مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

# Course Syllabus

| | | | |
|---|---|---|---|
| 1 | **Course title** | Computer Packages in Physics | |
| 2 | **Course number** | 0302280 | |
| 3 | **Credit hours** | 2 | |
| | **Contact hours (theory, practical)** | 4 hours weekly: 1 theory, 3 practical | |
| 4 | **Prerequisites/corequisites** | Modern Physics: PHYS 0302261 | |
| 5 | **Program title** | Physics | |
| 6 | **Program code** | 0302 | |
| 7 | **Awarding institution** | The University of Jordan | |
| 8 | **School** | Science | |
| 9 | **Department** | Physics | |
| 10 | **Course level** | 2nd year | |
| 11 | **Year of study and semester(s)** | 1st sem, 2022/2023 | |
| ١٢ | **Other department(s) involved in teaching the course** | | |
| ١٣ | **Main teaching language** | English | |
| ١٤ | **Delivery method** | ☒Face to face learning ☐Blended ☐Fully online | |
| ١٥ | **Online platforms(s)** | ☒Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others…… | |
| ١٦ | **Issuing/Revision Date** | 1/11/2022 | |

مركز الاعتماد وضمان الجودة

## ١٧ Course Coordinator:

| | |
|---|---|
| Name: **Khaled Bodoor** | Contact hours: S 130-530 |
| Office number: | Phone number: 0777358679 |
| Email: kbodoor@ju.edu.jo | |

## ١٨ Other instructors:

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

## ١٩ Course Description:

As stated in the approved study plan.

*Mathematica* is a software package and a computer algebra system widely used by mathematicians, physicists, scientists, engineers, and students. It is based on the Wolfram Language, conceived by Stephen Wolfram, and developed by Wolfram Research, based in Champaign, Illinois. Its first release was in 1988..Compared to other commercial software packages, *Mathematica* has the most extensive set of abilities, so that a wide range of computational problems and topics can be explored without needing to switch environments. In addition, the notebook interface of *Mathematica* is excellent for teaching because it holds everything you do (code, graphics, etc) in a single document. Therefore, this course will serve as an introduction into the various capabilities of *Mathematica* and

their applications in mathematics and physics, especially as they pertain to the courses offered at the undergraduate level.

**٢٠ Course aims and outcomes:**

A- Aims:

**To give the students the proper mathematical and physics background in electricity and magnetism.**

B- Students Learning Outcomes (SLOs):

For purposes of mapping the course SLOs to the physics program SLOs, at the successful completion of the physics program, graduates are expected to be able to:

**SLO (1)** Master professionally a broad set of knowledge concerning the fundamentals in the basic areas of physics: Quantum Mechanics, Classical Mechanics, Electrostatics and Magnetism, Thermal Physics, Optics, Theory of Special Relativity, Mathematical Physics, Electronics.

**SLO (2)** Apply knowledge of mathematics and fundamental concepts in the basic areas of physics to identify and solve physics related problems.

**SLO (3)** Utilize computers and available software in both data collections and data analysis.

**SLO (4)** Utilize standard laboratory equipment, modern instrumentation, and classical techniques to design and conduct experiments as well as to analyze and interpret data.

**SLO (5)** Develop a recognition of the need and ability to engage in life-long learning.

**SLO (6)** Demonstrate ability to use techniques, skills, and modern scientific tools necessary for professional practice.

**SLO (7)** Communicate clearly and effectively in both written and oral forms.

**SLO (8)** Apply proficiently team-work skills and employ team-based learning strategies.

**SLO (9)** Apply professional and ethical responsibility to society.

Upon successful completion of this course, students will be able to:

| Program SLOs / Course SLOs | SLO (1) | SLO (2) | SLO (3) | SLO (4) | SLO (5) | SLO (6) | SLO (7) | SLO (8) | SLO (9) |
|---|---|---|---|---|---|---|---|---|---|
| 1. **Differentiate between the different computing paradigms (procedural, functional, object-oriented, etc.) and understand the strengths and weaknesses of each.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2. **Understand the power and range of computing applications (symbolic manipulation and processing, numerical solutions and simulation, linear algebra, data processing, basic statistical analysis, etc.) and develop a better understanding of the mathematical and computational basis** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **of our understanding of the natural world .** | | | | | | | | |
| 3. | **Understand the process of modeling a problem and translating a proposed solution into an algorithm and then into actual code.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4. | **Master writing Mathematica code that is readable through the use of prefix and postfix notation, comments, etc.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **5.** | **Understand that a list is the data structure in Mathematica from which other structures are derived. Understand that the Wolfram Language represents mathematical formulas, lists, graphics, etc in one uniform way as expressions.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 6. | **Understand the specifics of functional programming, such as how to use Mathematica to repeatedly apply a function and apply functions to lists and matrices.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **7.** | **Plot functions in Cartesian and polar coordinates and master use of the Graphics package for the creation of 2D and 3D plots, including contour and density plots.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **8.** | **Use Mathematica to solve undergraduate-level problems from mathematics and physics, including problems from linear algebra, calculus, curvilinear coordinates, vector calculus, differential equations, electricity and magnetism, etc.** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **9.** | **Learn importing and exporting of data, graphics, and other types of files in different formats.** | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ |

## ٢١. Topic Outline and Schedule:

| Topic | Week | Instructor | Achieved ILOs | Evaluation Methods | Reference |
|---|---|---|---|---|---|
| **Getting started: Basics** | **1 -3** | **Dr. Khaled Bodoor** | **1,2,3,4,8** | **In class discussions and demos+ short quiz** | **Text book, Internet, Refs** |
| **Symbolic Expressions & Lists** | **4-5** | **Dr. Khaled Bodoor** | **2,3,5** | **In class discussions and demos** | **Text book, Internet, Refs** |
| **Functions** | **6** | **Dr. Khaled Bodoor** | **2,3,5,8** | **In class discussions and demos+ 2nd exam+ experiemnts** | **Text book, Internet, Refs** |
| **Plotting** | **7** | **Dr. Khaled Bodoor** | **2,3,7,8** | **In class discussions and demos+ home works** | **Text book, Internet, Refs** |

| | | | | | |
|---|---|---|---|---|---|
| **Algebraic Manipulations** | **8** | **Dr. Khaled Bodoor** | **2,3,8** | **In class discussions and demos** | **Text book, Internet, Refs** |
| **Calculus** | **9-10** | **Dr. Khaled Bodoor** | **2,3,8** | **In class discussions and demos** | **Text book, Internet, Refs** |
| **Applications** | **12-14** | **Dr. Khaled Bodoor** | **2,3,8** | | |
| **Files** | **11** | **Dr. Khaled Bodoor** | **8,9** | | |

## ٢٢ Evaluation Methods:

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

| Evaluation Activity | Mark | Topic(s) | SLOs | Period (Week) | Platform |
|---|---|---|---|---|---|
| Quizzes/Assignments | 20 | All topics | All | Every week | On campus |
| Midterm Exam | 30 | Basics, Lists, Functions, Plotting | 1,2,3,4,5, 6,7 | 10th week | On campus |
| Final Exam | 50 | COMPREHENSIVE | All | 16th week | On campus |

## ٢٣ Course Requirements

**Students are directed and encouraged to use the internet as a learning source and apply their skills to solve problems in their physics/math courses and in research.**

## ٢٤ Course Policies:

A- Attendance policies:

**No more than 15% of classes can be missed under any circumstances. The students are supposed to be on time for each session and will not be admitted after 10 minutes from the starting time.**

B- Absences from exams and submitting assignments on time:

**Assignments are only taken if submitted on time and no make ups for short quizzes.**

C- Health and safety procedures:

**Classes are held in rooms meeting safety and health requirements.**

D- Honesty policy regarding cheating, plagiarism, misbehavior:

**Any act of cheating or plagiarism is not tolerated and the students are clearly required to submit their own work. When collaboration is permitted in some assignments it will be clearly stated.**

E- Grading policy:

**The grading for this course is divided into: 20% quizzes/assignments, 30 % midterm exams, and 50% final exam.**

F- Available university services that support achievement in the course:

A proper library and well-furnished lab.

## ٢٥ References:

A- Required book(s), assigned reading and audio-visuals:

1) The notes and files at the link:

https://www.physics.umd.edu/courses/CourseWare/EssentialMathematica/

There is no required textbook for the course. We will reference, consult, and rely on different textbooks, lecture notes published by other instructors on the web, the *Mathematica* Help system, and the *Mathematica* online documentation provided by Wolfram Research.

B- Recommended books, materials, and media:

1) “The Mathematica Book“ by Stephen Wolfram. Publisher : Wolfram Media Inc; 5th edition (August 22, 2003)

2) “A Physicist's Guide To Mathematica” , By Patric T. Tam, Academic Press, 1997.

3) “Introduction to Mathematica for Physicists”, By A. Grozin, Springer 2014.

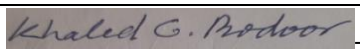
4) Links for online resource will be provided on the Teams page of the course.

مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

| |
|---|
| 5) Youtube, Internet sources, Physics lab |

## ٢٦ Additional information:

| |
|---|
| |

| |
|---|
| Name of Course Coordinator: **Khaled Bodoor**------Signature:  ----- Date: -**1/11/2022**---------- |
| Head of Curriculum Committee/Department: ---------- Signature: ---------- |
| Head of Department: ---------- Signature: ---------- |
| Head of Curriculum Committee/Faculty: ---------- Signature: ---------- |
| Dean: ---------- Signature: ---------- |