LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **PHYSICS**

FOURTH SEMESTER – **APRIL 2013**

PH 4959 - PARTICLE PHYSICS

Date : 03/05/2013   Dept. No.   Max. : 100 Marks
Time : 1:00 - 4:00

PART - A

Answer ALL questions: (10x2=20)

1. Name the different types of elementary fermions and their interactions in the standard model.

2. What is the total isospin of a baryon made up of three **u** quarks and their multiplicity?

3. Write down the Dirac equation in an electromagnetic field.

4. What is meant by charge conjugation ?

5. What are the elements of SU(2) group?

6. Are neutral current decays observed in atomic systems ? Why ?

7. Estimate the coupling constant between the electron field and the Higgs field .

8. Give the equation which expresses the conservation of electron lepton number.

9. Show that meson states are colour singlets.

10. What is asymptotic freedom ?

PART - B

Answer any FOUR questions: (4x7.5 = 30)

11. Discuss the solution of the K-G equation and its relevance to the Standard Model.

12. Show that the electromagnetic field appears as a consequence of the invariance of the Lagrangian of quantum electrodynamics under a local symmetry transformation.

13. Discuss Higg's mechanism of introducing mass into a theory.

14. Discuss the coupling of the lepton fields to the Z gauge field.

15. Discuss the quark-anti quark interaction at short distances.

PART - C

Answer any FOUR questions: (4x12.5 =50)

16. (a) Discuss the discovery of the heavier quarks.

    (b) Explain the role of quark colour in the standard model.

17. (a) Establish the Lorentz invariance of the Dirac equation.

    (b) Obtain the Lagrangian of quantum electrodynamics.

18. (a) Construct a Lagrangian density which is invariant under a local SU(2) transformation as well as a local U(1) transformation.

(b) Obtain an expression for the total dynamical contribution to the Lagrangian density associated with the gauge fields B and W.

19. Explain the construction of the Lagrangian density for the electro-weak interaction of the quarks.

20. Explain why colour symmetry is not readily apparent in the particles, baryons and mesons formed from quarks by the strong interaction .

<div align="center">***********</div>