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	06

1.	**Course Title**	Classical Electrodynamics-1
2.	**Course Number**	0362753
3.	**Credit Hours (Theory, Practical)**	3 theory
	Contact Hours (Theory, Practical)	3 theory
4.	**Prerequisites/ Corequisites**	No prerequisites
5.	**Program Title**	M.Sc. in Physics
6.	**Program Code**	
7.	**School/ Center**	Faculty of Science
8.	**Department**	Department of Physics
9.	**Course Level**	1st year
10.	**Year of Study and Semester (s)**	1st Semester 2024/2025
11.	**Other Department(s) Involved in Teaching the Course**	-
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**	October 2024
16.	**Revision Date**	January 2025

17. Course Coordinator:

Name: Dr. Ziad Abu Waar Contact hours: 10:30-11:30 Sunday, Tuesday and Wednesday

Office number: Physics 006 Phone number: 065355000 Ext.: 22063

Email: ziad.abuwaar@ju.edu.jo

18. Other Instructors:

Faculty Members of the Department of Physics

19. Course Description:

Electric field and potential, multipole potentials and fields, electric field in material media; Magnetic field, Biot Savart's law and Ampere's law, magnetic field in material media, vector potential, Green's theorem. Boundary value problems in electrostatics and magnetostatics: Laplace's and Poisson's equations in spherical, cylindrical and Cartesian coordinates. Method of Images. Time –dependent fields, energy in electromagnetic fields, Maxwell's equations, Poynting's theorem. Electromagnetic waves in free space, Propagation in bounded regions, reflection and refraction.

20. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. **SO1:** to be able to 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. **SO2:** to be able to formulate or design a scientific system, process, procedure or program to contribute achieving scientific desired needs.
3. **SO3:** to be able to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. **SO4:** to be able to communicate his/her scientific contributions effectively with a range of audiences.

5. **SO5:** to be able to recognize and demonstrate social, ethical and professional responsibilities and the impact of technical and/or scientific solutions in global economic, environmental, and societal contexts.
6. **SO6:** to be able to function effectively independently and on teams for establishing goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

21. Course Intended Learning Outcomes: (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. **Understanding the Fundamentals of Electromagnetism**
   - Develop a deep understanding of the basic principles of classical electrodynamics, including the electric and magnetic fields, charge distributions, and their interactions.
   - Formulate and apply Maxwell's equations in various contexts, including both in vacuum and in media.
2. **Apply Maxwell's Equations**
   - Gain proficiency in solving Maxwell's equations for simple systems, both in static and time-varying cases.
   - Analyze electromagnetic wave propagation in different media (e.g., vacuum, conductors, dielectrics).
3. **Electrostatics and Magnetostatics**
   - Master the techniques for solving electrostatic and magnetostatic problems, including the use of Poisson's and Laplace's equations, Green's functions, and boundary conditions.
   - Study methods such as the method of images and multipole expansion to solve problems with different symmetries.
4. **Energy and Momentum in Electromagnetic Fields**
   - Understand the concepts of electromagnetic energy density, Poynting vector, and the conservation of energy and momentum in electrodynamics.
   - Derive and interpret the energy-momentum tensor for the electromagnetic field.
5. **Electromagnetic Potentials**
   - Learn the gauge freedom in electrodynamics and understand the different gauges (Coulomb, Lorentz, and others).
   - Understand and use the concepts of the scalar and vector potentials in describing the electric and magnetic fields.
   - Apply the retarded potential formulation for solving time-dependent electromagnetic problems.
6. **Special Techniques in Electrodynamics**
   - Develop familiarity with advanced mathematical techniques used in electrodynamics, such as Fourier transforms, integral equations, and the use of spherical harmonics.
   - Use of complex analysis and Green's functions for solving boundary value problems.

Course ILOs	The learning levels to be achieved					
	Remembering	**Understanding**	**Applying**	**Analysing**	**evaluating**	**Creating**
1	✓	✓		✓	✓	
2		✓	✓	✓	✓	
3	✓	✓	✓	✓		
4		✓	✓	✓		
5		✓	✓	✓		
6		✓	✓	✓		

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

Program ILOs / Course ILOs	ILO (1)	ILO (2)	ILO (3)	ILO (4)	ILO (5)
1. **Understanding the Fundamentals of Electromagnetism**	✓	✓			
2. **Apply Maxwell's Equations**	✓	✓			

3. **Electrostatics and Magnetostatics**	✓	✓			
4. **Energy and Momentum in Electromagnetic Fields**	✓	✓			
5.**Electromagnetic Potentials**	✓	✓			
6.Special Techniques in Electrodynamics	✓	✓			

2٣. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1	Electric charge, Coulomb's Law	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
	1.2	electric fields, electric potential	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
2	2.1	Review of vector calculus: divergence, curl, gradient.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion, homework	

	2.2	Review of vector calculus: divergence, curl, gradient.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion, homework	
3	3.1	Gauss's law, symmetries solution to Poisson's equation, conductors, dielectric materials.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
	3.2	Gauss's law, symmetries solution to Poisson's equation, conductors, dielectric materials.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
4	4.1	Boundary value problems, method of images, uniqueness theorem, Laplace's equation.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
	4.2	Boundary value problems, method of images, uniqueness theorem, Laplace's equation.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
5	5.1	Boundary value problems, method of images, uniqueness theorem, Laplace's equation.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion, homework	
	5.2	Boundary value problems, method of images, uniqueness theorem, Laplace's equation.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
6	6.1	Dipole, quadrupole, and higher-order moments of charge distributions.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
	6.2	Dipole, quadrupole, and higher-order moments of charge distributions.	ILO (1,3)	Face To Face	Teams	Synchronous	Discussion	
7	7.1	Magnetic fields, Biot-Savart law, Ampere's law, magnetic vector potential.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion, homework	
	7.2	Magnetic fields, Biot-Savart law, Ampere's law, magnetic vector potential.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
8	8.1	Magnetic fields, Biot-Savart law, Ampere's law, magnetic vector potential.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
	8.2	Magnetic fields, Biot-Savart law, Ampere's law, magnetic vector potential.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
9	9.1	Magnetic fields, Biot-Savart law, Ampere's law, magnetic vector potential.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion, homework	
	9.2	Boundary conditions for the magnetic field, magnetization, and bound currents.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	

10	10.1	Boundary conditions for the magnetic field, magnetization, and bound currents.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
	10.2	Boundary conditions for the magnetic field, magnetization, and bound currents.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
11	11.1	Boundary conditions for the magnetic field, magnetization, and bound currents.	ILO (2,4)	Face To Face	Teams	Synchronous	Discussion	
	11.2	Time-varying fields, Maxwell's equations, displacement current, wave equation for electric and magnetic fields.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion, homework	
12	12.1	Time-varying fields, Maxwell's equations, displacement current, wave equation for electric and magnetic fields.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion	
	12.2	Time-varying fields, Maxwell's equations, displacement current, wave equation for electric and magnetic fields.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion	
13	13.1	Time-varying fields, Maxwell's equations, displacement current, wave equation for electric and magnetic fields.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion	
	13.2	Plane electromagnetic waves, polarization, propagation in vacuum.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion, homework	
14	14.1	Plane electromagnetic waves, polarization, propagation in vacuum.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion	
	14.2	Plane electromagnetic waves, polarization, propagation in vacuum.	ILO (5,6)	Face To Face	Teams	Synchronous	Discussion	
15	15.1	Review	ILO (1-6)	Face To Face	Teams	Synchronous	Discussion	
	15.2	Review	ILO (1-6)	Face To Face	Teams	Synchronous	Discussion	

24. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	ILO/s Linked to the Evaluation activity	Period (Week)	Platform
First Midterm	30 %	Electric fields, electric potential, method of images, Boundary value problems.	ILO 1,3	٨th	
2nd midterm	30 %	Dipole, quadrupole, Boundary conditions for the magnetic field, magnetization, and bound currents.	ILO 2, 4,5	12th	
Final exam	40 %	All subjects	ILO 1-6	15th	

٢٥. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

The students are expected to have internet connection and a calculator

٢٦. Course Policies:

A- Attendance policies:

Students are expected to attend all class sessions. If a student cannot attend a class session, the teacher must be notified prior to that. For the university's rules and regulations, the student's total absences must not exceed 15 % of the total class hours. Please refer to the University of Jordan student Handbook for further explanation.

B- Absences from exams and submitting assignments on time:

a. Failure in attending a course exam other than the final exam will result in zero mark unless the student provides an official acceptable excuse to the instructor who approves a make up exam.
b. Failure in attending the final exam will result in zero mark unless the student presents an official acceptable excuse to the Dean of his/her faculty who approves

an incomplete exam, normally scheduled to be conducted during the first two weeks of the successive semester.

C- Health and safety procedures:

We don't have any policy at the moment considering the safety procedures, nevertheless, the instructor in each session has to give a general safety instructions for the student.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

Cheating, plagiarism, misbehavior are attempts to gain marks dishonestly and includes; but not limited to:

- Copying from another student's work.
- Using materials not authorized by the institute.
- Collaborating with another student during a test, without permission.
- Knowingly using, buying, selling, or stealing the contents of a test.
- Plagiarism which means presenting another person's work or ideas as one's own, without attribution.
- Using any media (including mobiles) during the exam.

E- Grading policy:

Grades will be awarded based on the statistical distribution of marks out of 100%

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

- Faculty members website
- E-Learning website

٢٧. References:

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

- John. D. Jackson, Classical Electrodynamics, Third Edition, (John Wiley & Sons, Inc, 1999).

B- Recommended books, materials, and media:

- Classical Electricity and Magnetism by W. K. Panofsky and M. Phillips (Addison-Wesley, Cambridge, Mass, 2005).
- Introduction to Electrodynamics, David J. Griffiths, 4th edition,(Precntice Hall, NJ 2013).

2٨. Additional information:

Name of the Instructor or the Course Coordinator: ……Ziad Abu Waar……	Signature: ……...…	Date: October 10, 2024
Name of the Head of Quality Assurance Committee/ Department ……	Signature: ……...……	Date: ……..……
Name of the Head of Department ……	Signature: ……...……	Date: ……..……
Name of the Head of Quality Assurance Committee/ School or Center ……	Signature: ……...……	Date: ……..……
Name of the Dean or the Director ……	Signature: ……...……	Date: ……..……