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| **Course:** | Practical Numerical Analysis – 0907313 (1 Cr. – Core Course) |
| **Catalog Data:** | Computer packages for mathematical manipulations (MATLAB). |
| **Prerequisites by Course:** | 0301241 Linear Algebra I |
| **Prerequisites by Topic:** | Students are assumed to have had sufficient knowledge in calculus, statistics, probability and random variables, linear algebra, and computer programming. Knowledge in signals is a plus. |
| **Textbook:** | **Applied Numerical Methods with MATLAB® for Engineers and Scientists, Fourth Edition, Steven C. Chapra, 2018** |
| **References:** | MATLAB Programming for Numerical Analysis, César Pérez López, 2014 Mastering MATLAB 7, Duane Hanselman and Bruce Littlefield, Pearson Prentice Hall, 2005. |
| **Course Website:** | Microsoft Teams Group and Resources Dr. Ashraf Suyyagh Website: drsuyyagh.com |
| **Schedule & Duration:** | 11 Weeks, 9 Lab sessions, 180 minutes each (weeks include exams and holidays) |
| **Minimum Student Material:** | Textbook, class lab sheets, instructor videos, and access to a personal computer, MATLAB software, and internet. |
| **Minimum College Facilities:** | Classroom with whiteboard and projection display facilities, library, and computational facilities. Licensed MATLAB software. |
| **Course Objectives:** | This course introduces the students to MATLAB as a powerful tool in the analysis, design, and solution of engineering problems, as well as the implementation and use of major numerical analysis techniques and functions. This course further introduces the basics of numerical analysis. |

Upon successful completion of this course, a student should be able to:

1. Use MATLAB to perform different types of mathematical operations and apply numerical analysis concepts. [1,2]
2. Be able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (*e.g.* design experiments to find the number of iterations, or bins that makes a numerical method converge to a solution within a tolerance level) [6]
3. Be able to learn a new numerical method on your own other than the one taught in class, understand its concepts, governing equations, and write its code to apply it on an engineering, scientific, or mathematical problems. Be able to learn new numerical on their own and apply them on an engineering, scientific, or mathematical problem [7]

**Course Outcomes and Relation to ABET Program Outcomes:**

**ABET outcome to be assessed 6 and 7**

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| **Course Topics:** | The lab includes nine experiments that cover the following topics:<br>1. An overview of MATLAB environment<br>2. Numeric structure arrays and their associated operations<br>3. Data Import and Preprocessing, Discrete Math and Timing<br>4. Programming with MATALB – Scripts and Functions<br>5. Advanced MATLAB plots<br>6. Statistical and Probability Analysis and Error Modelling<br>7. Root Finding Algorithms<br>8. Solving Linear Systems<br>9. Numerical Integration and Differentiation<br>10. Curve Fitting, linear regression, Interpolation and Optimization |

**Course Outline**

| Lab Week | Lab | Experiment |
|---|---|---|
| 12th Oct | Exp. 1 | MATLAB Fundamentals I |
| 19th Oct | Exp. 2 | MATLAB Fundamentals II |
| 26th Oct | Exp. 3 | MATLAB Programming - Function and Script Files |
| 2nd Nov | Exp. 4 | Plotting |
| 9th Nov | Exp. 5 | Statistical and Probability Analysis + **Certificate** |
| 16th Nov. | Exp. 6 | Solving Linear Equations, Basics of Linear Regression and Curve Fitting, and Interpolation |
| 23rd Nov | - | **Midterm Exam (Labs 1-5)** |
| 30th Nov | - | **No Lab (Dept. Exams)** |
| 7th Dec | Exp. 7 | Error Analysis and Optimization Algorithms |
| 14th Dec | Exp. 8 | Numerical Methods for Finding Roots |
| 21st Dec | Exp. 9 | Numerical Integration and Differentiation |
| 28th Dec | - | - |
| **7th Jan** | | **Numerical Certificates Submission** |

**Final Exam TBA per University Calendar**

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| **Computer Usage:** | Students perform lab experiments and quizzes on their home PCs/Laptops<br>Students have practical exams on computers available in the lab. |
| **Attendance:** | Class attendance will be taken depending on Board of Trustees decisions and the universities polices will be enforced in this regard.<br>**Students who do not attend 3+ lab will be officially banned from class** |
| **Assessments:** | Quizzes, Certificates, Lab sheets and Exams. |

**Grading policy:**

| | 60/40 |
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| Lab sheets | **18%** |
| 4 MathWorks Certificates | **12%** |
| Midterm Exam | **30%** |
| Final Exam | **40%** |

Professor: Dr. Ashraf Suyyagh: a.suyyagh@ju.edu.jo

Teacher / TA: Eng. Hanan Al-Yasin :h.alyasin@ju.edu.jo

**Instructors:**

Online Contact Hours: Sunday – Thursday 8:30 A.M. – 3:30 P.M.
**(Email & MS Teams only).**
**For Office Hours, check the professor timetable on teams**

**Class Time and Location:**

Section 1: Tuesday 1:30 – 4:30 P.M. (Dr. Ashraf Suyyagh)
Section 2: Wednesday 10:00 – 1:00 P.M. (Eng. Hanan Al-Yasin)
Section 3: Wednesday 1:00 – 4:00 P.M. (Eng. Hanan Al-Yasin)

## Program Outcomes (PO)

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| 1 | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics |
| 2 | an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors |
| 3 | an ability to communicate effectively with a range of audiences |
| 4 | an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |
| 5 | an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives |
| 6 | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions |
| 7 | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies |