SYLLABUS

Physics 343: Mathematical Methods of Physics

Fall Term, 2010

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Office hours will be posted on the door of Room 111.
PLEASE NOTE THAT ATTENDANCE OF THE FALL CONVOCATION (SEPTEMBER 23 FROM 10:30 TO NOON) IS EXPECTED OF ALL STUDENTS IN PHYSICS 343.

Purpose and goals:

The purpose of this course is to introduce students of the physical sciences to the mathematical methods which are essential to the solution of practical problems. The methods which will be presented are those which are most frequently used in typical physics and engineering applications. The subject matter is not intended to be all-inclusive. Each unit of the course will provide an in-depth treatment of a particular subject area. Students will be encouraged to consult various reference books in expanding their knowledge and expertise in any of the areas that are introduced.

Undergraduate education in the physical sciences continues to become more advanced and sophisticated. As a result, mathematical topics previously reserved for graduate study have become part of the undergraduate program. Consequently, it has not been particularly simple to determine just which mathematical methods and models should be included in a one-semester course. The choices which have been made represent a fairly broad spectrum of commonly encountered subject areas. The coverage is at a level compatible with the successful completion of a differential equations course and should be comprehensible to the typical upper class undergraduate student.

The course will begin with a review of ordinary differential equations. Specific problems with numerical data will be used to introduce the topics but eventually general literal solutions will be derived. A first goal will be the successful solution of the assigned homework problems; a final goal will be the application of techniques learned in this course to problems assigned in other upper level physics courses.

Required Text:

"Mathematical Methods in the Physical Sciences", 3rd Edition, by Mary L. Boas, John Wiley, 2006.

Attendance Policy:

Each student is expected to attend all classes in this course. Daily attendance records will be kept. In the event that an exam is missed, a make-up will be given provided that the absence is EXCUSED. If the absence is UNEXCUSED, a ZERO will be recorded for that exam. In order for an absence to be excused, the student must present A) a valid medical excuse signed by a doctor or nurse, or B) an explanatory statement from the Dean of Students verifying that the absence qualifies as "excusable".

In the event that the number of unexcused absences in the course exceeds three (3), *one point* will be subtracted from the student's final average for each additional unexcused absence following the third.

Policy Regarding Homework:

"Due Dates" will be announced for the homework problems. Any problems turned in within 24 hours after a deadline will receive *half credit*. Homework submitted after that time will automatically be assigned a grade of *zero*.

Policy on Academic Honesty:

The Policy on Academic Honesty to be followed in this course is as follows:

Moravian College expects its students to perform their academic work honestly and fairly. A Moravian student, moreover, should neither hinder not unfairly assist the efforts of other students to complete their work successfully. This policy of academic integrity is the foundation on which learning at Moravian is built.

The College's expectations and the consequences of failure to meet those expectations are outlined in the current Student Handbook, available from the Student Affairs Office, and in the statement on Academic Honesty at Moravian, available from the Academic Dean's Office. If, at any point in a student's academic work at Moravian, a student is uncertain about his or her responsibility, as a scholar or about the propriety of a particular action, the instructor should be consulted.

Any student(s) failing to comply with Moravian College's policy of academic honesty will be reported to the Academic Standards Committee.

Policy Regarding Grading:

Grades will be determined as follows:

Exams - 50%
Homework - 25%
Final Exam - 25%

While grades will be computed by the indicated percentages, it is within the instructor's purview to apply qualitative judgment in determining the final grades for the course.

This syllabus will be followed rather closely; however, it is subject to change from time to time.

TOPICS TO BE COVERED

ORDINARY DIFFERENTIAL EQUATIONS

1. Examples of Differential Equations
2. Separable Equations
3. Rate Problems
4. First Order Differential Equations
5. Exact Equations
6. Integrating Factors
7. Linear Differential Equations of First Order
8. Bernoulli's Equation
9. Orthogonal Trajectories
10. Systems of Equations
11. Solutions by Determinants
12. Cramer's Rule
13. Linear Dependence and Independence
14. General Solutions of Linear Second Order Equations
15. The Equidimensional Equation
16. Method of Undetermined Coefficients
17. Method of Variation of Parameters
18. Method of Reduction of Order

THE LAPLACE TRANSFORM

1. Definition and Existence
2. Properties of Laplace Transforms
3. The Inverse Transform
4. The Convolution
5. Use of Tables of Transform
6. Application to Linear Equations with Constant Coefficients
7. Singularity Functions
8. The Gamma Function
9. Use of Laplace Transforms in Solving Differential Equations

MATRICES

1. Definitions and Properties
2. Solution of an Eigenvalue Problem

SERIES SOLUTIONS OF DIFFERENTIAL EQUATIONS

1. Power Series
2. Convergence of Power Series
3. Ordinary Points and Singular Points
4. Solutions Near an Ordinary Point
5. Solutions Near Regular Singular Points
6. The Indicial Equation
7. The Method of Frobenius
8. Equations of the Hypergeometric Type
9. Laguerre Polynomials
10. Bessel Functions
11. Hermite Polynomials
12. Legendre Polynomials

FOURIER SERIES AND INTEGRALS

1. Average. Root Mean Square
2. Even Functions. Odd Functions
3. Averages of Periodic Functions
4. Fourier's Theorem for Periodic Functions
5. Half-Range Fourier series
6. Complex Fourier Series
7. The Fourier Integral
8. Fourier Transforms

Students who wish to request accommodations in this class for a disability should contact Mr. Joseph Kempfer, Assistant Director of Learning Services for Disability Support, 1307 Main Street (ext. 1510). Accommodations cannot be provided until authorization is received from the Office of Learning Services.