Math – 52000, Section 23438

Course Syllabus

Spring 2018

General information

Class Time: TR 12:00 – 1:15 pm, LD 002
Instructor: Vitaly Tarasov
Office: LD 224 G
E-mail: vtarasov@iupui.edu
Phone: 274-8144
Use e-mail whenever possible.
Office Hours: By appointment
Textbook: David L. Powers
Boundary Value Problems and Partial Differential Equations
Calculator: A scientific calculator.
Midterm Exam: February 28, 12:00 – 13:15 pm
Final Exam: April 30, 10:30 am – 12:30 pm
Important Dates: January 13 — Last day to withdraw with no paperwork required.
March 10 — Last day to withdraw online with only an advisor’s approval required. In-person transactions must be completed by March 8 at 5:00 pm.
Other important registration dates can be found at: https://studentcentral.iupui.edu/calendars/official-calendar.html
For additional important information, see page 3 of the syllabus.

Prerequisites: Math 26100, Math 26600 (or 26200)
Home page: https://math.iupui.edu/~vt/520/
See also: https://math.iupui.edu/courses/

Important Note

If you need help — ASK! Ask questions in class, though remember that time in class is limited and it is mainly for new material. ASK during office hours — make an appointment and ASK. Try to formulate your questions clearly. A right question is a half of the answer. I cannot help you if you do not work to ask right questions.
Course Description
The objective of the course is solving boundary value problems involving partial differential equations. Separation of variables receives the most attention because it provides a uniform method for solving important cases of the heat, wave and potential equations.

Attendance
It is very important for doing well to attend every lecture. Though attendance is not mandatory, a student absent from the class bears full responsibility for all the material covered in class. I will assume that you already understand the material when you do not attend. When you do miss a class, contact a classmate to learn what was discussed.

Reading and Homework
I strongly recommend you to read a new section in the textbook before each lecture, see the Course Outline. It will be very helpful for you in class if you acquaint yourself in advance with the subject to be discussed. Recognizing familiar words makes it easier for you to follow a new material.

Homework is especially important in any math course. There will be weekly homework assignments and it is crucial that you stay current with the assignments. A link to a list of homework assignments is available at https://math.iupui.edu/~vt/520/. Although homework will not be collected and graded, well-done homework is a key to well-done quizzes and exams.

I encourage you to talk to your fellow students about homework problems you find difficult, preferably only after you have found them difficult. Talking to others about mathematics is a very effective way to learn mathematics. However, after discussions write out your solutions on your own to be sure that you understand the subject.


Quizzes
There will be 6 home-taken quizzes. They will be handed out in class and posted at https://math.iupui.edu/~vt/520/ on Jan. 22, Feb. 5, Feb. 19, Mar. 19, Apr. 2, Apr. 16. Quizzes are due in a week. Each quiz is worth 20 points.

Midterm Exam
There will be a midterm exam on February 28, covering all the material discussed from the beginning of the class. The exam consists of 5–7 problems and is worth 90 points. A makeup for the missed exam will be given only for a serious reason and a written, verifiable excuse for the missed exam will be required. You should ask for a makeup on March 5 the latest, and the makeup must be taken before the class on March 7. A makeup is not easier than the original.

Final Exam
There will be a comprehensive final exam on April 30 at 10:30 am – 12:30 pm. It will consist of 6–8 problems. The final exam is worth 120 points.
Reminder

To receive credit for quiz and exam problems you must show your work. Answers without solutions give you no credit. Please, write solutions in a well organized manner and indicate answers clearly. Be careful — if you get a right answer, but transform it further in a wrong way, it will be considered as a mistake.

Grading

Students are supposed to accumulate points throughout the course. There are 120 points from quizzes, 90 points from the midterm exam, and 120 points from the final exam. Totally, there are 330 points. Letter grades will be assigned at the end of the course according to the accumulated points. No letter grade D will be assigned. Numerical scores will be translated into letter grades approximately according to the scale:

\[
\begin{align*}
70.0\% & \leq 75.0\% < 80.0\% < 85.0\% < 90.0\% < 94.0\% \leq 100\% \\
B^- & \quad B & \quad B^+ & \quad A^- & \quad A & \quad A^+
\end{align*}
\]

\[
\begin{align*}
50.0\% & \leq 57.0\% < 64.0\% < 70.0\%
\end{align*}
\]

C^- C C^+

However, there may be minor deviations from this scale in both directions.

Additional information

Students who need to make adjustments to their schedules should do so as early as possible in the semester. During the first week of the semester until January 13, a student can drop and add a course online with no approval required, and no late add fees assessed. January 13 is the last day to withdraw with course deleted from record and no grade assigned. Through March 10, withdrawal from classes requires only an advisor’s approval using the online eDrop/eAdd link in One.IU, and student receives an automatic grade of W.

**In-person transactions must be completed by March 8 at 5:00 pm.**

Since March 10, withdrawal from classes requires approval of the instructor, the advisor, and the student’s Dean. The policy of the School of Science is that an instructor will not give a grade of W after March 10 unless a documentable excuse can be verified. For students enrolled in the School of Science, the Academic Dean or Executive Director of Academic Affairs will not endorse a withdrawal unless a documentable excuse can be verified. A complete list of important registration dates for the Spring 2018 can be found at:

https://studentcentral.iupui.edu/calendars/official-calendar.html

After January 13, all individuals attending classes on a regular basis must be officially enrolled in the class, or enrolled as an auditor. One time visitors to classes may be allowed only on an exception basis with prior permission of the instructor.

An important supplement to the syllabus on IUPUI policies is available via the Canvas course page: click on the Syllabus Supplement tab and follow the link on the Open in New Tab button to display the supplemental information.
course outline

0 Ordinary Differential Equations
  0.1 Homogeneous Linear Equations
  0.2 Nonhomogeneous Linear Equations
  0.3 Boundary Value Problems
  0.4 Singular Boundary Value Problems

1 Fourier Series
  1.1 Periodic Functions and Fourier Series
  1.2 Arbitrary Period and Half-Range Expansions
  1.3 Convergence of Fourier Series
  1.4 Uniform Convergence
  1.5 Operations on Fourier Series
  1.6 Mean Error and Convergence in Mean
  1.7 Proof of Convergence
  1.10 Complex Methods

2 The Heat Equation on a Finite Interval
  2.1 Derivation and Boundary Conditions
  2.2 Steady-State Temperatures
  2.3 Example: Fixed End Temperatures
  2.4 Example: Insulated Bar
  2.5 Example: Different Boundary Conditions
  2.6 Example: Convection
  2.7 Sturm-Liouville Problems
  2.8 Expansion in Series of Eigenfunctions
  2.9 Generalities on the Heat Conduction Problems
  3.5 Estimation of Eigenvalues

3 The Wave Equation on a Finite Interval
  3.1 The Vibrating String
  3.2 Solution of the Vibrating String Problem
  3.3 d’Alembert’s Solution
  3.4 One-Dimensional Wave Equation: Generalities

4 The Potential Equation
  4.1 Potential Equation
  4.2 Potential in a Rectangle
  4.3 Further Examples for a Rectangle
  4.5 Potential in a Disk
A Boundary Problems on Unbounded Regions
1.9 Fourier Integral
1.10 Complex Methods
2.10 Semi-Infinite Rod
2.11 Infinite Rod
3.6 Wave Equation in Unbounded Regions
4.4 Potential in Unbounded Regions

6 Laplace Transform
6.1 Definition and Elementary Properties
6.2 Partial Fractions and Convolutions
6.3 Partial Differential Equations
6.4 More Difficult Examples

7 Numerical Methods
7.1 Boundary Value Problems
7.2 Heat Problems
7.3 Wave Equation
7.4 Potential Equation

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<thead>
<tr>
<th>Calendar</th>
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<tbody>
<tr>
<td>January: 8 10 15 17 22 24 29 31</td>
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<tr>
<td>February: 5 7 12 14 19 21 26 28</td>
</tr>
<tr>
<td>March: 5 7 19 21 26 28</td>
</tr>
<tr>
<td>April: 2 4 9 11 16 18 23 25 30</td>
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Legend: Quizzes Due Midterm Exam Final exam

The instructor reserves the right to adjust this syllabus if necessary.