UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Seventh Semester – Fall 2021

Roll No. .....

Paper: Particle Physics-II **Course Code: PHY-408** **Time: 3 Hrs.** **Marks: 60**

Q.1. Give short answers of the following: **(10x3=30)**

1. Show that $\gamma^\mu\gamma^\nu + \gamma^\nu\gamma^\mu = 2g^{\mu\nu}$
2. Show that $\beta^2 = 1$
3. Why do we need relativistic wave equation?
4. Show that $g^{\mu\nu}g_{\mu\nu} = 4$
5. Show that γ^0 is hermitian and γ^k is anti hermitian, where $k = 1, 2, 3$
6. Show that $c^2t^2 - x^2$ remains invariant under Lorentz transformation,
7. Show that $(\sigma.p)^2 = |p|^2$
8. How does Dirac theory explains the negative energy solutions?
9. Define Chirality and Helicity operators.
10. Derive Klein-Gordon equation from relativistic energy momentum relation.

Answers the following questions. **(3x10=30)**

Question2. Derive adjoint form of Dirac equation. Write down the matrix form of α and β matrices. Also derive continuity equation for Dirac equation and show that probability density is positive definite.

Question3. Discuss large and small components of Dirac Spinor in detail.

Question4. Show that $\bar{\Psi}\sigma^{\mu\nu}\Psi$ behaves as a tensor quantity.