(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 9 Sub. Code : 2 6 1 1 5

Exam. Code : 0 4 7 5

M.Sc. Physics 4th Semester

(2056)

PARTICLE PHYSICS–II

Paper : PHY-8042

Time Allowed : 3 Hours] **[Maximum Marks : 80**

Note :– Attempt **five** questions in all, including Q. No. **9** (Unit–V) which is compulsory and selecting **one** question each from Units I–IV.

UNIT–I

1. (a) Explain the symmetry groups SU(2), SU(3), and SU(6) in context with the quark model. 8

   (b) Find the irreducible representations of $3 \times 3 \times 3$ in SU(3) using Young's tableaux. 8

2. (a) Show that 2 and 2* representations are equivalent. 4

   (b) Discuss the application of symmetry groups in hadron spectroscopy. 8

   (c) Derive Gellmann Okubo Mass formula. 4

UNIT–II

3. (a) On the basis of quark model, find the magnetic moment of proton. Given that

$$\phi_s^p = \frac{1}{\sqrt{6}}(udu + duu - 2uud) \text{ and } \phi_A^p = \frac{1}{\sqrt{2}}(ud - du)u.$$

6

(b) Describe meson spectroscopy in the quark model. 4

(c) Describe the quantum numbers of quarks. Explain baryon number, strangeness, charm, isospin, and hypercharge. 6

4. (a) Explain low energy electron-proton scattering and define nucleon form factors. 8

(b) State and prove Noether's theorem and explain its significance in particle physics. 8

UNIT–III

5. (a) What are weak processes? Give examples. Write the four-fermion interaction Hamiltonian. 8

(b) Explain Yang-Mills theory and discuss its motivation and construction. 8

6. (a) What is two component theory of neutrino, how does one determine the Helicity of neutrino? 8

(b) Explain GIM model. What are neutral and charged currents? 8

UNIT–IV

7. (a) Write the salient features of electroweak theory. Write its Lagrangian and explain the significance of each term. 8

   (b) Show the existence of a zero mass particle in any field theory where global continuous symmetry is broken. 8

8. (a) Explain the Standard Model of particle physics. Describe its gauge group, particle content, and interactions. 8

   (b) Discuss the properties, role, and experimental discovery of the Higgs boson. 8

UNIT–V

9. (a) Define unitary spin. 2

   (b) What are structure functions? 2

   (c) What is quark confinement? 2

   (d) Write the QCD Lagrangian. 3

   (e) Write quark composition of proton, neutron, pion, kaon, Ω^- and λ-particle. 3

   (f) What are Fermi and Gamow Teller transitions? 4