هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Electromagnetic Fields**
Course Code:	**PHY 1321**
Program:	**Bachelor of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	4
Last Revision Date:	***26/09/2024***

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A. General information about the course:

1. Course Identification

1. Credit hours: (4)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 5/ Year 3)					
4. Course General Description:					
This course provides the most fundamental concepts of the laws of electromagnetism and their physical characteristics in dielectric and conductive media. It deals with static electric and magnetic fields as well as the properties of conducting dielectric and magnetic materials. It covers the following topics: electrostatics, behavior of matter in electric fields, DC circuits, magnetic fields, and properties of dielectrics and magnetic materials. Faraday's law, AC circuits, and electromagnetic waves. More mathematical techniques are also given using Laplace's, Poisson, Lorentz, Biot-Savart etc. in different dimensions and with boundary conditions to calculate the field more accurately in space and time. Finally it deals with the 4 major Maxwell's equations.					
5. Pre-requirements for this course (if any)**:**					
Electricity and magnetism, PHY 1221					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Understand the basic concepts of electric and magnetic fields.**
- **Apply various techniques to electrostatic problems.**
- **Knowledge of the properties of the electric fields in matter.**
- **Understand the magnetic properties of simple current distributions using Biot-Savart and Ampere's laws.**
- **Describe electromagnetic induction and related concepts, and make calculations using Faraday and Lenz's laws.**
- **Include the basic physical content of Maxwell's laws in integral form.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		75

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Outline the concepts of electromagnetic vector fields.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the basic knowledge of electrostatics, electric potential, energy density and their applications.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**State the basic understanding of Maxwell's equations and electromagnetic wave propagation.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	**Explain and summarize the basic knowledge gained from studying electromagnetic fields course**.	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2, S3**	▪ Problem classes and group tutorial. ▪ Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility**			
3.1	Values, autonomy, and responsibility	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation. ▪ Homework. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Vector Analysis**: Scalar Product, Vector Product, Cartesian Coordinates, Circular Cylindrical Coordinates, Spherical Coordinates, Vector Position and Differential Element in Length, Fields, Directional Derivative and Gradient, Line Integral, Surface Integral, Divergence of a Vector, Divergence Theorem, Curl of a Vector, Stockes' Theorem, Conservative Fields, Laplacian of a Scalar.	**16**
2.	**Electrostatic Fields:** Coulomb's Law and Field Intensity, Electric Fields due to Continuous Charges Distributions, Electric Flux Density, Gauss's Law-Maxwell's Equation, Electric Potential, Relationship between $\vec{E}$ and V-Maxwell's Equation, Electric Dipole and Flux lines, Energy Density in Electrostatic Fields.	**15**
3.	**Electric Fields in Matter:** Properties in Materials, Conductors, Polarization in Dielectrics, Dielectrics Constant and Strength.	**15**

4.	**Magnetic Fields in Matter:** Biot-Savart's Law, Ampere's Circuit Law-Maxwell's Equation, Maxwell's Equations for Static Electromagnetic Field, Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Energy.	**14**
5.	**Maxwell's Equations and Electromagnetic Wave Propagation:** Faraday's Law, Displacement Current, Maxwell's Equations in Final Forms, Time-Harmonic Fields, Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence.	**15**
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (class quizzes, homework, solving problems, etc.....)**	**weekly**	**10 %**
2.	**Midterm Exam 1**	**6thweek**	**25 %**
3.	**Midterm Exam 2**	**12thweek**	**25 %**
4.	**Final Exam**	**16thweek**	**40 %**

*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	Sadiku M., ***Elements of Electromagnetic***, 2nd Edition, Saunders College (1995).
Supportive References	- Nayfeh M.H. and Brussel M.K, ***Electricity and Magnetism,*** John-Wiley & Sons, New York (1985). Griffiths D. J., ***Introduction to Electrodynamics,*** 3rd Edition, Prentice Hall, N. J, USA (1999).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities	**- Classrooms.** **- Labs.**

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	
Technology equipment (projector, smart board, software)	- **Classroom equipped with a whiteboard and a projector.**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	- **Students** - **Second examiner**	- **Indirect (The students complete the evaluation forms at the end of term. Final exam is evaluated by the second examiner)**
Effectiveness of Students assessment	- **Instructors** -	- **Direct (exams, HW, project, …)**
Quality of learning resources	- **Faculty** - **Students**	- **Indirect (surveys)**
The extent to which CLOs have been achieved	- **Instructors** - **Program Leaders**	- **Direct (excel sheet)**
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**Quality Unit-Physics Department**
REFERENCE NO.	**Department council No. 06**
DATE	**26/09/2022**