| | | |
|---|---|---|
| **Form: Course Syllabus** | **Form Number** | EXC-01-02-02A |
| | **Issue Number and Date** | 2/3/24/2022/2963 05/12/2022 |
| | **Number and Date of Revision or Modification** | |
| | **Deans Council Approval Decision Number** | 2/3/24/2023 |
| | **The Date of the Deans Council Approval Decision** | 23/01/2023 |
| | **Number of Pages** | 07 |

| | | |
|---|---|---|
| **1.** | **Course Title** | **Partial Differential Equations I** |
| **2.** | **Course Number** | 0331321 |
| **3.** | **Credit Hours (Theory, Practical)** | 3 |
| | **Contact Hours (Theory, Practical)** | 3 |
| **4.** | **Prerequisites/ Corequisites** | 0301221 |
| **5.** | **Program Title** | B. Sc. |
| **6.** | **Program Code** | |
| **7.** | **School/ Center** | Science |
| **8.** | **Department** | Mathematics |
| **9.** | **Course Level** | Compulsory Specialization Requirement |
| **10.** | **Year of Study and Semester (s)** | 2nd or 3rd year, all semesters. |
| **11.** | **Other Department(s) Involved in Teaching the Course** | None |
| **12.** | **Main Learning Language** | English |
| **13.** | **Learning Types** | ☐Face to face learning ☐Blended ☐Fully online |
| **14.** | **Online Platforms(s)** | ☐Moodle ☐Microsoft Teams |
| **15.** | **Issuing Date** | 3/10/2024 |
| **16.** | **Revision Date** | |

**17. Course Coordinator:**

| | |
|---|---|
| Name: Dr. Ahmed Y. Abdallah | Contact hours: 11:30-12:30 S, T, Th<br>11:30-1:00 M, W |
| Office number: 208 | Phone number: 22076 |
| Email: farah@ju.edu.jo | |

**18. Other Instructors:**

| |
|---|
| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |
| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |

**19. Course Description:**

| |
|---|
| As stated in the approved study plan.<br>Classification of PDEs; 2nd order linear homogeneous PDEs with constant coefficients and PDEs which are comparable to ODEs; Separation of variables; Sturm-Liouville BVP; Fourier series, integrals, and transforms; BVPs related to wave, heat, and Laplace PDEs. |

**20. Program Student Outcomes (SO's):**

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Identify, formulate, and solve broadly-defined technical or scientific problems by applying knowledge of Mathematics and Science and/or technical topics to areas relevant to the discipline.

2. Formulate or design a system, process, procedure or program to meet desired needs.

5. Reflect the impact of technical and/or scientific solutions in economic, environmental, and societal contexts.

**21. Course Intended Learning Outcomes (CLO's):**

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Classify PDEs and Solve special types of linear second order PDEs including homogeneous PDEs with constant coefficients, PDEs which are comparable to ODEs, and separation of variables.
2. Study Sturm-Liouville BVPs.
3. Use Fourier series, integrals and transforms to solve BVPs including heat, wave, and Laplace equations.
4. Formulate physical problems using PDEs.
5. Analyze (comment) the solution of PDEs theoretically or graphically.

| Course CLOs | The learning levels to be achieved | | | | | |
|---|---|---|---|---|---|---|
| | Remembering | Understanding | Applying | Analysing | evaluating | Creating |
| CLO 1 | • | • | • | | | |
| CLO 2 | | • | • | | • | |
| CLO 3 | | • | • | | • | |
| CLO 4 | | | | | | • |
| CLO 5 | | | | • | | |

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:**

| Program SO's / Course CLO's | SO (1) | SO (2) | SO (3) | SO (4) | SO (5) | SO (6) | SO (7) | SO (8) |
|---|---|---|---|---|---|---|---|---|
| CLO (1) | • | | | | | | | |
| CLO (2) | • | • | | | | | | |
| CLO (3) | • | • | | | • | | | |
| CLO (4) | | • | | | • | | | |
| CLO (5) | | • | | | | | | |

**23. Topic Outline and Schedule:**

| Week | Lecture | Topic | CLO/s Linked to the Topic | Learning Types<br>Face to Face (FF)<br>Blended (BL)<br>Fully Online (FO) | Platform Used | Synchronous (S)<br>Asynchronous (A) | Evaluation Methods | Learning Resources |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.1 | Linear operators | 1 | FF | Teams | S | | Textbook |
| | 1.2 | Linear PDEs, Classification of a linear PDE of 2nd order | 1 | FF | Teams | S | | Textbook |
| | 1.3 | Boundary value problems with PDEs | 1 | FF | Teams | S | | Textbook |
| 2 | 2.1 | Second order linear PDEs With constant coefficients | 1 | FF | Teams | S | | Textbook |
| | 2.2 | Second order linear PDEs With constant coefficients | 1 | FF | Teams | S | | Textbook |
| | 2.3 | Separation of variables | 1 | FF | Teams | S | | Textbook |
| 3 | 3.1 | Orthogonality and vectors | 2 | FF | Teams | S | | Textbook |
| | 3.2 | Orthogonal functions | 2 | FF | Teams | S | | Textbook |
| | 3.3 | The Sturm-Liouville boundary value problems | 2 | FF | Teams | S | | Textbook |
| 4 | 4.1 | The Sturm-Liouville boundary value problems | 2 | FF | Teams | S | | Textbook |
| | 4.2 | The Sturm-Liouville boundary value problems | 2 | FF | Teams | S | | Textbook |
| | 4.3 | Uniform convergence of Series, series of orthogonal functions | 2 | FF | Teams | S | | Textbook |
| 5 | 5.1 | Piecewise continuous functions, A basic Fourier series | 3 | FF | Teams | S | | Textbook |
| | 5.2 | A basic Fourier series | 3 | FF | Teams | S | | Textbook |
| | 5.3 | A basic Fourier series | 3 | FF | Teams | S | | Textbook |
| 6 | 6.1 | A basic Fourier series | 3 | FF | Teams | S | | Textbook |
| | 6.2 | Fourier sine and cosine series | 3 | FF | Teams | S | | Textbook |
| | 6.3 | Fourier sine and cosine series | 3 | FF | Teams | S | | Textbook |
| 7 | 7.1 | Fourier sine and cosine | 3 | FF | Teams | S | | Textbook |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | series | | | | | | |
| | 7.2 | Uniform convergence of Fourier series | 3 | FF | Teams | S | | Textbook |
| | 7.3 | Differentiation and integration of Fourier series | 3 | FF | Teams | S | 1st Exam | Textbook |
| **8** | 8.1 | A generalization of Fourier series | 3 | FF | Teams | S | | Textbook |
| | 8.2 | A generalization of Fourier series | 3 | FF | Teams | S | | Textbook |
| | 8.3 | Fourier sine and cosine integrals | 3 | FF | Teams | S | | Textbook |
| **9** | 9.1 | Fourier sine and cosine integrals | 3 | FF | Teams | S | | Textbook |
| | 9.2 | Exponential Fourier integral | 3 | FF | Teams | S | | Textbook |
| | 9.3 | Fourier transforms | 3 | FF | Teams | S | | Textbook |
| **10** | 10.1 | Fourier transforms | 3 | FF | Teams | S | | Textbook |
| | 10.2 | Fourier transforms | 3 | FF | Teams | S | | Textbook |
| | 10.3 | Fourier transforms | 3 | FF | Teams | S | | Textbook |
| **11** | 11.1 | The vibrating string | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 11.2 | The vibrating string | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 11.3 | The vibrating string with two nonhomogeneous conditions | 3+4+5+6 | FF | Teams | S | | Textbook |
| **12** | 12.1 | Longitudinal vibrations along an elastic rod | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 12.2 | Longitudinal vibrations along an elastic rod | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 12.3 | Heat conduction | 3+4+5+6 | FF | Teams | S | 2nd Exam | Textbook |
| **13** | 13.1 | Heat conduction | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 13.2 | Laplace's equation | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 13.3 | Laplace's equation | 3+4+5+6 | FF | Teams | S | | Textbook |
| **14** | 14.1 | Temperature in a circular disk with insulated faces | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 14.2 | Temperature in a circular disk with insulated faces | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 14.3 | A semi-infinite bar | 3+4+5+6 | FF | Teams | S | | Textbook |
| **15** | 15.1 | An infinite bar | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 15.2 | A semi-infinite string | 3+4+5+6 | FF | Teams | S | | Textbook |
| | 15.3 | A semi-infinite string with initial velocity | 3+4+5+6 | FF | Teams | S | | Textbook |
| **16** | | | | FF | Teams | S | Final Exam | Textbook |

**24. Evaluation Methods:**

Opportunities to demonstrate achievement of the CLOs are provided through the following assessment methods and requirements:

| Evaluation Activity | Mark | Topic(s) | CLO/s Linked to the Evaluation activity | Period (Week) | Platform |
|---|---|---|---|---|---|
| **1st Exam** | 30 | Chapters 1+2+3 | 1+2 | 7th week | On Campus |
| **2nd Exam** | 20 | Chapters 4+7<br>Sections:<br>From 8.1 to 8.7 | 3+4 | 12th week | On Campus |
| **Final Exam** | 50 | All course material | 1+2+3+4+5+6 | 16th week | On Campus |

**25. Course Requirements:**

Each student must have:

- Computer
- Internet connection
- Account on Microsoft Teams

**26. Course Policies:**

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
5. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homework.

**27. References:**

**A-** Required book:

J. Ray Hanna, John H. Rowland. Fourier series, transforms, and boundary value problems. (2008), 2nd edition, Dover Publications, Inc., USA.

**B-** Recommended books:

**(1)** Richard Haberman, Applied Partial Differential Equations with Fourier Series and Boundary Value Problems, (2013), 5-th edition, Pearson.
**(2)** W. Boyce and R. DiPrima, Elementary Differential Equations and Boundary Value Problems. (2012), 10-th edition, J. Wiley & Sons, Inc., USA.
**(3)** S.J. Farlow, (1993), Partial Differential Equations for Scientists and Engineers, (reprint), J. Wiley & Sons, Inc., USA.
**(4)** Tyn Myint-U and L. Debnath, Linear Partial Differential Equations for Scientists and Engineers, (2006), 4-th edition, Birkhauser, Boston.

**28. Additional information:**

| | | |
|---|---|---|
| Name of the Instructor or the Course Coordinator:<br>**Prof. Ahmed Y. Abdallah** | Signature:<br>…… | Date:<br>3/10/2024 |
| Name of the Head of Quality Assurance Committee/ Department:<br>**Prof. Manal Ghanem** | Signature:<br>…… | Date:<br>…… |
| Name of the Head of Department:<br>**Prof. Baha Alzalg**. | Signature:<br>…… | Date:<br>…… |
| Name of the Head of Quality Assurance Committee/ School of Science:<br>**Prof. Emad A. Abuosba** | Signature:<br>…… | Date:<br>…… |
| Name of the Dean or the Director:<br>**Prof. Mahmoud I. Jaghoub** | Signature:<br>…… | Date:<br>…… |