Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Department of Physics

GENERAL ELECTIVE FOR PG

IV SEM

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
GPPH104	GE	Advanced Characterization methods for Nanomaterials	60	20	20	0	0	3	0	0	3

Course Objectives	1. To develop the comprehensive understanding of advanced characterization methods for Nanomaterials and ability to apply them to a particular nanomaterial and laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Outcomes	1. Student will be able to understand and solve the problems related to characterization of Nanomaterials. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).**
Th	Theory	
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

GPPH104: Advanced Characterization methods for Nanomaterials

UNIT I: Basic of Nanoscience Background to nanoscience, Nanomaterials in Different Configurations: 3D, 2D, 1D & 0D Materials, surface to volume ratio, Synthesis of Nanomaterials: Hydrothermal, Sol–Gel Method, Resistive heating and Electron beam deposition, Sputtering

UNIT II: X-ray/ Synchrotron based Spectroscopy techniques: powder X-ray diffraction, glancing angle X-ray diffraction, X-ray fluorescence, X-ray photo-electron spectroscopy, X-ray absorption fine structure

UNIT III: Optical characterization techniques: RAMAN spectroscopy, UV-visible spectroscopy, FT-IR spectroscopy, Photoluminescence, Ionoluminescence

UNIT IV: Microscopic Techniques Optical microscopy, scanning tunneling microscopy, scanning electron microscopy, transmission electron microscopy

UNIT V: Magnetic characterization: Superconducting quantum interference device magnetometry (SQUID), Vibrating sample magnetometry (VSM), Mössbauer spectroscopy

REFERENCES

1. Essentials in nanoscience and nanotechnology, Narendra Kumar, Sunita Kumbhat., 2016, John Wiley & Sons
2. Scanning Electron Microscopy, Ludwig Reimer, 1998, Springer
3. MODERN SPECTROSCOPY, J. Michael Hollas, 2004, WILEY
4. Luminescence: From Theory to Applications, Cees Ronda, 2008, WILEY

5. Magnetic Characterization Techniques for Nanomaterials, Challa S.S.R. Kumar, 2018, Springer

Department of Physics

GENERAL ELECTIVE FOR UG

IV SEM

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assesment*	End Sem University Exam	Teachers Assessment*				
GUPH104	IDC	Fundamentals of Quantum Mechanics	60	20	20	0	0	3	0	0	3

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Quantum Mechanics and Spectroscopy and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Outcomes	1. Student will be able to understand and solve the problems related to Quantum Mechanics and Spectroscopy. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).**
Th	Theory	
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation**

P	Practical	**in Lab work (Given that no component shall be exceed 50% of Marks).**

GUPH104: Fundamentals of Quantum Mechanics

UNIT I Particles and waves inadequacies in classical physics, Blackbody radiation: quantum theory of light. Photoelectric effect, Compton Effect, Wave nature of matter: de Broglie hypothesis.

UNIT II Wave-particle duality, Davisson-Germer experiment, Wave description of particles by wave packets. Group and phase velocities and relation between them, Two-slit experiment with electrons. Probability, Wave amplitude and wave functions.

UNIT III Heisenberg's uncertainty principle (uncertainty relations involving canonical pair of variables): derivation from wave packets. Energy, momentum and Hamiltonian operators, Derivation of Time dependent and independent Schrodinger wave equation.

UNIT IV Time-independent Schrodinger wave equation for stationary states, Properties of wave Function. Interpretation of wave function, Probability density, Conditions for physical acceptability of wave functions, Linearity and superposition Principles, Eigen values and Eigen functions

UNIT V Expectation values, Wave function of a free Particle. Applications of Schrödinger wave equation: Eigen functions and Eigen values for a particle in a one dimensional box.

References

1. Quantum Mechanies: V. Devanathan, Narosa Publishing House, New Delhi, 2005
2. Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005
3. Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville tate University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009
4. Physics of Atoms and molecules: B.H. Bransden and C.J. Joachaim, Pearson Education, Singapore. 2003

5. Fundamentals of Molecular Spectroscopy: C.M. Banwell and M. McCash. McGraw Hill (U.K. edition).
6. Introduction to Atomic Physics, H. E. White Quantum Mechanics: Schaums Outlines, Y. Peleg, R. Pnini, E. Zaarur, E. Hecht.