Western University
Department of Applied Mathematics

AM 3815a – Partial Differential Equations I

COURSE OUTLINE 2018-2019

CALENDAR DESCRIPTION:

Boundary value problems for Laplace, heat, and wave equations; derivation of equations; separation of variables; Fourier series; Sturm-Liouville Theory; eigenfunction expansions; cylindrical and spherical problems; Legendre and Bessel functions; spherical harmonics; Fourier and Laplace transforms.

COURSE INFORMATION:

Instructor: Joshua LeClair
Room MC 275D
Office Hrs: TBD
Email: jlecla3@uwo.ca

Lectures: 1:30-2:30pm, M/W/F, UCC 37

GTA:

PREREQUISITES:

(i) Mathematics 1600A/B; Applied Mathematics 2402A; Calculus 2303A/B or Calculus 2503A/B; or (ii) Calculus 2402A/B and Statistical Sciences 2503A/B or the former Applied Mathematics 2503A/B. In each course a minimum mark of 60% is required.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

COURSE OBJECTIVES:

The objective of this course is to introduce students to certain central concepts of mathematical modelling. Partial differential equations are a powerful modelling tool and can be used to describe phenomena in biology, economics, engineering, and the physical sciences. Through the derivation of model equations, the formulation of appropriate boundary conditions, and the analysis and development of solutions, students in this course will develop a cohesive understanding of classical linear PDE. Although this course focuses almost exclusively on analytical solution techniques, a cursory discussion of numerical methods will be included (time permitting). All evaluations will encourage students to refine their mathematical communication skills and will emphasize the importance of connecting mathematical conclusions to real-world applications.

TEXT (SUGGESTED):

Logan, J. David. *Applied Partial Differential Equations*. Springer, 2015 (3rd Edition)

Although lectures will draw on material from a variety of texts (sources will be mentioned in class notes), the coverage of Logan's text most closely matches that of this course. Please note that an **eBook version** of this text is **freely available** through **Western Libraries**. Additionally, Western students may purchase a discounted softcover edition of the text through Western Libraries (details will be provided in class) or a hardcover edition through the Bookstore.

REFERENCES:

Olver, Peter J. *Introduction to Partial Differential Equations*. Springer, 2016.

Asmar, Nakhlé H. *Partial Differential Equations with Fourier Series and Boundary Value Problems*. Dover Publications, 2016 (3rd Edition)

EVALUATION:

Assignments*	10%	(4 equally weighted assignments)
Term Tests	20%	(Test-1, week of Oct.15 ; Test-2, week of Nov.12)
Midterm Exam	20%	(week of Oct.29)
Final Exam	50%	

All tests and examinations are **closed book**. Supplementary information sheets may be provided. Only **non-programmable** calculators will be allowed during the tests and final examination.

*Assignments will reinforce course content through investigations into specific applications of PDE models. Solutions will be evaluated for completeness and clarity only. Supplemental practice problems (not to be submitted) will be made available on OWL throughout the term.

COURSE POLICIES:

General Expectations

- Students are expected to check OWL regularly for course material, announcements, information, etc.
- Students are expected to complete associated readings and suggested exercises at a steady pace throughout the term.
- Students are expected to attend all lectures. In the event that a student is unable to attend a lecture, it is the student's responsibility to review any material that was missed.

Evaluation

- Evaluation criteria are based strictly on achievement. Claims of an excellent academic history, of attendance in the course, or of personal issues (family, relationship, financial, etc.) cannot be used to justify a higher grade in the course.
- No extra assignments, essays, problem sets, or other work of any kind will be offered to any student for extra credit.
- The requirement for a higher grade (to maintain a scholarship, for admission to a graduate program, etc.) is not a justifiable reason for modifying a grade (ie. no grades will be "bumped").

Assignments

- In the event of illness or other serious circumstances, accommodations for assignments may be granted at the discretion of the instructor. Such requests must be directed to the instructor and be made at least **48 hours** before the associated deadline to be considered.

Midterm Exam

- No make-up options will be offered regardless of the circumstances for which the midterm was missed. Missing the midterm exam with academic consideration will automatically shift the weight of the missed midterm exam into the final exam.

Term Tests

- No make-up options will be offered regardless of the circumstances for which the test was missed. Missing a term test with academic consideration will automatically shift the weight of the missed test into the final exam.
- Missing both term tests without academic consideration will result in failure of the course.

CHEATING:

University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offense Policy in the Western Academic Calendar). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

ACADEMIC ACCOMODATION:

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your faculty's Dean's Offices as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. Students seeking academic accommodation for medical reasons should review the university's policy on Accommodation for Illness:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

SUPPORT SERVICES:

A list of services offered by the Office of the Registrar can be found at www.registrar.uwo.ca. Students who are in emotional/mental distress should refer to Mental Health @ Western (www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help. Additional student-run support services are offered by the USC. Visit www.westernusc.ca/services for details.

APPROXIMATE SYLLABUS:

Week of	Topic(s)	Evaluations	Learning Outcomes
Sept. 10	Model Equations: 3 Classical PDE		Recognize prototypical PDE and be able to connect each to the phenomenon it models
Sept. 17	Boundary Conditions and Classification of Second Order PDE	Assignment #1 Due	
Sept. 24	Hello again, linear algebra: how do we construct solutions to PDE?		Understand how orthogonal sets of functions form a basis for solutions
Oct. 1	Fourier Series and Recap	Assignment #2 Due	
Oct. 8	***FALL READING WEEK***		
Oct. 15	Separation of Variables and Sturm-Liouville.	Term Test #1 (material until Oct. 5)	Classify and solve PDEs using various standard techniques (separation of variables and transform methods)
Oct. 22	S.O.V and Nonhomogeneous Problems		
Oct. 29	Cylindrical Domains and Bessel Functions	Midterm Exam (cumulative)	
Nov. 5	Spherical Domains and Legendre Polynomials	Assignment #3 Due	
Nov. 12	Infinite Domains and Fourier Transforms	Term Test #2 (material from Midterm until Nov. 9)	
Nov. 19	Introduction to Finite Difference Schemes		Interpret solutions to a PDE model and draw conclusions about real-world models
Nov. 26	Applications: solving real-world problems with PDE models		
Dec. 3	Buffer/Review	Assignment #4 Due	

Coverage and assignment deadlines subject to change as course progresses