

224.4041 – Advanced topics in mathematics and physics for Marine sciences, Semester A

Adapted for hybrid and remote teaching

Instructor: [Dr.] [Regina] [Katsman]

Teaching Assistants & Office Hours:

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Course Type : Lecture/Computational Lab

Course Level : MSc/ PhD

Pre-Requisites: No

Course Overview:

The main objective of the course is to gain a preliminary knowledge enabling the students to study the advanced courses of "Physical oceanography", "Time series analysis", and "Numerical methods". The following main 3 subjects will be covered: (1) Introduction to MATLAB including programming basics, matrix theory, and data analysis; (2) Mathematics including fundamentals of theory of complex numbers (complex plane, function of complex variables, differentiation and integration), ordinary differential equations (first and second order), partial differential equations with constant coefficients (method of separation of variables), Fourier transform; (3) Physics including fundamentals of wave theory and element of hydrodynamics.

Topics:

MATLAB (introduction)

1. Introduction to matrices (elementary operations), elementary math, graphics
2. Programming fundamentals, interpolation, differentiation and roots of polynomials, data and file management
3. Advanced matrix operations, solution of systems of linear equations, programming scripts and functions

Mathematics

4. Analytical geometry: equations of straight line, circle, parabola, hyperbola
5. Complex numbers, algebraic and trigonometric forms, complex plane, root extraction
6. Functions of complex variable, derivative of complex functions, Cauchy-Riemann conditions
7. Integral of complex function, anti-derivative, definite integral
8. Ordinary differential equations, differential equations of the 1st order
9. Differential equations of the 2nd order with constant coefficients
10. Partial differential equations, separation of variables

Physics

11. Newton's laws, rotating coordinate system, Coriolis force
14. Waves, oscillations, properties of waves, examples

At the end of the course students will be able to: [Learning Outcomes]

1. have basics mathematics and physics applicable for Marine Sciences;
2. apply them in the area of marine geosciences;
3. take advanced courses on physical oceanography/time series analysis/numerical analysis;

Requirements: Attendance, Exam, Homework assignments

Grading:

Passed – 60%, no final grade



Website: [<http://marsci.haifa.ac.il/en/academics/marine-geosciences/marine-geosciences-courses>]

Reading List:

MATLAB:

1. Valentine, D. T., Hahn, B. D. (2007) Essential MATLAB for engineers and scientists, Amsterdam : Butterworth Heinemann.
2. Hunt, B. R., Lipsman, R. L. (2009) A guide to MATLAB : for beginners and experienced users, Cambridge, UK : Cambridge University Press.

Mathematics:

3. Grossman, S.I. (1984), Calculus, Orlando: Academic Press.
4. Janusz, G. J. (1994), Calculus, Dubuque, Iowa: Wm. C. Brown.

Physics:

5. Alonso, M., Finn, E.J. (1969) Fundamentals of University physics, Addison-Wesley.
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