GIET UNIVERSITY, GUNUPUR – 765022

M. Sc (Third Semester) Examinations, December' 2020

PHPC 301 – Relativistic Quantum Mechanics & Field Theory
(Physics)

Time: 2hrs   Maximum: 50 Marks

(The figures in the right hand margin indicate marks.)

Q.1. Answer **ALL** the questions   (2 x 10 = 20)

a. What is the basic difference between relativistic and non relativistic quantum mechanics?

b. Discuss the drawbacks of K.G equation.

c. Explain the concepts of Dirac theory.

d. Show that $\gamma_\mu \gamma_\nu + \gamma_\nu \gamma_\mu = 2 g_{\mu\nu}$

e. Define field, field strength and field function.

f. Explain Gauge invariance and charge conservation.

g. Write the Lagrangian in terms of field functions for a neutral scalar field.

h. Express the momentum in terms of creation, annihilation and number operators for a complex scalar field.

i. Discuss about the Dirac's Hole theory.

j. Discuss the various steps towards quantization of a field.

PART – B   (6 x 5=30 Marks)

Answer *ANY FIVE* questions   Marks

2. Derive Klein-Gordon equation for a free particle and charged particle in an electromagnetic field.   (6)

3. Express Dirac equation in covariant form.   (6)

4. Determine the energy eigen function and discuss the energy levels of free Dirac particle.   (6)

5. Discuss about the spin of the particle.   (6)

6. Discuss about the classical theory of fields. Derive the Euler Lagrangian equation.   (6)

7. Show that symmetry leads to a conservation using Noether's theorem. Discuss about the space time translation invariance.   (6)

8. What is Field Quantization? Discuss about the Neutral scalar meson field to derive its energy eigen value.   (6)

9. Derive the expression for the momentum and energy in terms of creation, annihilation and number operators.   (6)

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