Department of Physics

Jagannath Barooah University
Jorhat-1 (Assam)

Teaching Plan for the Session: 2025-26

Pranjal Bora, Assistant Professor, Physics
Odd Semester: 2025-26

Class/Semester	**Title & Code of The Paper Allotted (credit)**	**Method of Teaching**	**Teaching Material**	**Unit**	**Topic**	**Period/Hours Required**	**Details of the Contents**	**Remarks/Books**
B.Sc. 1st Semester	**Mechanics (PHYMJ-1)** (4 Credits)	Lecture, PPT Presentation, Discussion	, Whiteboard LCD Projector	Unit 8	Oscillations	8 hours	Unit 8: SHM: simple harmonic oscillations, damped oscillations, forced oscillations, transient and steady states, resonance, and sharpness of resonance. power dissipation and quality factor. differential equation of simple harmonic oscillations, general solutions, kinetic and potential energies, and total energy with graphical representations.	*1. An Introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973 McGraw-Hill.* *2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.*
B.Sc 3rd semester	Mathematical Physics-I (4 Credits) PHYMJ 3	Lecture, PPT Presentation, Discussion	Whiteboard LCD Projector	Units 1, 3 & 4	vector calculus , Dirac delta	25+2+10 = 37	Unit 1: Properties of vectors under rotations. scalar product and its variance under rotations, vector	Mathematical physics GUPTA & KUMAR Mathematical Physics B.S. Rajput

					function and Fourier series		product, scalar triple product, and their interpretation in terms of area and volume. scalar and vector fields. Vector differentiation: directional derivatives and normal derivatives. gradient of a scalar field and its geometrical interpretation, divergence and curl of a vector field. del and the Laplacian operator. vector identities. Vector integration: line, surface and volume integral of vector fields. gauss divergence theorem. Green and Stokes' theorems and their applications. Unit2: Dirac delta function and its properties: definition with graphs, representation as a limit of gaussian and rectangular function. properties of dirac delta function. Unit4: Periodic functions: orthogonality of sine and cosine function , expansion of periodic functions in a series of sine and cosine functions and determination of fourier	Mathematical Physics H K Das

							coefficients.Expansion of functions with arbitrary period intervals. Even and odd functions and their fourier expansions. Term by term differentiation and integration of fourier series. Persevals Identity.	

B.Sc. 5th Semester	**Atomic and Molecular Physics** **PHYMJ 7**	Lecture, PPT Presentation	Whiteboard, LCD Projector	Unit 2 Unit 3	U2. Interaction of atoms with electric and magnetic fields U3.Line width and broadening of spectral lines.	12+6=18 Hours	Unit 2: Interaction of atoms with electric and magnetic fields; magnetic fields, precessional motion, spin-orbit interaction , fine structure, influence of external magnetic fields, and the Zeeman and Paschen-Back effects in one- and two-electron systems. Lande g-factor and splitting of spectral lines. Unit 3: Line width and broadening; factors influencing spectral line widths, collisional Doppler, and Heisenberg broadening. transitional probability, population of states, Beer-Lambert Law.	B. B. Laud. Lasers and nonlinear optics H E White. Introduction to Atomic Spectra, Tata McGraw Hill

M.Sc. 1st Semester	**Quantum mechanics PPHYC 103**	Lecture, PPT	Whiteboard, LCD projector	Unit 6 Relativistic Quantum Mechanics	Relativistic quantum mechanics	12 hours	Klein-Gordon equation, interpretation of KG equation, particle in a coulomb field, Dirac equation for a free particle, Dirac matrices, the covariant form of the Dirac equation, probability density, plane wave solution, negative energy states, and the spin of Dirac particles.	Quantum Mechanics by Zettli Quantum Mechanics by A K Ghatak

M.Sc. 3rd Semester	**Numerical and Computational Physics PPHYC 403**	Lecture, PPT	Whiteboard, LCD projector	Unit 3	Interpolation methods Numerical differentiation and integration.	12 hours	**Interpolation: Lagrange and Newton interpolation. Linear interpolation. Numerical differentiation and integration:** Simpson's rule, trapezoidal rule, Gaussian quadrature method, Gauss-Laguerre-Gauss-Hermite method, and Runge-Kutta method of second and fourth order.	Sastry, Introductory methods of numerical analysis. Introduction to numerical analysis, Hilbert F. B.

Even Semester: 2025-26

Class/Semester	Title & Code of The Paper Allotted (credit)	Method of Teaching	Teaching Material	Unit	Topic	Period/Hours Required	Details of the Contents	Remarks/Books
B.Sc. 2nd Semester	Electricity and Magnetism PHYMJ 2	Lecture, PPT Presentation,	Whiteboard, LCD Projector	Unit 3	**Magnetic effect of electric current**	10 hours	Unit 3: Magnetic force between current elements and definition of magnetic field**B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current	1. Electricity, & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw 2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-H

							elements. Torque on a current loop in a uniform Magnetic Field	ill Education 3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
B.Sc. 4th Semester	**Classical mechanics I PHYMJ 5**	Lecture, PPT	Whiteboard, LCD Projector,	Unit 1 Unit 2 Unit 3 Unit 4	Mechanics of system of particles Variational principle and its applications Lagrangian and Hamiltonian formulations.	34 hours (Theory)	Mechanics of a system of particles: conservation of linear, angular momentum and Energy. Constraints and constrained motion, degree of freedom and generalized coordinates, generalized notatios for displacement, velocity , acceleration and force. Limitations of Newtonian Mechanics..	Advanced Classical Mechanics by Herbert Goldstein. Classical Mechanics by Rana and Jogg Advanced Classical Mechanics by GUPTA AND kUMAR.

B.Sc. 6th Semester	**Nuclear and Particle Physics Credit 4**	Lecture	Whiteboard, LCD Projector	Unit 7 & 8	Particle accelerators and particle physics	15 hours	Particle Accelerators: Van de Graaff generator, linear accelerator, cyclotron, synchrotron, and betatron. Particle Physics: particle interactions ; basic features, types of particles, and their families. symmetries and conservation laws, energy and momentum, angular momentum, parity, baryon number, lepton number , isospin, strangeness and charm, color quantum numbers, and gluons.	1) Introductory Nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd.,2008). 2) Concepts of Nuclear Physics by Bernard L. Cohen (Tata McGraw-Hill,1998). 3) Introduction to the Physics of Nuclei & Particles, R.A. Dunlop. (Thoms

								onAsia, 2004). 4) Introduction to High Energy Physics, D.H. Perkins, Cambridge

M.Sc. 2nd SEM	Nuclear and Particle Physics PPHYC 202	LECTURE, PPT.	WHITE BOARD, PROJECTOR	Units 6 & 7 Elementary particle and nuclear astrophysics	16 hours	Fundamental forces, properties of mesons and baryons, symmetries and conservation laws, the quark model, the concept of colored charge, properties of quarks and leptons, Gauss symmetry in electrodynamics, particle interactions, and Feynman diagrams. Nuclear astrophysics: stellar structure,	K. S. Krone Introductory Nuclear Physics, John Wiley. Particle Physics by Griffiths.

						nuclear burning stages, hydrogen and helium burning, core collapse, Chandrasekhar limit, supernova, white dwarf, neutron stars, pulsars and black holes, and synthesis of nuclei in stars.	

Besides the Theory Classes, we use to demonstrate in practical classes of both UG and PG and also supervise the projects to be performed by both UG and PG students.