Semester VII						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH501C	Numerical Methods	2	1	0	6
2	PH417T	Nuclear and Particle Physics	2	1	0	6
3		Institute Elective-3/RnD Project-1				6
4		Program Elective-II				6
5	PH401L	Advanced Physics Laboratory	0	0	3	3
	PH401S	Seminar-I	0	0	4	4
						31

1	**Title of the course** (L-T-P-C)	**Numerical Methods** **2-0-2-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Representation of numbers. Round-off error. Condition and stability. Convergence. System of Linear Equations: Exact methods: Lower-Upper (LU) decomposition, Gauss-elimination methods without and with partial pivoting, Iterative methods: Gauss-Jacobi and Gauss- Seidal methods, Matrix norm Condition number and Ill-conditioning, Singular value decomposition, Matrices- Eigenvalues and eigenvectors. Non-linear Equations and Roots of Polynomials: Bisection method, Newton–Raphson's method, Direct Iterative method with convergence criterion. Numerical Interpolation and Curve Fitting: Lagrange, Hermite, cubic spline interpolation methods and discussion on associated errors, Curve fitting by least squares. Numerical Calculus: Integral Calculus:- General quadrature formula, Simpson's rules, Improper integrals, Gaussian quadrature formulae. Differential Calculus:- Numerical differentiation, Richardson Extrapolation, Monte Carlo Methods. Ordinary Differential Equations: Euler methods, Runge- Kutta methods and Numerov methods, second order differential equations, coupled differential equations, finite differences, eigen values via finite differences, Power method and eigenvalue problem. Partial Differential Equations: Numerical solutions, Finite difference representation, Elliptic equations.
4	**Texts/References**	• P L DeVries, J E Hasbun "A First Course in Computational Physics", John Wiley, 2nd Edition, 2010. • Tao Pang, An Introduction to Computational Physics, Cambridge Univ. Press, 2nd Edition, 2006. • K E Atkinson, "An Introduction to Numerical Analysis", Wiley 2nd Edition,2008. • S S Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall, 5th Edition, 2012. • E W Cheney, D R Kincaid, "Numerical Mathematics and Computing", Cengage Learning, 7th Edition, 2012.

1	**Title of the course** (L-T-P-C)	**Nuclear and Particle Physics** **2-1-0-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Basic properties of nuclei and interactions, Nuclear binding energy, Nuclear moments, Nuclear models-independent particle model, shell model, Deuteron problem, Central and tensor forces, Radioactive decay- theory of alpha decay, Fermi theory of beta decay, gamma decay, Nuclear reactions- direct and compound reactions, Elementary particles- classification, symmetries and conserved quantum numbers, quark model, Particle Accelerators, Detectors (electrostatic accelerators, cyclotron, synchrotron; linear accelerators, fixed target, and colliding beam accelerators, circular colliders), Particle interactions and introduction to Feynman diagrams, Standard Model of Particle Physics.
4	**Texts/References**	1. S S M Wong, Introductory Nuclear Physics, 2nd Edition, Wiley-VCH Verlag GmbH & Co, 2004 2. B L Cohen, Concepts of Nuclear Physics, Mc Graw Hill, 2017. 3. H A Enge, Introduction to Nuclear Physics Addison- Wesley 1966. 4. J S Lilley, Nuclear Physics: Principles and Applications, John Wiley and Sons 2001.