Course Specification
(Bachelor)

Course Title:	**Modern Physics**
Course Code:	**PHY 1250**
Program:	**Bachelor of Science in Applied Mathematics**
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 6-7/ Year 3-4)					
4. Course General Description:					
This course provides an introduction to developments in modern physics over the last 150 years that have radically altered our view of nature. This course is intended for students who have already had basic physics and calculus courses. Relativity and quantum ideas are considered first to provide a framework for understanding the physics of atom and nuclei. The theory of the atom is then developed with emphasis on quantum mechanical notions. Next comes a discussion of the properties of aggregates of atoms, which includes a look at statistical physics. Finally, atomic nuclei and elementary particles are examined.					
5. Pre-requirements for this course (if any)**:**					
Classical Mechanics (1), PHY 1105					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **State the basic principles of special relativity and elementary quantum mechanics and the regimes in which the different theories apply.**
- **Apply these principles in conjunction with elementary mathematical techniques to solve simple problems in relativistic and quantum mechanics.**
- **Present a solution to a physics problem in a clear and logical written form.**
- **Take responsibility for learning by attending lectures and workshops, and completing coursework.**

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		

No	Mode of Instruction	Contact Hours	Percentage
	• 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	**Statethe basic knowledge of the molecular and nuclear structure.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the basics of quantum theory of light and atomic structure.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the scientific foundation for applications of modern physics.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying waves and optical physics.**	**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.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
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	**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. ▪ Miniproject(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Relativity:**Einstein's principle of special relativity, consequences of special relativity, Lorentz transformation equations, Relativistic momentum and relativistic form of Newton's laws, Relativistic energy, Equivalence of mass and energy.	**14**
2.	**Quantum Theory of Light:**Particle properties of waves, Blackbody radiation and Planck's hypothesis, Photoelectric effect, Explanation of the photoelectric effect, X-rays and some applications, Compton effect, Pair production.	**14**
3.	**Introduction to Quantum Physics:**Photons and electromagnetic waves, Wave properties of particles, De Broglie waves, Matter waves, Electron microscope, Uncertainty principle.	**12**
4.	**Atomic Structure:**Particle nature of matter, Early models of the atom, Bohr's quantum model of the hydrogen atom, Atomic spectra and transitions, Nuclear effects on spectral lines, Franck-Hertz experiment.	**10**
5.	**Molecular and nuclear Structure:**Molecular bonding, Energy states and spectra, Molecular vibration and rotation, Electronic transitions in molecules. Nuclear Structure: Nuclear composition, Some properties of nuclei, Binding energy and radioactivity.	**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 %
4.	Midterm Exam 2	12thweek	25 %
5.	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	- Serway R.A., ***Modern Physics,*** Brooks Cole; 3rd Edition (2004). - Krane K., ***Modern Physics,*** Wiley, New York (1983).
Supportive References	- Beiser A. and Berg I., ***Concepts of Modern Physics***, 6th Edition, McGraw-Hill, Inc (2006).
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.

Assessment Areas/Issues	Assessor	Assessment Methods
		- 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