

Course Information**Instructor:** Dr. Justin T. Webster (Justin)**Lecture:** M, W Sec. 1: 4:00 – 5:15 pm, PAH. 124;**Office Hours:** T, 10 – 11am; W, 1:00 – 2:00pm; and by appt.***Course Website:** [http://webster.math.umbc.edu/MATH614\(f22\).html](http://webster.math.umbc.edu/MATH614(f22).html)**Texts:** Required 1) S. Kesavan, *Topics in Functional Analy. and Appl.*, 3rd Ed., **New Age International**Required 2) L. Evans, *Partial Differential Equations*, 2nd Ed., **AMS**Optional 3) H. Brezis, *Functional Analy., Sobolev Spaces, and PDE*, **Springer**

This is a three credit-hour course meant to provide rigorous fundamentals of the theory of *partial differential equations* (PDEs). Studying PDEs can be quite challenging, and PDE topics, analyses, and techniques can be quite disparate. In this course we will focus on what can be considered *modern* PDEs, making use of some notions from *functional analysis* by treating PDEs as problems posed on infinite dimensional (function) spaces.

Prerequisites: MATH 600 or permission of the instructor.

Topics: As per the catalog course listing, topics covered include: linear second-order PDEs (classification and classical solutions); distributions; Sobolev spaces (embedding, compactness, and trace theorems); Hilbert space principles; elliptic theory (well-posedness, regularity); and, time permitting, heat and wave dynamics

Ph.D. Comprehensive Exam Information: From the PDE syllabus:

- General concepts: Well-posedness, boundary and initial conditions, weak solutions, fundamental solutions and $\delta(\mathbf{x})$.
- Laplace's equation: Maximum principle, mean-value properties, variational characterization, smoothness, energy methods.
- Heat equation: Maximum principle, regularity, energy methods, uniqueness.
- Wave equation: Energy method, speed of propagation, dependence and influence, conservation, d'Alembert.
- Function spaces: Bilinear forms on functions spaces, Sobolev spaces and associated theorems

Other Suggested Textbook: Renardy and Rogers, *An Introduction to Partial Differential Equations*, 2nd ed., **Springer**.

The following are the course policies, which may be changed at any time.

Contacting Me: The best way to contact me is via email or Google Chat (via my.umbc). I will respond within 36 hours, but do not expect an immediate response. **Please schedule all appointments outside of office hours through e-mail, with at least 24 hour notice.* Students are responsible for announcements made in class, and e-mails sent to the primary UMBC email account. This course will primarily run through my homepage (above). Please check this often.

Class Meetings: Class will meet in person, synchronously. Occasionally asynchronous lecture content may be posted.

Assignments: Homework will be assigned approximately every two weeks. These problem sets will not come directly from a single textbook and will be TeXed up and posted. Due dates will be made clear at the time of assignment. Each homework will be worth the same point value. A random selection of the problems on each homework will be graded, and selected solutions will occasionally be posted. It is assumed that homework solutions will be typeset using LaTeX; you may ask for an exemption to handwrite your solutions, which I will consider only if your written presentation is exemplary. Homeworks can be turned in via e-mail as .pdf attachments. *The lowest homework score will be dropped.* Mandatory reading will occasionally be assigned (e.g., a long proof or peripheral theorem/discussion). Students may be asked to make a short video presentation or live presentation of a topic in the last few weeks of class.

Quizzes/Activities: An in-class quiz will happen occasionally. It may be longer (60 min) or shorter (15 min, a basic comprehension check), depending on the material. Once material is covered in class or assigned for reading, it is valid for quizzes and assignments. Quizzes may also focus on proofs from assigned reading. *Make-ups will generally not be granted.*

Final Exam: There will be a cumulative final exam which will serve as preparation for the PDE component of the DE comprehensive exam. The date and time of the final are *absolutely* fixed, and only in the most extreme cases will arrangements be made to reschedule.

Final Exam - 3:30–5:30pm, Monday, Dec. 16th

Grading: Grades will be assigned based on raw percentages in the standard 100 percent scale (with no “+” or “-”). *During the semester, grades will not be rounded, and there will be no curve for graded material.* However, I reserve the right to adjust final grades based on factors such as attendance, participation, and demonstrated effort towards understanding the material. The final grading breakdown will be as follows: Final Exam – 40%; Assignments and Quizzes – 60%.

Course Description and Outcomes: By the end of the semester the students should have mastered the fundamental concepts in the modern theory of PDEs, and demonstrate the ability to solve problems based on these concepts. Such outcomes will be assessed on homework and the final exam.

Etiquette, Please: Please attend class, and while I will not require it, I would prefer that you leave your camera on. I encourage discussion and questions, so please be engaged while you attend. I do utilize “cold-calling”, so if you are in class, please be paying attention.

Attendance: Attendance will not factor into the overall grade, but there are obvious ramifications for missing more than a couple class sessions.

Important Dates: Please be aware of the following dates:

Labor Day (no class) - Sep. 2;	add/drop deadline - Sep. 11;
withdraw deadline - Nov. 6;	Thanksgiving break - Nov. 28–29
last day of classes - Dec. 10;	finals - Dec. 12–18.

Other Stuff:

UMBC Academic Integrity Policy: By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC’s scholarly community in which everyone’s academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, the UMBC Integrity webpage <http://www.umbc.edu/integrity>, the UMBC Undergraduate Student Academic Conduct Policy for undergraduate students, the UMBC Policies section of the UMBC Directory http://www.umbc.edu/undergrad_ed/ai/ or the UMGSB Policy and Procedures for Student Academic Misconduct for graduate students.

Athletes, Veterans, and Other Considerations: If you are a NCAA or club sports athlete, or have *any* special circumstances, you should inform me as soon as possible. For veterans, certain additional resources may be available: <http://veterans.umbc.edu/>. Special accommodations can be made for scheduling and other specific needs on an individual basis. Please inform me of your situation as soon as possible. For disability-related needs, documentation may be required.

Accessibility and Disability Accommodations, Guidance and Resources: Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADA AAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities. If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures. If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success. SDS email: disAbility@umbc.edu; SDS phone: 410-455-2459

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination: UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University’s Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at titleixcoordinator@umbc.edu or 410-455-1717. You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community. If you are interested in making a report, please use the online reporting/referral form. Please note that, if you report anonymously, the University’s ability to respond will be limited.

Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations: All faculty members and teaching assistants are considered Responsible Employees, per UMBC’s Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received. *While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to*

the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

- Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.
- Center for Counseling and Well-Being (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) Online Appointment Request Form
- Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; i3b@umbc.edu; Monday – Friday 8:00 a.m. – 10:00 p.m.
- Women’s Center (open to students of all genders): 410-455-2714; womenscenter@umbc.edu; Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.
- Additional on and off campus supports and resources can be found at:
<https://ecr.umbc.edu/>.

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

UMBC’s Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination expressly prohibits all forms of discrimination and harassment on the basis of sex, including pregnancy. Resources for pregnant, parenting and breastfeeding students are available through the University’s Office of Equity and Civil Rights. Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and ensure ongoing access to their academic program with respect to a leave of absence, returning following leave, or any other accommodation that may be needed related to pregnancy, childbirth, adoption, breastfeeding, and/or the early months of parenting.

Pregnant and Parenting Students: In addition, students who are pregnant and have an impairment related to their pregnancy that qualifies as disability under the ADA may be entitled to accommodations through the Office of Student Disability Services.

Religious Observances & Accommodations: UMBC Policy provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences or requested modifications for religious observances in advance, and as early as possible. For questions or guidance regarding religious observances and accommodations, please contact the Office of Equity and Civil Rights at ecr@umbc.edu.

Hate, Bias, Discrimination and Harassment: UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement. Consistent with these principles, UMBC Policy prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information. Students (and faculty and staff) who experience discrimination, harassment, hate, or bias based upon a protected status or who have such matters reported to them should use the online reporting/referral form to report discrimination, hate, or bias incidents. You may report incidents that happen to you anonymously. Please note that, if you report anonymously, the University’s ability to respond may be limited.