SVKM's NMIMS Deemed-to-be University
Mukesh Patel School of Technology Management and Engineering

Program: B. Tech (all program) except Mechanical, Civil, CSBS, CSDS, Artificial Intelligence MBA. Tech (all program) except Mechanical	**Semester:** II
Course/Module: Quantum and Statistical Physics	**Module Code:**

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Objectives:

1. To teach the drawbacks of classical physics in explaining several experimental facts and old quantum theory.
2. To discuss the necessity of new mechanics (i.e. quantum mechanics), the laws related to it and their applications.
3. To understand the idea of statistical mechanics and its applications.

Outcomes:

After completion of the course, students would be able to:

1. explain the basic laws related to quantum mechanics and apply them to solve related problems.
2. elucidate the concepts of statistical mechanics and solve problems using the same.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1.	Introduction to Quantum Physics, Black body radiation, Explanation of it using the photon concept, Photoelectric effect, Compton effect, de Broglie hypothesis, Experiments demonstrating wave properties of electron: Electron interference (double slit experiment), Electron Diffraction (Davison - Germer experiment), Uncertainty Principle. Wave-particle duality, Born's interpretation of the wave function, Verification of matter waves, Uncertainty principle.	6
2.	Basic postulates of quantum mechanics, concept of wave function, Superposition principle of eigenstates. Concept of collapse of wave function. Time dependent and time independent Schrodinger Equation, Concept of free particle, particle in an infinite and finite potential well, box problem. Bound vs. unbound states.	8
3.	Concept of Quantum Tunnelling. Reflection and Transmission coefficients.	6

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	Few realistic examples of tunnelling, e.g., alpha decay, Probe microscopes (Scanning Tunnelling microscope). Simple Harmonic Oscillator, explanation in 1D (no detailed derivation). Hydrogen atom.	
4.	Introduction to Statistical Physics. Ensembles (Canonical, Micro canonical and Grand canonical) Classical (Maxwell-Boltzmann) and Quantum statistics, [Bose Einstein (BE) and Fermi Dirac (FD)]. Derivation of classical statistics and BE and FD statistics.	6
5.	Applications: equipartition of energy, Planck's distribution, Bose-Einstein Condensation	4
	Total	**30**

Text Books:

1. A. Beiser, S. Mahajan and S. Choudhury, "Concept of Modern Physics", Tata McGraw Hill, 7th Edition (SIE) 2015.
2. Arthur Beiser, Perspectives of Modern Physics, McGraw Hill, 1969

Reference Books:

1. Eisberg and Resnik, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles" Wiley, 2nd edition 2006.
2. R. A. Serwey, C. J. Moses, C. A. Moyer, "Modern Physics", Thomson, 3rd edition 2005.
3. David J. Griffiths, "Introduction to Quantum Mechanics", Pearson, 2nd Edition 2015.
4. Frederick Reif, "Fundamentals of Statistical and Thermal Physics", Waveland press 2009.

Any other information:

Total Marks of Internal Continuous Assessment (ICA) : 50 Marks

Distribution of ICA Marks :

Description of ICA	**Marks**
Class Test	20
Term Work	30
Total Marks :	**50**

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