

BS-MS Major in Physics

Semester IV						
Sr. No	Course Code	Course Name	L	T	P	C
1	PH 202	Classical Mechanics	2	1	0	6
2	PH 203	Quantum Mechanics - I	2	1	0	6
3	PH 204	Mathematical Physics-I	2	1	0	6
5		Program Elective-I	2	1	0	6
6		HSS Elective-I	3	0	0	6
		Total Credits				30

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1	Title of the course (L-T-P-C)	Classical Mechanics (2-1-0-6)
2	Pre-requisite courses(s)	Nil
3	Course content	<p>Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws.</p> <p>Principles of Canonical Mechanics - Constraints and generalized coordinates, Alembert's principle, Lagrange's equation, Hamilton's variational principle, canonical systems, symmetries and conservation laws, Noether's theorem, Liouville's Theorem.</p> <p>Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field.</p> <p>Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top.</p> <p>Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation.</p> <p>Special Theory of Relativity: Newtonian relativity, Michelson-Morley experiment, Special theory of relativity, Lorentz transformations and its consequences, addition of velocities, variation of mass with velocity, mass-energy relation, Minkowski four-dimensional continuum, four vectors.</p> <p>Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables. Lagrangian and Hamiltonian formulation of continuous systems.</p>
4	Texts/References	<ol style="list-style-type: none"> 1. Classical Mechanics: H. Goldstein, C. P. Poole, and J. Safko, Pearson 2011. 2. Classical Mechanics: N. C. Rana and P. S. Joag, Tata McGraw Hill, 2017. 3. Introduction to Classical Mechanics: David Morin, Cambridge University Press, 2008. 4. Mechanics: L.D. Landau and E. M. Lifshitz, Butterworth-Heinemann, 3rd edition, 1982. 5. Mechanics: From Newton's Laws to Deterministic Chaos, F. Scheck, Springer, 5th edition, 2010. 6. Introduction to Classical Mechanics, R G Takwale and P S Puranik, Tata McGraw Hill, 2008.

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1	Title of the course (L-T-P-C)	Quantum Mechanics - I (3-1-0-8)
2	Pre-requisite courses(s)	PH101 MA101
3	Course content	<p>Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity.</p> <p>Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator.</p> <p>Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator.</p> <p>Theory of Angular Momentum: Spherical harmonics, eigenvalues of L^2 and L_z, addition of angular momentum, commutation relations, degeneracies.</p> <p>Hydrogen atom, quantum numbers, two particle systems.</p>
4	Texts/References	<ol style="list-style-type: none"> 1 Introduction to Quantum Mechanics, D. J. Griffiths and D. F. Schroeter, Cambridge University Press, 3rd edition, 2019. 2 Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press, 2017. 3 Principles of Quantum Mechanics, R. Shankar, Springer, 2014. 4 Quantum Physics, S. Gasiorowicz, John Wiley, 2000. 5 Quantum Mechanics, L. D. Landau and E.M. Lifshitz, Pergamon press, 1965