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GIET UNIVERSITY, GUNUPUR - 765022
M. Sc (Third Semester) Examinations, December - 2023
22PHPC301 - Relativistic Quantum Mechanics & Field theory
(Physics)

Time: 3 hrs

Maximum: 70 Marks

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

PART - A**(2 x 10 = 20 Marks)**Q.1. Answer *ALL* questions

	CO #	Blooms Level
a. What is central potential and give its characteristics?	CO1	K1
b. Discuss the concepts of Relativistic quantum mechanics.	CO1	K1
c. Discuss about the positive and negative energy states.	CO1	K1
d. Show that $\gamma_\mu \gamma_\nu + \gamma_\nu \gamma_\mu = 2\delta_{\mu\nu}$	CO2	K2
e. Write short notes on 'Dirac Hole theory'.	CO2	K1
f. State Noether's theorem and its consequence.	CO3	K1
g. Differentiate between global and local symmetries.	CO3	K1
h. Discuss the various steps towards quantization of a field.	CO4	K1
i. Define a neutral scalar meson field.	CO4	K1
j. Differentiate between neutral and charged meson field.	CO4	K1

PART - B**(10 x 5=50 Marks)**Answer ANY FIVE questions

	Marks	CO #	Blooms Level
2. a. Derive the Klein-Gordan equation for a free particle? Discuss its drawbacks.	10	CO1	K1
3.a. Derive the expression for the Klein Gordan equation in an Electromagnetic field for a zero spin particle?	10	CO1	K1
4. a. Discuss the properties of gamma matrices.	5	CO2	K1
b. Discuss about the non-relativistic correspondence of Dirac equation in the presence of electromagnetic field.	5	CO2	K1
5.a. What is Spin orbit coupling? Derive the expression for the spin orbit interaction energy.	10	CO2	K1

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| 6. a. | Show that symmetry leads to a conservation using Noether's theorem. Discuss about the space time translation invariance. | 10 | CO3 | K1 |
| 7.a. | What is a field? Formulate the Hamiltonian for the field? Derive the Poisson bracket formulation for the fields. | 10 | CO3 | K1 |
| 8. a. | Derive the expression for the momentum in terms of creation, annihilation and number operators for charged meson field. | 10 | CO4 | K1 |