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

Course Specification
(Bachelor)

Course Title	**Mathematical Physics (2)**
Course Code:	**PHY 1334**
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: (3)					
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 is a course in the applications of mathematics to solutions of physical problems. The mathematical methods covered in this course include partial differentiations, complex variables, partial differential equations, and integral equations. The course will cover some mathematical techniques commonly used in physics. This is not a course in pure mathematics, but rather on the application of mathematics to problems of interest in the physical sciences.					
5. Pre-requirements for this course (if any)**:**					
Mathematical Physics (1), PHY 1233					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Learn and understand the basic knowledge of mathematical methods used in physics.**
- **Learn and understand the basic knowledge of partial differentiation, complex variables, partial differential equations, and integral equations.**
- **Demonstrate competence with a wide variety of mathematical tools and techniques.**
- **Demonstrate a breadth of general knowledge in mathematical physics as well as depth in topics covered in this course.**
- **Understand the interactions between mathematics and physics and demonstrate the ability to apply mathematical concepts and techniques into problems in physics.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		60

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	**Describe the partial differentiation and its applications.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline the functions of a complex variable.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the basic concepts of the integral equations.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Define the basic mathematical tools commonly used in Physics.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge**	**S1, S2**	• Lectures. • Class discussions.	▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	gained from studying mathematical physics course.		▪ Tutorials.	▪ Participation.
2.2	**Develop the student's 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, on paper 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	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**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.	**Partial differentiation:** Definitions, Exact and inexact differentials, Useful theorems, Change of variables, Taylor's theorem for many variable functions, Thermodynamics notation, Differential of integrals.	**16**
2.	**Complex Variables:** Definitions and functions of complex variable, Cauchy-Riemann relations, Power series, Some elementary functions, Complex integrals, Cauchy's theorem, Cauchy's integral formula, Taylor and Laurent series, Residue theorem. Application: Complex potential.	**20**
3.	**Applications on partial differential equations**: General form and particular solution, Linear second order PDEs, Classification of PDEs. Separation of variables: solution of: Laplace equation – the wave equation-Poisson's equation, Inhomogeneous problems, Integral transform methods. Boundary Value Problems.	**14**
4.	**Integral Equations**.	**10**
	Total	**60**

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	- Boas M.L. ***Mathematical Methods in the Physical Sciences***, 3rd Edition, John Wiley (2006).
Supportive References	- Arfken G.B. and Weber H.J., ***Mathematical Methods for Physicists***, Academic Press; 6th Edition (2005). -Chow T., ***Mathematical Methods for Physicists: A Concise Introduction***, Cambridge University Press (2000). -
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, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms. - Labs.
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	26/09/2024