Syllabus*: Modern Physics (1) (110102261)

Second Semester 2021 /2022

COURSE INFORMATION	
Course Name: : Modern Physics (1) **Semester:** Second **Department:** Department of physics **Faculty:** Science	**Course Code:** 110102261 **Section:** 1 **Core Curriculum**: Compulsory
Day(s) and Time(s): Sunday: 12:00-13:00 Tuesday: 12:00-13:00 Thursday: 12:00-13:00 **Classroom:** e.g. 133 ل ز	**Credit Hours:** 3 **Prerequisites**: 110102102 and 110101102

COURSE DESCRIPTION

Special relativity, structure of matter: Atomic structure: models of the atom. Quantum theory of radiation: Planck's radiation law, Compton effect. Wave nature of matter: X–ray diffraction, particle diffraction, DeBroglie postulate. Introduction to quantum mechanics: Schrodinger's equation, some applications

DELIVERY METHODS

The course will be delivered through a combination of active learning strategies. These will include:

- PowerPoint lectures and active classroom based discussion
- Collaborative learning through small groups acting in an interdisciplinary context.

FACULTY INFORMATION

Name	
Academic Title:	**Associated Professor**
Office Location:	**202**
Telephone Number:	**4407**
Email Address:	**shatnawi@hu.edu.jo**
Office Hours:	**Sunday** 10.00-11.00 **Tuesday** 10.00-11.00 **Thursday** 10.00-11.00 *Please send an e-mail (shatnawi@hu.edu.jo) to meet at any other time.*

REFERENCES AND LEARNING RESOURCES

Required Textbook Concepts of Modern Physics Arthur Beiser, McGraw Hill, 6th edition, 2002, ISBN 978-0072448481.

Suggested Additional Resources

1. **Modern Physics** by Hans Ohanian, Prentice Hall, 2nd edition, 1995.
2. **Modern Physics** by Paul Tipler and Ralph Llewellyn, W. H. Freeman, 4th edition, 2002.
3. **Modern Physics** by Raymond A. Serway, Clement J. Moses, and Curt A. Moyer, Thomson Learning, Inc. 3ed edition, 2005.
4. **1000 Solved Problems in Modern Physics** by Ahmad Kamal, Springer, 2010.

Useful Web Resources:

(1) https://galileoandeinstein.phys.virginia.edu/more_stuff/Applets/Lightclock/home.html
(2) https://www.youtube.com/watch?v=-NN_m2yKAAk
(3) https://www.youtube.com/watch?v=TFe7HUu7-c8

STUDENT LEARNING OUTCOMES MATRIX*

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
CC-LO-5 Think critically and creatively in a variety of methods in order to make decisions and solve problems.	Modern-LO-1: Apply critical thinking and demonstrate problem-solving skills in two or more of the major fields of physics.	1. Develop an understanding of the basic principles of the major branches of Physics.	1. Understanding the basic concepts in modern physics.	• Exams • Quizzes • homework assignments
		2. Obtain a thorough foundation in the various fields of physics.	2. Demonstrate the ability to explain some of the phenomena relevant to the studied topics.	• Exams • Quizze
		3. Apply the principles of modern physics for solving selected problems	3.1 Special relativity problems. 3.2 Comparison between classical and modern physics explanations for electron diffraction, photoelectric effect and many other phenomena. 3.3 Solve Schrödinger equation for simple problems (particle in a box).	• Exams • Quizzes • homework assignments
		4. Develop an understanding of the hydrogen atom	4.1 Apply Schrödinger equation for solving the hydrogen atom. 4.2 Explain the use of different quantum numbers 4.3 Explain the energy levels of the hydrogen atom.	• Exams • Quizzes • homework assignments

.CC-LO-4. Communicate competently with others using oral and written English skills	Modern-LO-4: Use modern literature search methods to obtain information about physics topics and write reports.	5. Obtain an understanding of the role of physics in other disciplines, and its importance in society.	5. Acquire the ability to learn independently; articulate the importance of independent learning for future professional development	• "On-line" reading assignments

*** يتم تعديلها وفقا لما يتم تحديده لكل مساق بالتنسيق مع الكلية والقسم المعني**

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

Special Needs Section:
Tel:
Location:
Email:

COURSE REGULATIONS

Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or

being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.
- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Course Calendar and Assessment

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

Assessment	Grade Weighting	Deadline Assessment
e.g. Exam 1	30%	To be determined later
e.g. Exam 2	30%	To be determined later
e.g. Final Exam (3)	40%	**To be determined later**

Description of Exams

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.

Homework: Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.

You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of self-tests and end of chapter exercises are given at the end of the book.

No make-up exams, homework or quizzes will be given. Only documented absences will be considered as per HU guidelines.

Grades are not negotiable and are awarded according to the following criteria*:

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00
B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00

I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

"Lecture hours and weeks are approximate and may change as needed"

Chapter 1	**Relativity**	**Week 1-3**	**9 lecture hours**
1. 1	Special Relativity		
1. 2	Time Dilation		
1.3	Doppler Effect		
1.4	Length Contraction		
1.5	Twin Paradox		
1.7	Relativistic Momentum		
1.8	Mass and Energy		
1.9	Energy and Momentum		
Chapter 2	**Particle Properties of Waves**	**Week 4-5**	**6 lecture hours**
2.1	**Electromagnetic Waves**		
2.2	**Blackbody Radiation**		
2.3	**Photoelectric Effect**		
2.4	**What Is Light?**		
2.5	**X-Rays**		
2.6	**X-Ray Diffraction**		
2.7	**Compton Effect**		
2.8	**Pair Production**		
2.9	**Photons and Gravity**		
Chapter 3	**Wave Properties of Particles**	**Week 6-7**	**6 lecture hours**
3. 1	**De Broglie Waves**		
3. 2	**Waves of What?**		
3. 3	**Describing a Wave**		
3. 4	**Phase and Group Velocities**		
3. 5	**Particle Diffraction**		
3. 6	**Particle in a Box**		
3. 7	**Uncertainty Principle I**		
3. 8	**Uncertainty Principle II**		
3. 9	**Applying the Uncertainty Principle**		
Chapter 4	**Atomic Structure**	**Week 8-9**	**6 lecture hours**
4. 1	**The Nuclear Atom**		
4. 2	**Electron Orbits**		
4. 3	**Atomic Spectra**		
4. 4	**The Bohr Atom**		
4. 5	**Energy Levels and Spectra**		
4. 7	**Correspondence Principle**		
4.8	**Nuclear Motion**		
Chapter 5	***Quantum Mechanics***	**Week 10-12**	**9 lecture hours**

5.1	**Quantum Mechanics**		
5. 2	**The Wave Equation**		
5. 3	**Schrödinger's Equation: Time-Dependent Form**		
5. 5	**Expectation Values**		
5. 6	**Operators**		
5.7	**Schrödinger's Equation: Steady-State Form**		
5.8	**Particle in a Box**		
5.9	**Finite Potential Well**		
5.10	**Harmonic Oscillator**		
Chapter 6	**Quantum Theory of the Hydrogen Atom**	**Week 13-14**	**6 lecture hours**
6. 1	**Schrödinger's Equation for the Hydrogen Atom**		
6. 2	**Separation of Variables**		
6. 3	**Quantum Numbers**		
6. 4	**Principal Quantum Number**		
6. 5	**Orbital Quantum Number**		
6. 6	**Magnetic Quantum Number**		
6.7	**Electron Probability Density**		
Review		***Week 15***	
University Exams		***Week 16***	

Classroom Participation: Oral Presentation

Classroom Participation: Assessment Criteria					
Criteria	**Quality**				**Score**
	Excellent (4 points)	**Good (3 points)**	**Satisfactory (2 points)**	**Needs Improvement (1 points)**	
Degree to which student integrates course readings into classroom participation	- often cites from readings; - uses readings to support points; - often articulates "fit" of readings with topic at hand.	-occasionally cites from readings; - sometimes uses readings to support points; -occasionally articulates "fit" of readings with topic at hand **.**	-rarely able to cite from readings; - rarely uses readings to support points; - rarely articulates "fit" of readings with topic at hand	-unable to cite from readings; -cannot use readings to support points; cannot articulates "fit" of readings with topic at hand .	
Interaction / participation in classroom discussions	-always a willing participant, responds frequently to questions; - routinely volunteers point of view .	-often a willing participant, - responds occasionally to questions; - occasionally volunteers point of view .	-rarely a willing participant, - rarely able to respond to questions; - rarely volunteers point of view .	-never a willing participant., - never able to respond to questions; - never volunteers point of view .	
Interaction /participation in classroom learning activities	-always a willing participant; -acts appropriately during all role plays; - responds frequently to questions; - routinely volunteers point of view.	-often a willing participant; -acts appropriately during role plays; - responds occasionally to questions; -occasionally volunteers point of view.	-rarely a willing participant. -occasionally acts inappropriately during role plays; - rarely able to respond to direct questions; -rarely volunteers point of view .	-never a willing participant - often acts inappropriately during role plays;, - never able to respond to direct questions; - never volunteers point of view.	
Demonstration of professional attitude and demeanor	-always demonstrates commitment through thorough preparation; - always arrives on time; - often solicits instructors' perspective outside class.	- rarely unprepared; rarely arrives late; - occasionally solicits instructors' perspective outside class **.**	-often unprepared; occasionally arrives late; - rarely solicits instructors' perspective outside class .	-rarely prepared; - often arrives late; -never solicits instructors' perspective outside class	

Assessment Rubrics to be determined by the department. Add samples below.

Element	Excellent			Satisfactory			Needs Improvement			Points
	8	7	6	5	4	3	2	1	0	
Organization	▪ There is a logical sequence of information. ▪ Title slide and closing slide are included appropriately.			▪ There is some logical sequence of information. ▪ Title slide and closing slides are included.			▪ There is little or no logical sequence of information. ▪ Title slide and/ or closing slides are not included.			
Slide Design (text, colors, background, illustrations, size, titles, subtitles)	▪ Presentation is attractive and appealing to viewers.			▪ Presentation is somewhat appealing to viewers.			▪ Little to no attempt has been made to make presentation appealing to viewers.			
Content	▪ Presentation covers topic completely and in depth. ▪ Information is clear, appropriate, and accurate.			▪ Presentation includes some essential information. ▪ Some information is somewhat confusing, incorrect, or flawed.			▪ Presentation includes little essential information. ▪ Information is confusing, inaccurate, or flawed.			
Language	▪ Spelling, grammar, usage, and punctuation are accurate ▪ Fluent and effective			▪ There are minor problems in spelling, grammar, usage, and/or punctuation.			▪ There are persistent errors in spelling, grammar, usage, and/or punctuation. ▪ Less or not fluent and effective.			
Delivery	▪ Ideas were communicated with enthusiasm, proper voice projection and clear delivery. ▪ There was sufficient eye contact with audience. ▪ There were sufficient use of other non-verbal communication skills. ▪ Appropriate delivery pace was used.			▪ There was some difficulty communicating ideas due to voice projection, lack of preparation, incomplete work, and/or insufficient eye contact. ▪ Insufficient use of non-verbal communication skills. ▪ Delivery pace is somewhat appropriate.			▪ There was great difficulty communicating ideas due to poor voice projection, lack of preparation, incomplete work, and/or little or no eye contact. ▪ No use of nonverbal communication skills. ▪ Inappropriate delivery pace was used.			
Interaction with Audience	▪ Answers to questions are coherent and complete. ▪ Answers demonstrate confidence and extensive			▪ Most answers to questions are coherent and complete. ▪ Answers somehow demonstrate confidence and			▪ Answers to questions are neither coherent nor complete. ▪ Is tentative or unclear in			

	knowledge.	extensive knowledge.	responses.	
	Total Score (Y x 5/16) =			