

Roll No.

Total Pages : 3

CMDQ/D-23

5122

PARTICLE PHYSICS-I

Paper-PHY-303C

Time Allowed : 3 Hours]

[Maximum Marks : 60

Note : Attempt **five** questions in all, selecting **one** question from each Unit. Question No. **1** is compulsory. All questions carry equal marks.

Compulsory Question

1. Attempt following questions :

- (a) Define resonance and how does it differ from unstable particle? 3
- (b) Write the decay mode (resonance) involved in the discovery of b-quark. 2
- (c) Why parity is a multiplicative quantum number? 3
- (d) In Baryon decuplet model, for Δ^{++} resonance, three u quarks with same spin occupies the same energy level. How? 2
- (e) Draw Feynman diagram for decay of proton. 2

UNIT-I

- 2. (a) Derive the expression for total cross-section and deduce the optical theorem. 6
- (b) Write a brief note on the discovery of top quark. 6
- 3. (a) Discuss the application of Breit-Wigner formula to describe Z^0 resonance. How does measurement of Z^0 helps to establish three types of neutrino? 6
- (b) Explain decay of K^+ to three pions using Dalitz plot. 6

UNIT-II

- 4. Discuss importance of isospin symmetry in particle physics and what are isospin transformation. Prove that why $\sigma_{p+n}/\sigma_{p+p} = 0.5$. 12
- 5. (a) Show that deuteron is an isosinglet state. 7
- (b) Write a brief note isospin conservation in strong interactions. 5

UNIT-III

- 6. Discuss quark model of early sixties. Describe baryon decuplet ($3/2^+$) in terms of strangeness and isospin. Also, explain the prediction of this model which later led to discovery of $S = -3$ particle. 12
- 7. (a) Discuss isospin violation in weak interactions with suitable examples. 6

- (b) Explain why isospin part of the total wave function for deuteron system need to be antisymmetric. 6

UNIT-IV

8. (a) What is charge conjugation and show that C-parity of neutral pion is +1. 6
- (b) What is parity and show that its eigen value is $(-1)^{\ell}$.
How does observed neutrinos are eigenstates of operator CP. 6
9. Discuss briefly :
- (a) G-parity. 6
- (b) Consequences of CPT theorem. 6