ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER	**PHYSICS**	TIME:3Hrs/week
PH8401(4)	**QUANTUM MECHANICS**	Max.Marks:100
w.e.f. 20AH Batch	**SYLLABUS**	

Course Objectives:

- *To provide students with a comprehensive understanding of postulates, Eigen values and Eigen functions, approximate methods, relativistic quantum theory, and quantization of wave fields in Quantum Mechanics.*

Course Outcomes:

Upon the successful completion of the course, students will be able to:

- *CO1: Outline postulates of quantum mechanics and the significance of operators*
- *CO2: Describe orbital and spin angular momentum, commutation of operators, eigenvalues and eigen functions of angular momentum and related concepts.*
- *CO3: Explain time independent nondegenerate perturbation, WKB approximation, Quantization & tunneling and time dependent perturbation.*
- *CO4: Discuss the inadequacies of the Klein-Gordon equation, Dirac's relativistic equation, Negative energy states and spin of electrons.*
- *CO5: Summarize the concepts of field, various quantization techniques, quantization of non- relativistic Schrodinger equation, commutation and anti-commutation relations, system of fermions and bosons and creation and annihilation.*

SYLLABUS

Unit-I: Postulates of Quantum Mechanics **12 Hrs**

Postulates of quantum mechanics, Eigen values and Eigen functions for finite well and barrier, Simple harmonic oscillator by operator method.

Liner vector space-Ket and Bra notations, Observables as Hermitian operators, Properties of Hermitian operators, Matrix representation of and operator, Unitary transformation.

Unit-II: Angular Momentum **12 Hrs**

Orbital angular momentum – Lx,Ly,Lz, L2, L+, L –operators; Commutation of operators, Eigen functions and Eigen values of J2 and Jz, Spin angular momentum, Eigen functions and Eigen values of Spin angular momentum and matrices, Addition of angular momenta, Clebsch-Gordon coefficients for J1=J2 = ½.

UNIT-III: Approximate Methods **12 Hrs**

Time independent nondegenerate perturbation- Anhormonic oscillator, Variation method-He atom, Harmonic perturbation, WKB approximation- Connecting formulae-Application to potential well and potential barrier, Quantization and tunnelling, Time dependent perturbation, Transition - Harmonic perturbation and Fermi Golden rule.

UNIT-IV: Relativistic Quantum Theory **12 Hrs**

Klein – Gorden equation, Probability current density, Inadequacy of K. G. equation, Dirac's linear equation- plane wave solution; Negative energy states and spin of electrons.

UNIT-V: Quantization of Wave Fields **12Hrs**

Concept of Field –Method of Canonical Quantization: Lagrangian Formulation of Field, Hamilton Formulation of Field – Second Quantization – Field equation – Quantization of Non-relativistic Schrodinger equation – Commutation and Anti-Commutation Relations, The N-representation- System of Fermions and Bosons– Creation and Annihilation.

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Quantum Mechanics: G. Aruldas PHI learning private limited Second edition, 2018
2. Quantum Mechanics: S.L. Kakani and H.M. Chandalia Sultan Chand and,SonsFirstEdition,2004
3. Advanced Quantum Mechanics: B.S.Rajput,Pragatiprakasan,2019
4. Quantum Mechanics: V.K. Thankappan, New Age International(P)Ltd.,Publishers,1993

5. ATextbookofQuantumMechanics:P.M.MathewsandK.Venkatesan,Tata McGraw Hill Publishing Company, 2008

6. Quantum Mechanics:S.L.Gupta,V.Kumar,H.V.SharmaandR.C.Sharma, Jai Prakash Nath and Company, 2007

Reference Books:

1. Quantum Mechanics: Concepts and Applications by Nouredine Zettili, Wiley, Ed., 2021

2. Introduction to Quantum Mechanics by David J. Griffiths and Darrell F. Schoeter, Third Ed., Cambridge University Press India Pvt Ltd., 2018.

3. An Introduction to Quantum Mechanics, P.T. Mathews McGraw Hill Publishing Company,1974