School of Mathematical Sciences

☑ New ☐ Revised COURSE: COS-MATH-742 Partial Differential Equations II

1.0 Course Designations and Approvals:

<table>
<thead>
<tr>
<th>Required Course Approvals:</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Unit Curriculum Committee</td>
<td>10-20-10</td>
<td>10-27-10</td>
</tr>
<tr>
<td>College Curriculum Committee</td>
<td>11-01-10</td>
<td>9-27-11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optional Course Designations:</th>
<th>Yes</th>
<th>No</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>✓</td>
<td></td>
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<tr>
<td>Writing Intensive</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Honors</td>
<td>✓</td>
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2.0 Course information:

Course Title: Partial Differential Equations II
Credit Hours: 3
Prerequisite(s): COS-MATH-741 or permission of instructor
Co-requisite(s): None
Course proposed by: School of Mathematical Sciences
Effective date: August 2013

<table>
<thead>
<tr>
<th>Contact Hours</th>
<th>Maximum Students/section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
</tr>
<tr>
<td>Lab</td>
<td></td>
</tr>
<tr>
<td>Workshop</td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
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</table>

2.1 Course Conversion Designation: (Please check which applies to this course)

☐ Semester Equivalent (SE) to:
☑ Semester Replacement (SR) to: 1016-807, 1016-808
☐ New

2.2 Semester(s) offered:

☐ Fall       ☑ Spring       ☐ Summer
☐ Offered every other year only ☐ Other
2.3 Student Requirements:

Students required to take the course:
None

Students who might elect to take the course:
Graduate students and advanced undergraduate students in mathematics, physics, imaging science, or engineering

3.0 Goals of the course: (including rationale for the course, when appropriate)

3.1 To analyze differential equations arising in physics and engineering in two and three dimensions.
3.2 To analyze and apply the techniques for their solutions.
3.3 To analyze the properties of solutions.

4.0 Course description: (as it will appear in the RIT Catalog, including pre- and co-requisites, semesters offered)

COS-MATH-742 Partial Differential Equations II
This is a continuation of Partial Differential Equations I and deals with advanced methods for solving partial differential equations arising in physics and engineering problems. Topics to be covered include second order equations, Cauchy-Kovalevskaya theorem, method of descent, spherical means, Duhamel’s principle, and Green’s function in higher dimensions. (COS-MATH-741 or permission of instructor) Class 3, Credit 3 (S)

5.0 Possible resources: (texts, references, computer packages, etc.)

5.1 Yehuda Pinchover; Jacob Rubinstein, An Introduction to PDEs, Cambridge, Cambridge, UK.
5.3 Craig Evans, Partial differential equations, AMS, Boston, MA.

6.0 Topics: (outline) Topics with an asterisk(*) are at the instructor’s discretion, as time permits

6.1 Second Order Equations in Higher Dimensions
   6.1.1 Classification
   6.1.2 Cauchy-Kovalevskaya theorem

6.2 Wave Equation in 2 and 3 Dimensions
   6.2.1 Method of spherical means
   6.2.2 Method of descent
   6.2.3 Duhamel’s principle

6.3 Laplace Equation in 3 Dimensions
   6.3.1 Laplace equation in a cylinder
   6.3.2 Laplace equation in a ball
   6.3.3 Maximum principle and mean value theorem
6.4 Green’s Functions in Higher Dimensions
6.5 Fourier Transform*

7.0 Intended learning outcomes and associated assessment methods of those outcomes: Assessment methods with an asterisk(*) are at the instructor’s discretion

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessment Methods</th>
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<tbody>
<tr>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>7.1 Analyze general Cauchy problems and Cauchy-Kovalevskaya Theorem</td>
<td>✓</td>
</tr>
<tr>
<td>7.2 Solve wave equation in two and three dimensions</td>
<td>✓</td>
</tr>
<tr>
<td>7.3 Analyze Laplace equation in three dimensions</td>
<td>✓</td>
</tr>
<tr>
<td>7.4 Compute Green’s functions in higher dimensions</td>
<td>✓</td>
</tr>
</tbody>
</table>

8.0 Program goals supported by this course:

8.1 To develop an understanding of the mathematical framework that supports engineering, science, and mathematics.

8.2 To develop critical and analytical thinking.

8.3 To develop an appropriate level of mathematical literacy and competency.

8.4 To provide an acquaintance with mathematical notation used to express physical and natural laws.

9.0 General education learning outcomes and/or goals supported by this course: Not applicable

10.0 Other relevant information: (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)

None