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| Philadelphia University |  PHILADELPHIA UNIVERSITY <small>THE WAY TO THE FUTURE</small> | Approval date: |
| Faculty of Science | | Issue: |
| Department of Math | | Credit hours: 3 |
| Academic year 2022/2023 | | Course Syllabus |

Course information

| Course# | Course title | Prerequisite |
|--|----------------------------|----------------------|
| 250372 | Computer Aided Mathematics | ODEs 250203 |
| Course type | | Class time |
| <input type="checkbox"/> University Requirement <input type="checkbox"/> Faculty Requirement <input checked="" type="checkbox"/> Major Requirement <input type="checkbox"/> Elective <input checked="" type="checkbox"/> Compulsory | | SMTWT 11:30-12:30 |
| | | Room # |
| | | 2827 |

Instructor Information

| Name | Office No. | Phone No. | Office Hours | E-mail |
|------------|------------|-----------|----------------------|--|
| Feras Awad | 822 | 2132 | SMTWT 10:15-11:15 | fawad@philadelphia.edu.jo |

Course Delivery Method

| Course Delivery Method | | | |
|-----------------------------------|---------------------------------|---|----------|
| <input type="checkbox"/> Physical | <input type="checkbox"/> Online | <input checked="" type="checkbox"/> Blended | |
| Learning Model | | | |
| Precentage | Synchronous | Asynchronous | Physical |
| | 0% | 33% | 67% |

Course Description

What is Mathematica? The structure of Mathematica, Notebook interfaces, editing Cells and Text, Palettes. Mathematica as a Calculator: Basic Arithmetic, precedence, Built-in Constants: Built-in functions. Numerical Notation: prefix, postfix, infix forms for Built-in functions, Mathematica help. Variables and functions: Rules for Names, immediate Assignment, functions, substitution rule, anonymous functions. Lists: what is a list? Functions producing lists, working with elements of list, listable functions, useful functions. Logic and set theory: being logical, truth tables, element handling sets, Quantifiers. number theoretic functions, numerical functions, Fibonacci sequence, digits in Numbers, selecting from lists. Computer algebra: working with polynomials and powers. Working with rational functions. working with transcendental functions. Solving equations: equations and their solutions, inequalities, single variable calculus: function domain and range, limits, differentiation, implicit differentiation, Maximum and minimum, integration. Sums and products: sequences, the sum command, Taylor polynomials, the product command, vectors and matrices: vectors, Matrices, the conditional function if. Special types of matrices. Basic matrix operations, solving linear systems.

Course Learning Outcomes

| Number | Outcomes | Corresponding Program outcomes |
|---------------------|--|--------------------------------|
| Knowledge | | |
| K1 | Understand the basic principles of the Wolfram Language. | K_p1 |
| K2 | Learn the use of commands and functions for solving and visualizing mathematical problems. | K_p3 |
| Skills | | |
| S1 | Use Wolfram Language to solve problems graphically, numerically and analytically. | S_p4 |
| Competencies | | |
| C1 | Thinking reasonably and the ability to make decisions. | C_p1 |
| C2 | Work in a team to implement one of the tasks of the course. | C_p2 |

Learning Resources

| | |
|------------------------------|---|
| Course textbook | <ul style="list-style-type: none"> Feras Awad (2022) A Glimpse to Mathematica [Wolfram Language] (4th ed.). Instructor Lectures and Notes. |
| Supporting References | <ul style="list-style-type: none"> Wellin, P. (2013) Programming with Mathematica: An Introduction (1st ed.). Cambridge University Press. Hastings, C., Mischo, K., Michael M. (2015) Hands-on start to Wolfram Mathematica (1st ed.). Champaign: Wolfram Media, Inc. |
| Supporting websites | WolframCloud: www.wolframcloud.com/ |
| Teaching Environment | <input type="checkbox"/> Classroom <input checked="" type="checkbox"/> laboratory <input checked="" type="checkbox"/> Learning platform <input type="checkbox"/> Other |

Meetings and Subjects Timetable

| Week | Topic | Learning Methods | Tasks | Learning Material |
|------|--|------------------|-------|----------------------------------|
| 1 | Explanation of the study plan for the course, and what is expected to be accomplished by the students. Introduction: What Is the Wolfram Language? Wolfram Cloud. What is Mathematica? The Structure of Mathematica. Common Kinds of Interfaces to Mathematica. Notebook Interfaces. Editing Cells and Text. Palettes | Lecture | | Course Syllabus Chapter 1 |
| | Mathematica as a Calculator: Commands for Basic Arithmetic. Precedence. Built-in Constants. Built-in Functions. Numerical and Scientific Notations. Prefix and Postfix Forms for Built-in Functions. Mathematica Help | Lecture | | Chapter 2 |
| 2 | Variables and Functions: Rules for Names. Immediate Assignment. Functions. Substitution Rule. | Lecture | | Chapter 3 |

| | | | | |
|---|---|---------|---------|-----------|
| | Anonymous Functions. Functions with Conditions. Recursion | Lecture | Quiz | Chapter 3 |
| 3 | Lists: What is a List? Functions Producing Lists. Displaying Lists. Working with Elements of a List. Pseudorandom Numbers. | Lecture | | Chapter 4 |
| | Useful Functions. Listable Functions. Nested Loops. | Lecture | Quiz | Chapter 4 |
| | Vectors. Matrices. Special Types of Matrices. Basic Matrix Operations | Lecture | Project | Chapter 4 |
| 4 | Logic and Set Theory: Being Logical. Truth Tables. Element “ \in ”. Handling Sets. Quantifiers | Lecture | | Chapter 5 |
| | Number Theory Primes. Integer Factorization. Digits in Numbers. Fibonacci Sequence. | Lecture | | Chapter 6 |
| 5 | Number Theoretic Functions. Selecting from Lists | Lecture | Project | Chapter 6 |
| | Computer Algebra and Solving Equations Working with Polynomials and Powers. Working with Rational Functions. Working with Transcendental Functions. | Lecture | Quiz | Chapter 7 |
| | Equations and Their Solutions. Inequalities | Lecture | | Chapter 7 |
| 6 | Single Variable Calculus: Limits. Differentiation. Maximum and Minimum. Integration. | Lecture | | Chapter 8 |
| | Sequences. Series. Taylor Polynomials | Lecture | Quiz | Chapter 8 |
| 7 | Final Exam | | | |

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

| Using Technology |
|---|
| <ul style="list-style-type: none"> Use Wolfram Language to solve mathematical problems. |
| Communication Skills |
| <ul style="list-style-type: none"> Choose a mathematical problem and present it to the students and explaining its solution method using Wolfram Language. |
| Application of Concepts Learnt |
| <ul style="list-style-type: none"> Choose a famous math problem on YouTube and solve it using Wolfram Language. |

Assessment Methods and Grade Distribution

| Assessment Methods | Grade Weight | Assessment Time (Week No.) | Link to Course Outcomes |
|-----------------------|--------------|----------------------------|-------------------------|
| Mid Term Exam | 30% | 4 | K1, K2 |
| Various Assessments * | 30% | Continuous | S1, C1, C2 |
| Final Exam | 40% | 6 | K1, K2 |
| Total | 100% | | |

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

Alignment of Course Outcomes with Learning and Assessment Methods

| Number | Learning Outcomes | Learning Method* | Assessment Method** |
|---------------------|--|------------------|----------------------------|
| Knowledge | | | |
| K1 | Understand the basic principles of the Wolfram Language. | Lecture | Exam |
| K2 | Learn the use of commands and functions for solving and visualizing mathematical problems. | Lecture | Exam |
| Skills | | | |
| S1 | Use Wolfram Language to solve problems graphically, numerically and analytically. | Lecture | Computer Assignment |
| Competencies | | | |
| C1 | Thinking reasonably and the ability to make decisions. | Discussion | Quiz |
| C2 | Work in a team to implement one of the tasks of the course. | Project | Group Project |

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

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

Course Polices

| Policy | Policy Requirements |
|-------------------------|---|
| Passing Grade | The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%). |
| Missing Exams | <ul style="list-style-type: none"> • Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from an exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date. |
| Attendance | The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and six lectures (S, T). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded. |
| Academic Honesty | Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights. |

Program Learning Outcomes to be Assessed in this Course

| Number | Learning Outcome | Course Title | Assessment Method | Target Performance level |
|--------|--|----------------------------|-------------------|--|
| Sp4 | The use of technology and software in the various fields of mathematics. | Computer Aided Mathematics | Project | 100% of the students get 70% or more on the rubric |

Description of Program Learning Outcome Assessment Method

| Number | Detailed Description of Assessment |
|--------|---|
| Sp4 | The student is given a problem, and use Wolfram Language to write a code that solves the problem. |

Assessment Rubric of the Program Learning Outcome

| | Poor (1 pt.) | Fair (2 pts) | Good (3 pts) |
|--|---|--|---|
| Code Structure Structure of code, use of functions and procedures, code segmentation | Student is very confused and does not understand the topic, nor is able to clearly grasp how to apply it or when to use it. | Student has a decent grasp of the process but makes some major mistakes. | Student is almost perfect in their understanding of the topic, with some minor confusion or mistakes. |
| Code Reuse How well code reuse is implemented | Long code segments, improper usage of functions, functions with side effects. | Code structure needs work. | Code structure has perfectly followed guidelines. Short code segments, proper use of functions. |
| Correctness How correct is the output of the program | Too much redundancy in code | Occasional code redundancy | No code redundancy |
| Execution How smoothly does the program execute - are there any bugs | Program does not work correctly; output is wrong most of the time or there is no output. | Program works correctly in general in most areas but not in all areas. | Program works correctly in all areas and generates correct output. |
| | Program does not execute. | Program executes but crashes in some areas. | Program executes perfectly. |