Methods of Mathematical Physics (001-2-7004)

Dr. Naftali Smith

3 credits

The aim of this course is to coach students towards proficiency in the exploitation of mathematical tools in their research work.

Prerequisites: Linear Algebra, Calculus, Ordinary Differential Equations (ODEs), Complex numbers.

Syllabus

Lectures/Exercises/Credit: Duration - one semester; 3 weekly lecture hours; 3 credit points.

1. Review of selected topics in linear algebra
2. Review of selected topics in vector analysis
3. Review of selected topics in ODE's
3. Integral equations: Fredholm equation, Volterra equations
4. The Diffusion equation:
Solutions in 1-3 dimensions, Green's function, Coordinate systems
5. Approximation methods:
The o and O symbols, WKB method, Steepest Descent method
5. Expansion methods:
Multiple time scales, Normal forms, Matched Asymptotic Expansions;
Examples of applications in nonlinear systems
6. Special functions: The Gamma function, Bessel functions, and Legendre polynomials

Bibliography

1. J. Mathews and R.L. Walker, Mathematical Methods of Physicists (Addison-Wesley, 1970).
2. K.M. Bender and S..A. Orszag, Advanced Mathematical Methods for Scientists and Engineers
(McGraw Hill, 1978).
3. F.W. Byron and R.W. Fuller, Mathematics of Classical and Quantum Physics (Dover, 1992).
4. P.B. Kahn, Mathematical Methods for Scientists and Engineers (Dover, 2004).
5. P.B. Kahn and Y. Zarmi, Nonlinear Dynamics, (Wiley, 1997).
6. G.B. Arfken and H.J. Weber, Mathematical Methods for Physicists (Academic Press, 1995).
7. H.S. Wilf, Mathematics for the Physical Sciences (Dover, 1978).
8. R.E. Collins, Mathematical Methods for Physicists and Engineers (Dover, 1999).
9. T.W. Körner, Exercises for Fourier Analysis (Cambridge, 1993).

Grade: 20% Home Assignments, 80% Final exam