

Handout For the PH504 Course:

December 30, 2009

Syllabus

Ordinary Differential Equations: First and second order equations with constant coefficients, series solution-Frobenius' method, Sturm-Liouville equations, Legendre, Bessel, Hermite, and Laguerre functions, Hypergeometric and confluent hypergeometric equations.

Integral Transforms: Fourier and Laplace transforms, applications.

Partial Differential Equations: Laplace equation, method of separation of variables in Cartesian, Spherical, and Cylindrical coordinates, Green's function for Laplace equation, wave equations, Helmholtz equation.

Group Theory: Groups, subgroups, conjugacy classes, cosets, invariant subgroups, factor groups, homomorphism, kernels, continuous groups, Lie groups, generators, $SO(2)$ and $SO(3)$, $SU(2)$. Group representations.

Texts

1. G. B. Arfken and H. J. Weber, *Mathematical Methods for Physicists*, Academic Press (1994).
2. A. W. Joshi, *Elements of Group Theory*, New Age (1997).

References

1. M. L. Boas, *Mathematical Methods in Physical Sciences*, John Wiley & Sons (1983).
2. E. A. Coddington, *Introduction to Ordinary Differential Equations*, Prentice Hall of India (1995).
3. I. Sneddon, *Elements of Partial Differential Equations*, McGraw Hill (1986).
4. M. Hamermesh, *Group Theory and Its Applications to Physical Problems*, Dover (1989).

Lecture Plan

No	Topic	Subtopic	#l
1	Ordinary Differential Equations (15 Lectures)	First order DE with Constant Coefficients: 1.1,1.3	2
		Second order DE with constant coefficients: 2.2, 2.3	2
		Series solution-Frobenius' method: 2.4	4
		Sturm-Liouville Theory	3
		Legendre, Bessel, Hermite, and Laguerre functions, Hypergeometric and confluent hypergeometric equations.	4
2	Integral Transforms (3 lectures)	Fourier and Laplace transforms, applications.: 5	3
3	Partial Differential Equations (12 lectures)	Laplace equation: 3	4
		wave equations: 4	4
		Helmholtz equation:	4
4	Group Theory (12 lectures)	Groups, subgroups	2
		conjugacy classes, cosets, invariant subgroups, factor groups	2
		homomorphism	2
		continuous groups, Lie groups, generators	2
		SO(2) and SO(3), SU(2)	2
		Group representations	2