescence.
 - (5) Briefly explain the electronic transitions in photo-conductors.
 - (6) Write about the applications of PLASMA.
- (c) Write answer to any **two** of the followings : **10**
(5 Marks each)
- (1) Write detailed note on the BCS theory of superconductors.
 - (2) Write detailed note on the Josephson effect of superconductors.
 - (3) Write detailed note on Photo-sensitivity.
 - (4) Describe the method of production of PLASMA in absence of any type of gas.
 - (5) Write detailed note on PLASMA frequency.