COURSE SYLLABUS STEM Ed Abroad Program

Course Title: Elementary Differential Equations and Laplace Transforms

Course Semester: Fall

University and Country: Adam Mickiewicz University, Poznan, Poland

Number of ECTS: 8

Course Designations for Transfer Credit: MA314 (NCSU), MATH266/267 (ISU)

Content: Solution methods for ordinary differential equations. First order equations, linear equations, constant coefficient equations. Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis. Laplace transforms and series solutions to ordinary differential equations.

Prerequisites: Calculus II with a grade of C- or better.

Aims:

Be able to identify types of differential equations and use appropriate methods to solve them.

- Be able to use the method of integrating factors to solve first order linear equations.
- Be able to separate variables and compute integrals in solving first order separable equations.
- Know how to find a general solution of a linear second order constant coefficient homogeneous differential equation by seeking exponential solutions.
- Be able to use the method of undetermined coefficients to find a particular solution of a linear second order constant coefficient nonhomogeneous differential equation.
- Be able to find a general solution of a linear second order constant coefficient nonhomogeneous equation.
- Be able to solve an initial value problem associated with a linear second order constant coefficient homogeneous or nonhomogeneous equation.
- Be able to extend the methods used for linear second order constant coefficient equations to higher order linear constant coefficient equations, both homogeneous and non-homogeneous.
- Be able to use the eigenvalue-eigenvector method to find general solutions of linear first order constant coefficient systems of differential equations of size 2 or 3.
- Be able to find a fundamental matrix for linear first order constant coefficient system of differential equations of size 2 or 3.
- Be able to use the method of variation of parameters to find a particular solution of a nonhomogeneous linear first order constant coefficient system of size 2.

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Learn how differential equations are used to model physical systems and other applied problems. These could include the following types of problems.

- Be able to formulate and use elementary models for population dynamics, such as the logistic equation, to describe transient and steady state behavior.
- Be able to work with models for the linear motion of objects using assumptions on the velocity and acceleration of the object.
- Be able to set up and solve a problem involving stirred tank reactor dynamics.
- Be able to use Newton's second law to set up a model for a simple spring-mass system; and use appropriate methods to obtain the solution of the model problem.
- Be able to use models for continuous compounding of interest to describe elementary savings and loan problems.

Gain an elementary understanding of the theory of ordinary differential equations.

- Understand statements on existence and uniqueness of solutions.
- Understand the role of linear independence of solutions in finding general solutions of differential equations.
- Understand what constitutes a general solution of a differential equation.
- Understand the concept of stability as it relates to equilibrium solutions.
- Be able to use the method of Laplace transforms to solve linear second order constant coefficient homogeneous and nonhomogeneous equations.
- Be able to use series methods to find a power series solution of a linear second order variable coefficient homogeneous equation about an ordinary point.

Recommended Books:

Zill/Wright, Differential Equations and Laplace Transforms, Cengage/9th Edition, ISBN: 9781305965799

Teaching Staff:

TBA with consultation by Fritz Keinert from Iowa State University.

Grading System and Percentage Contribution:

Lecture assessment

Homework	10%
Problem Sessions	12%
Exam (3 @16% each)	48%
Final Exam, Cumulative	30%
Total	100%

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Grading System: The grading system used at Adam Mickiewicz University (AMU) is as follows:

5 100%-91%
4+ 90%-86%
4 85%-76%
3+ 75%-71%
3 70%-60%
2 59% and less

This translates into the following ECTS (European Credit Transfer and Accumulation System, an internationally recognized system) grading scale:

ECTS Grade	AMU Grade	Definition
A	5.0	EXCELLENT – outstanding performance with only minor errors
B	4+ / 4.5	VERY GOOD – above the average standard but with some errors
C	4.0	GOOD – generally sound work with a number of notable errors
D	3+ / 3.5	SATISFACTORY – fair but with significant shortcomings
E	3.0	SUFFICIENT – performance meets the minimum criteria
FX	2.0	FAIL – some more work required before the credit can be awarded
F	2.0	FAIL – considerable further work is required

Hours: (Lecture / Recitation)

The course will meet for 4 hours per week. This includes 3 hours of lecture, covering new material, and one hour of recitation (review and problem solving). The tentative schedule is

Week 1: Introduction and Overview, Sections 1.1, 1.2
Week 2: Sections 2.2, 2.3
Week 3: Sections 2.4, 2.5
Week 4: Sections 1.3, 3.1
Week 5: Section 3.2, review, Exam 1
Week 6: Sections 4.1, 4.2
Week 7: Sections 4.3, 4.4
Week 8: Sections 4.6, 4.7
Week 9: Section 5.1, review, Exam 2
Week 10: Sections 7.1, 7.2
Week 11: Sections 7.3, 7.4
Week 12: Sections 7.5, Appendix B
Week 13: Sections 8.1, 8.2
Week 14: Section 8.3, review, Exam 3
Week 15: Sections 6.1, 6.2, semester review
Final Exam