

2071  
M.Sc. (Physics) Fourth Semester  
PHY-7051: Particle Physics - II

Time allowed: 3 Hours

Max. Marks: 60

**NOTE:** Attempt five questions in all, including Question No. IX (Unit-V) which is compulsory and selecting one question each from Unit I -IV.

x-x-x

**UNIT - I**

- I. a) Describe the SU(2) and SU(3) symmetry groups in context to particle physics.  
b) Discuss meson mixing and mass formulae in context with application of symmetry groups. (2x6)
- II. a) Using Young's tableaux find the irreducible representations of  $3 \times 3 \times 3$  in SU(3) and  $6 \times \bar{6}$  in SU(6).  
b) Show that 2 and  $2^*$  representations are equivalent. (2x6)

**UNIT - II**

- III. a) Write the symmetry states for three objects in SU(2).  
b) Describe Bjorken scaling. (2x6)
- IV. a) State and prove Noether's theorem.  
b) On the basis of quark model, show that ratio of magnetic moment of proton and neutron is  $-3/2$ . (2x6)

**UNIT - III**

- V. a) What are weak processes? Give examples. Write the four fermion interaction Hamiltonian.  
b) Describe the features of QCD and write its Lagrangian. (2x6)
- VI. a) Discuss motivation, construction and consequences of Yang Mills theory.  
b) Discuss four fermion theory of weak interactions. (2x6)

**UNIT - IV**

- VII. a) Discuss the discovery of Higgs boson and its properties.  
b) Write the Lagrangian of Standard model explaining each term. (2x6)
- P.T.O.

(2)

- VIII. a) Show the existence of a zero mass particle in any field theory where global continuous symmetry is broken.
- b) Discuss the salient features of unification of electromagnetic and weak interactions. (2x6)

UNIT - V

IX. Attempt the following:-

- a) What are non-abelian gauge fields?
- b) What is  $\omega - \phi$  mixing?
- c) What is the significance of colour quantum number?
- d) What do you mean by helicity?
- e) Describe Higgs Mechanism?
- f) Write the quark content of neutron, pion, lambda particle and omega particle. (6x2)

x-x-x