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| **Philadelphia University** |  | **Approval date:** |
| **Faculty of Science** | **Issue:** |
| **Department of Mathematics** | **Credit hours: 3** |
| **Academic year 2023/2024** | **Course Syllabus** | **Bachelor** |

**Course information**

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| **Course #** | **Course title** | | | **Prerequisite** | |
| **250444** | **Matrix Theory** | | | **0250241** | |
| **Course type** | | | **Class time** | | **Room #** |
| 🞏 University Requirement 🞏Faculty Requirement  🗹 Major Requirement 🗹 Elective 🞏Compulsory | | | Sun. Tues.  14:15-13:05 | | 21003 |
| Degree / NQF Level | | 🞏Diploma degree (6) 🗹Bachelor degree (7) | | | |

**Instructor Information**

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| --- | --- | --- | --- | --- |
| **Name** | **Office No.** | **Phone No.** | **Office Hours** | **E-mail** |
| **Dr. Rola Alseidi** | 904 | 2405 | Sat, Mon  09:45 - 11:00 | **ralseidi@philadelphia.edu.jo** |
| Sun, Tues  11:15 – 12:30 |

**Learning Method**

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| **Learning Method** |
| 🞏**Face to face** 🞏 **Online** 🗹 **Blended** |

**Course Description**

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| **Course Description** |
| This course deals with the following main topics: review of main concepts of linear algebra such as determinants, rank and nullity, eigenvalues and eigenvectors. Also, it includes the study of characteristic polynomial, minimal polynomial, spectral theorem, Cayley-Hamilton theorem, Jordan form, companion matrices, spectral radius and investigate some types of matrices, singular value decomposition |
| **Course Objectives** |
| 1. Define some type of matrices. 2. Prove some fundamental theorems in matrix theory. 3. Students will be well prepared for higher -level mathematics courses. |

**Course Learning Outcomes**

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| **Outcomes** | |
| **Knowledge** | |
| K1 | Understand the concepts of determinants, rank, nullity eigenvalues and eigenvectors. |
| K2 | Identify special classes of matrices and their properties. |
| K3 | Understand the concepts of spectral radius, characteristic polynomial, minimal polynomial. |
| **Skills** | |
| S1 | Prove some theorems on spectral properties of various types of matrices. |
| S2 | Apply the matrix method to analyze the behavior of physical systems that evolve over time. |
| **Competence** | |
| C1 | Thinking reasonably and the ability to make decisions. |
| C2 | Work in a team to implement one of the tasks of the course. |

**Learning Resources**

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| **Course textbook** | * Lecture Notes |
| **Supporting References** | * Linear algebra with applications by [Leon](http://library.philadelphia.edu.jo/scripts/minisa.dll/175/PAUTHOR/Leon?KEYSEARCH&amp;DISPLAY=AUTHORS%2B), Steven J., 9th ed. Boston: Pearson Education Limited, 2015. * Linear Algebra by L.W. Jhonson & R.D. Riess & J.T. Arnold- Addisson Wesely 2007. * Matrix Analysis, Horn and Johnson |
| **Supporting websites** | * http://videolectures.net/mit1806s05\_linear\_algebra/ |
| **Teaching Environment** | 🗹 **Classroom** 🞏 **Laboratory** 🞏 **Learning platform** 🞏 **Other** |

**Meetings and Subjects Timetable**

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| **Week** | **Topic** | **Learning Methods** | **Tasks** |
| 1 | **Course Syllabus:**  Explanation of the study plan for the course, and what is expected to be accomplished by the students.  **Technology Preliminaries:**  Moodle, Microsoft Teams | Face to Face Learning,  Moodle assignments and projects |  |
| 2 | **Review of some concepts in linear algebra.** | Face to Face Learning,  Moodle assignments and projects |  |
| 3 | Spectral Mapping Theorem  Minimal Polynomial and Similar matrices. | Face to Face Learning,  Moodle assignments and projects |  |
| 4 | Jordan Canonical Form | Face to Face Learning,  Moodle assignments and projects | Quiz |
| 5 | Hermitian Matrices | Face to Face Learning,  Moodle assignments and projects | Assignment |
| 6 | Unitary Matrices, Positive Definite matrices. | Face to Face Learning |  |
| 7 | Normal and Nilpotent Matrices | Face to Face Learning,  Moodle assignments and projects |  |
| 8 | **Si**ngular Values Decomposition. | Face to Face Learning,  Moodle assignments and projects |  |
| 9 | Companiom Matrix and Zeroes of Polynomial. |  |  |
| 10 | Vector and matrix norms | Face to Face Learning,  Moodle assignments and projects | Quiz |
| 11 | Matrix product (Kronecker, Hadamard, and Khatri-Roa products) | Face to Face Learning,  Moodle assignments |  |
| 12 | Special Matrices ( Toeplitz, Vandermonde, Hankel and Hessenberg matrices. | Face to Face Learning,  Moodle assignments and projects |  |
| 13 | Spectral Radius Inequality | Face to Face Learning,  Moodle assignments and projects | Assignment |
| 14 | Numerical Range and Numerical radius | Face to Face Learning,  Moodle assignments and projects |  |
| 15 | Review | Face to Face Learning  Face to Face Learning,  Moodle assignments and projects |  |
| 16 | Final Exam | | |

**Assessment Methods and Grade Distribution**

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| **Assessment Methods** | **Grade Weight** | **Assessment Time (Week No.)** | **Link to Course Outcomes** |
| **Mid Term Exam** | 30% | 8 | K1, K2, C1 |
| **Various Assessments \*** | 30% | Continuous | S1, S2, C1, C2 |
| **Final Exam** | 40% | 16 | K1, K2, K3, C1 |
| **Total** | 100% |  |  |

\* Includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.