বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

M.Sc. Examinations 2020
Semester IV
Subject: PHYSICS
Paper: PHS 401
(Theory)

Full Marks: 40 **Time: 2 hrs.**

Candidates are required to give their answers in their own words as far as practicable.

UNIT – PHS401.1 (Particle Physics)

Answer any one of the following:

1. Discuss (with particular examples) about the conservation of lepton quantum number and isospin quantum number in elementary particle reactions.

2. Discuss how strange quantum number was proposed in particle physics.

3. i) Establish the relation between Mass and Length in Natural unit.

   ii) Show that: $1GeV^{-2} = 0.39$ mb

4. Briefly discuss the SU(2) group structure of spin-1/2 particles.

5. Briefly discuss the SU(3) Color symmetry of strong interaction.

6. Draw the weight diagram of Pseudo scalar ($J^p = 0^-$) mesons, enumerating clearly the quark content and different quantum numbers. How the diagram will be modified in the presence of charm quark.

7. i) Show that charge conjugation operator anti-commutes with baryon number operator.

   ii) Explain why neutrino is not an eigen state of charge conjugation operator.

8. What is G-parity? Discuss it's importance in particle physics.

9. Show that fermions and anti-fermions have opposite intrinsic parity.

10. Briefly discuss the strangeness oscillation phenomenon of K-mesons.

11. Anti-proton beams are produced in the collision of a high energy proton with proton at rest in the laboratory: $P+P \rightarrow P+P+P+\bar{P}$. i) What will be the threshold energy of this reaction? ii) Calculate the same, when the second proton is coming from opposite direction with same speed.
12. Enumerate all baryon states (with quark structure) in SU(3) flavor decomposition i.e., $3 \otimes 3 \otimes 3$

PHS – 401.2 (Statistical Mechanics)

Answer any One of the following questions

1. Find out the expression of internal energy (U) of an ideal Fermi system and show that it holds the relation P=2/3(U/V).
2. Describe the magnetic behaviour of ideal Fermi gas at low temperature and low field limit.
3. Show that Fermi temperature of a typical metal is much higher than room temperature.
4. Describe the variation of fermi function with energy at T=0, and T= finite. Also describe the variation of derivative of fermi function with energy?
5. Discuss briefly the condition of Bose-Einstein condensation of an ideal Bose gas
6. Considering electrons as fermions show that the thermionic current density varies with temperature square
7. Describe the process of 'co-existence of gas and liquid' in the P-V diagram of Vander Waals gas.
8. Describe the variation of specific heat of an ideal Bose gas as a function of (T/T_c).
9. In the dynamical model of phase transition mark the basic difference among Heisenberg Model, Ising model and Betts model.
10. Describe the basic concept of one dimensional Ising model.
11. Derive the expression of internal energy of an ideal Bose gas.
12. Derive the expression of grand partition function of charged particles in the presence of external magnetic field.