PH-8204 **Mathematical Methods of Physics-II**

L	T	P	C
4	1	0	5

Course outcomes:

After successful completion of the course, the students should be able to

CO1: use the group theory as well as tensors in physics problems.

CO2: know the importance of integral equations in physics.

CO3: know the basic syntaxes of C++ computer language.

CO4: handle the programming in C++ computer language.

CO5: design themselves computer programs as per their need.

CO/PO Mapping

S-strong, M-medium and W-weak indicate the strength of correlation

COs	Programme outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	W		W		M	S	S	S	S
CO2	S	S	S	M	S	W	M	W	M	W		M
CO3	S	W	M	W	W	S	S	S	S	M	S	S
CO4	S	S	S		S	M	M		M	S	W	W
CO5	M	W	S	W	S		S	S			M	W

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UNIT-I

Group Theory: What is a group? Multiplication table, Conjugate elements and classes, subgroups, Isomorphism and Homomorphism, Definition of representation and its properties, Reducible and irreducible representations, Schur's lemmas (only statements), characters of a representation., Topological groups and Lie groups, Three dimensional rotation group, special unitary groups SU(2) and SU(3), Example of C4v. Numericals. **15hrs**

Tensors: Tensors in index notation, Kronecker and Levi Civita tensors, Covariant and Contravariant tensors, Inner and Outer products, Contraction, Symmetric and antisymmetric tensors, Quotient law, Noncartesian tensors, Metric tensors, Covariant differentiation, Applications, Numerical **8hrs**

Integral Equations: Definitions and classifications, integral transforms and generating functions. Neumann series, Separable Kernels, Hilbert-Schmidt theory. Green's functions in one dimension.

7hrs

UNIT-II

Computational physics and data analysis: Introduction to C++, classes, objects, C++ programming Syntax for input and output, loops, decisions, simple and inline functions, Strings and Pointers. **10hrs**

Basic numerical methods:

Statistics: Measures of central moment, Correlation coefficients. Interpolations - Least squares fitting, Lagrange interpolation, Cubic spline fitting. Numerical differentiation, Numerical integration by Simpson and Weddle's rules; Numerical solution of differential equations by Euler, Predictor-corrector and Runge-Kutta methods, Matrices, addition, multiplication, determinant, eigenvalues and eigenvectors, inversion, Solution of simultaneous equations. Numericals based on above methods.

20hrs

Total=60hr

Books:

1. Group Theory for Physicists: A.W. Joshi (Wiley Eastern, New Delhi) 2011.
2. Mathematical Methods for Physicists: G. Arfken and H.J. Weber, (Academic Press, San Diego) 7th edition, 2012.
3. Matrices and Tensors in Physics: A.W. Joshi (Wiley Eastern, New Delhi) 2005.
4. Numerical Mathematical Analysis, J.B. Scarborough (Oxford Book Co., Kolkata) 4th edition.
5. A First Course in Computational Physics: P.L. Devries (Wiley, New York) 1994.
6. Mathematical Physics: P.K. Chatopadhyay (Wiley Eastern, New Delhi) 2011.
7. Introduction to Mathematical Physics: C. Harper (Prentice Hall of India, New Delhi) 2006.
8. Numerical Mathematical Analysis, J.B. Scarborough (Oxford & IBH Book Co.) 6th ed., 1979.
9. A first course in Computational Physics: P.L. DeVries (Wiley) 2nd edition, 2011.
10. Computer Applications in Physics: S. Chandra (Narosa) 2nd edition, 2005.
11. Computational Physics: R.C. Verma, P.K. Ahluwalia and K.C. Sharma (New Age) 2000.
12. Object Oriented Programming with C++: Balagurusamy, (Tata McGrawHill) 4th edition 2008.

c/BOS

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