هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Electrodynamics**
Course Code:	**331Phys**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2022**
Last Revision Date:	**22/12/2022**

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered:					
4. Course general Description This course discusses the electric phenomena when the charge is assumed to be at rest (electrostatics), magnetic phenomena under steady state current consideration (magnetostatics) and some special techniques. The course mainly focuses on establishing the notion of electrodynamics based on the time and spatial dependence of the electric and magnetic fields. It also encompasses Maxwell's equations and derivation of electromagnetic wave equations for vacuum and material medium.					
5. Pre-requirements for this course (if any): 231Phys					
6. Co- requirements for this course (if any):NA					
7. Course Main Objective(s) This course is designed to provide the students with: 1. The mathematics of vector operations, vector calculus, and the curvilinear coordinates 2. The fundamental background and the foundation of electrodynamics. 3. Problem-solving skills to calculate the electric and magnetic fields as well as the electrostatic problems using special techniques 4. A deep understanding of electrostatics and magnetostatics concepts. 5. The experimental and theoretical origin of Maxwell's equations. 6. Mathematical techniques to derive and solve the wave equation. 7. Knowledge with the fundamental properties of the electromagnetic wave propagation in vacuum and different mediums.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	30	91%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning	3	9%
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	3
5.	Others (specify)	
	Total	33

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Describe:** the electric field of different charge distributions, the electric flux, electric potential of localized charge distributions and in term of electric field, the magnetic force, the current, the electromotive force, the magnetic flux, and the induced electric field the electromagnetic wave parameters	PLO1.1	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**State**: the summary of electrostatic boundary conditions, the work and energy of point and continuous charge distributions, the comparison between electrostatic and magnetostatic, Max well's equations in differential and integral form	PLO1.2	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss:**The properties of the electric field lines, the properties of the magnetic field, the properties of the monochromatic plane wave propagation in vacuum	PlO1.2	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	Skills			
2.1	**Apply** the fundamental theorem of differential and integral calculus in electrodynamics, Gauss's law to calculate the electric field, method of images to determine the induced charge surface, Biot-Savart and Amperes' law to find the magnetic field.	PLO2.1	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Derive** Gauss's law in differential and integral form, Poisson and Laplace' equations, the continuity equation of charge, Faraday's Law of induction, Ampere's law, the wave equation in different media	PLO2.2	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Solve** the wave equation in vacuum and material	PLO2.1	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group	PLO2.4	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	assignments, essays or web-based activities			questioning, quizzes, written exams **Indirect:** student survey
3.0	Values, autonomy, and responsibility			
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	PLO3.1	Discussion, question and answer	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	**1. Vector analysis** 1.1 Vector Algebra**:** vector operations, component form, triple product, position vector and displacement 1.2 Differential calculus: gradient, del operator, divergence, curl. Second derivatives with examples. 1.3 Integral calculus: Line, surface and volume integrals. The fundamental theorem of calculus, the fundamental theorem for gradients, the fundamental theorem for divergences, the fundamental theorem for curls. 1.4. Curvilinear Coordinates: spherical polar and cylindrical coordinates	6
2.	**2. Electrostatics** 2.1 The electric field. 2.2 Divergence and curl of electrostatic fields. 2.3 Electric potential. 2.4 Work and energy in electrostatics.	9
3	**3. Special techniques** 3.1. Laplace equation 3.2. The Method of Images	Self study

4	**4. Magnetostatics** 4.1 Lorentz force law: magnetic fields, magnetic forces, currents 4.2 The Biot-Savart law: steady current, magnetic field of steady current 4.3 Divergence and curl of B: Application of Ampere's law, Comparison of magneto statics and electrostatics.	6
5	**5. Electrodynamics** 5.1 Electromotive force: Ohm' law. Electromotive force, emotional electromotive force. 5.2 Electromagnetic induction: Faraday's law. Section, the induced electric field 5.3 Maxwell equations. Electrodynamics before Maxwell, Fix Maxwell's equations, Maxwell's equation.	9
6	**6. Electromagnetic waves** 6.1 Waves in one dimension: the wave equation, sinusoidal waves, polarization. 6.2 Electromagnetic waves in vacuum: The wave equation of E and B, monochromatic plane waves, energy and momentum in electromagnetic waves.	3
Total		33

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	4	5%
2.	Quiz 1	5	5%
3.	Mid-term	6	20%
4	Assignment	8	5%
5	Quiz	9	5%
6	Group work	Over semester	10%
7	Final	12	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Introduction to Electrodynamics, 3rd Edition, Dived J. Griffiths, Prentice-

	Hall-, Inc., Englewood Cliffs, 1991
Supportive References	- Foundations of Electromagnetic Theory, 4th Edition, John R. Reitz, Frederick J. Milford, Robert W. Christy, Addison-Wesley Publishing Company, Inc., 2008
Electronic Materials	• *e-Learning* in the School of *Physics* and Astronomy *(www.ph.ed.ac.uk/elearning)* • Physical Sciences Resource Center (PSRC) (www.psrc-online.org) The Physics Homepage *(www.physics.ox.ac.uk)*
Other Learning Materials	• Mathematical packages: *Mathematica*, Math Lab, and Maple. • Software: Virtual Physics

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Class rom
Technology equipment (projector, smart board, software)	Data show- smart board Projectors
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Effectiveness of students assessment	Instructor	Direct/Indirect
Quality of learning resources		
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT BOARD
REFERENCE NO.	PHYS2304
DATE	28/2/2023

Approved by:

Head of Physics Department

Dr. Hussain Alathlawi