



Phys 3503	MATHEMATICAL METHODS OF PHYSICS-II	(CR3)
Preq.	Phys 3501	

Objectives

To understand mathematical tool such as tensor analysis, group theory and complex analysis.

Syllabus

Tensor analysis, some notations, Cartesian tensors, First- and zero-order Cartesian tensors, second- and higher-order Cartesian tensors, the algebra of tensors, the quotient law, Kronecker delta δ_{ij} and Levi Civita tensor ϵ_{ijk} , Isotropic tensors, improper rotations and pseudo tensors, dual tensors, physical applications of tensors, integral theorems for tensors, non-Cartesian coordinates, the metric tensor, General coordinate transformations and tensors, relative tensors, derivatives of basis vectors and Christoffel symbols, covariant differentiation, vector operators in tensor form, absolute derivatives along curves, Riemann curvature tensor, Complex Analysis Complex numbers, powers and roots, Sets in the Complex planes, Functions of a complex variables, Cauchy–Riemann equations, Exponential and Logarithmic functions, Contour Integrals, Cauchy–Goursat theorem, Independence of path, Cauchy’s Integral formulas, Sequences and Series, Taylor series, Laurent Expansion, Zeros and Poles, Singularities, Residues and Residues Theorem, Evaluation of real Integrals, Groups Theory, Review of groups, subgroup, cyclic groups, and permutation groups, isomorphism, Cayley’s theorem, properties of isomorphism, automorphism, cosets, properties of cosets, Lagrange’s theorem, an application of cosets to permutation groups, the rotation groups of a cube and soccer ball, conjugate classes and invariant subgroups, group representations, some special groups, the symmetry group D_2 , D_3 , one-dimensional unitary group $U(1)$, orthogonal groups $SO(2)$ and $SO(3)$, the $SU(n)$ groups, Homogeneous Lorentz group.

Recommended Books

1. *Mathematical Methods for Physicists (7th Edition)* by G. B. Arfken, H. J. Weber and F. E. Harris, Academic Press (2012)
2. *A Guide to Mathematical Methods for Physicists* by M. Petrini, G. Pradisi and A. Zaffaroni, World Scientific Press (2017)
3. *Mathematical physics: A modern introduction to its foundations* by S. Hassani, Sadri, Springer (2013)
4. *Mathematics for physicists*, by P. Dennery and A. Krzywicki Dover Publications (2012).
5. *Mathematical methods for physics and engineering* by K. F. Riley, M. P. Hobson, and S. J. Bence (3rd Edition), Cambridge (1999)
6. *Mathematical Methods for Physicists: A Concise Introduction* by T. L. Chow, Cambridge (2000)
7. *Contemporary Abstract Algebra* by J. A. Gallian (8th Edition), Cengage Learning (2013)