Course Specification

(Bachelor)

Course Title: :	**General Physics**
Course Code:	**PHY 1101**
Program:	**Bachelor of Science in Physics.** **Bachelor of Science in Applied Mathematics.** **Bachelor of Science in Chemistry.** **Bachelor of Science in Biology**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	4
Last Revision Date:	***29/09/2024***

Table of Contents

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 1/ Year1)					
4. Course General Description:					
This course covers topics like kinematics and the study of work and energy and. Students will gain with a deep understanding of these concepts and topics. A laboratory portion of this course will provide hands-on experience with these topics.					
5. Pre-requirements for this course (if any)**:**					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Provide the basic concepts and build a strong foundation in the principles of classical mechanics.
- Analyze different physical situations and phenomena in terms of the fundamental laws of classical mechanics.
- Understand how these principles are applied in the world around us.
- Gain an understanding of the classical laws of physics and how they are applied to real world problems.
- Observe and analyze physical data relevant to some of the experiments in mechanics.
- Develop critical thinking and analytical problem-solving skills.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	90	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**	30
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		90

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 concepts and principles in introductory dynamics in one and two dimensions.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline physical phenomena using Newton's laws of motion.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe physical phenomena using energy and work concepts.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	Skills			
2.1	**Explain and summarize the basic knowledge gained from studying mechanics.**	**S1, S2**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Explain and summarize the basic knowledge gained from studying mechanics.**	**S1, S2**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.3	**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
2.4	**Explain and use information from the output of experiment to draw conclusions.**	**S2, S3**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Compare with standard results. ▪ Feedback and explanations.
2.5	**Summarize conclusions and write reports.**	**S3, S4**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Compare with standard results. ▪ Feedback and explanations.
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.	**Physics and Measurements:** Standards of length, mass, and time, dimensional analysis, conversion of units, estimates and order-of-magnitude calculations, significant figures.	**4**
2.	**Motion in One Dimension:** Displacement, velocity and acceleration, one dimensional motion with constant acceleration, freely falling objects.	**10**
3.	**Vectors:** Vector and scalar quantities, some properties of vectors, components of a vector and unit vectors.	**10**
4.	**Motion in Two Dimensions:** position vector, velocity vector, acceleration vector, two-dimensional motion with constant acceleration, projectile motion.	**12**
5.	**Newton's Laws of Motion:** The concept of force, Newton's first law, Newton's second law, the force of gravity and weight, Newton's third law, frictional force, some applications of Newton's laws.	**12**
6.	**Work and Energy:** Scalar product of two vectors, work done by a constant/variable force, kinetic energy and the work-kinetic energy theorem, potential energy, conservative and non-conservative forces, conservative forces and potential energy, conservation of mechanical energy, work done by non-conservative forces, power.	**12**

	List of Topics *(Laboratory)*	
1.	**Experiment 1:** Measurements and uncertainties. Virtual experience.	3
2.	**Experiment 2:** Free fall.	3
3.	**Experiment 3:** Forces in equilibrium.	3
4.	**Experiment 4:** Simple pendulum.	3
5.	**Experiment 5:** Constant Spring.	3
6.	**Experiment 6:** Simple harmonic motion.	3
7.	**Experiment 7:** Free fall: Conservation of mechanical energy of a uniformly accelerated mass.	3
8.	**Experiment 8:** Describe the movement of an object moving at a constant speed and constant acceleration.	3
9.	**Experiment 9:** Friction and Newton's second law.	3
10.	**Experiment 10:** Ohm's Law.	3
Total		**90**

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.	**Laboratory**	**All the semester**	**30 %**
3.	**Midterm Exam 1**	**6th week**	**10 %**
4.	**Midterm Exam 2**	**12th week**	**10 %**
5.	**Final Exam**	**16th week**	**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. and Jewett J.W., ***Physics for Scientists and Engineers with Modern Physics,*** 9th Edition, Brooks/Cole, Belmont, CA, USA (2014).
Supportive References	- Halliday D. and Resnick R., ***Physics***, 9th Edition, John Wiley and sons (2011).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	- Laboratory Manual supplied by the Department of Physics. Laboratory Manual is available at the website of the Department of Physics.

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

Course Specification
(Bachelor)

Course Title:	**Calculus (1)**
Course Code:	**MAT 1101**
Program:	**Bachelor of Science in Physics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☒ College	☐ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 1 / Year 1					
4. Course general Description:					
Calculus (1) provides a solid foundation for advanced studies and practical applications in mathematics. Indeed, it introduces essential mathematical concepts, starting with solving linear and quadratic equations, polynomials, and inequalities, along with functions and their domains, ranges, and operations. It covers trigonometric functions and sequences, followed by an exploration of limits and continuity, including limit theorems and asymptotes. The course focuses on differentiation, teaching how to compute derivatives and apply them to concepts like tangent lines and velocity. Finally, students learn to optimize functions, analyze monotonicity, and determine concavity.					
5. Pre-requirements for this course (if any)**:**					
None.					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
The course aims to establish a solid foundation in algebra and functions, covering topics such as solving equations and inequalities, analyzing polynomials, and understanding trigonometric concepts. It also focuses on limits and continuity, differentiation techniques, and their applications, including optimization and graph analysis.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Define key concepts related to linear equations, absolute value inequalities, and polynomial factoring.	K1,	Lectures and tutorials	Quizzes and written definitions
1.2	Describe the fundamental characteristics of functions, including domain, range, and composition.	K1, K2	Interactive discussions and group work	Concept maps and homework assignments
1.3	Recall the definitions of limits and continuity, and the processes for computing derivatives.	K1	Tutorials and guided problem-solving sessions	Multiple-choice exams and problem sets
2.0	**Skills**			
2.1	1. Utilize appropriate integration techniques, including substitution and integration by parts, to effectively solve complex problems involving definite and improper integrals.	S1	Problem-based learning, workshops, tutorials, and hands-on practice.	Problem sets in assignments
2.2	2. Construct graphical representations of functions and curves described by parametric equations, accurately determining arc lengths and surface areas using calculus methods.	S2	Hands-on workshops with graphing software, tutorials, and guided practice.	Assignments; and Class participation and feedback.
2.3	3. Evaluate the convergence of infinite series by applying various convergence tests and effectively communicate the results through written explanations and presentations.	S3, S4	Lectures on convergence tests, group discussions, tutorials, and presentations.	Exams and class participation
3.0	**Values, autonomy, and responsibility**			
3.1	1. Demonstrate ethical responsibility by collaborating effectively with peers, fostering a respectful and inclusive learning environment during group activities and projects.	V1	Group activities, peer review sessions, tutorials, and collaborative projects.	Direct: Group evaluations; Indirect: Reflection on group dynamics and peer feedback.
3.2	2. Cultivate self-directed learning by engaging in independent study and	V2	Independent study assignments, self-	Direct: Individual assignments;

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	reflection, recognizing the importance of personal responsibility in mastering calculus concepts.		directed projects, tutorials, and reflective journaling.	Indirect: Reflective journals and self-assessment.

C. Course Content

No	List of Topics	Contact Hours
1.	**Equations and Inequalities:** Solving Linear Equations and Inequalities, Absolute value, Solving Inequalities Containing an Absolute Value, Equations of lines, Quadratic Equations and Inequalities, Special Product Formulas.	10
2.	**Functions:** Domain, Range, and graphs of functions, Common Functions, Composition of functions, Inverse function; Exponential and Logarithmic Functions, Laws of Exponents and Logarithms.	10
3.	**Trigonometry:** Unit Circle, Angles and their Measurements, Important Trigonometric Identities, Trigonometric Functions, Inverses Trigonometric Functions, Complex Numbers, Complex Numbers in Polar Form and De Moivre's Theorem.	10
4.	**Limits and Continuity:** The Concept of Limit, Computation of limits, Continuity of functions, Intermediate value theorem, Limits Involving Infinity, Asymptotes, Formal definition of the limit.	15
5.	**Differentiation:** Tangent Lines and Velocity, The Derivative, Computation of Derivatives: The Power Rule, The Product and Quotient Rules, The Chain rule, Derivatives of Trigonometric Functions, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation, The Mean Value Theorem.	15
6.	**Applications of Differentiation:** Indeterminate Forms and L'Hopital's Rule, Maxima and minima values, Monotonic functions and the first derivative test, Concavity and the second derivative test, Graphing functions.	15
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homeworks, Quizzes, participation	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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	***Calculus***, 4th Edition, R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Supportive References	**1.** ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6th Edition, 1994. **2.** ***Calculus: Early Transcendentals***, 7th Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008. **3.** ***Essential Calculus with Application***; Richard A. Silverman, Dover Publications, 1989. **4.** ***Schaum's Outline of Calculus***, 6th Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of limits, continuity, and differentiation. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Student and teaching staff**	**Surveys and Questionnaires**
Effectiveness of Students assessment	**Course Coordinator**	**Peer Reviews**
Quality of learning resources	**Students and teaching staff**	**Classroom Observations**
The extent to which CLOs have been achieved	**Student Representatives**	**Student Performance Evaluations (exams, projects) CLOs Excel sheet.**
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	General Chemistry (1)
Course Code:	CHM 1101
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	1
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (2,2, 2)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: Level 1/ First year					

4. Course general Description:

This introductory and general chemistry course covers fundamental observations, laws, and theories of chemistry at the basic level. Topics include atoms/molecules, stoichiometry, acids/bases, solutions, equilibrium, gases, solids, liquids, thermodynamics, the periodic table, and chemical bonding. The chemistry lab is taken in parallel with the course and covers the following basic experiments: density, mass-mass relationship, limiting reactant, acid-base titrations, solubility product, reactions in aqueous solution, Calorimetry and redox reactions.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

By the end of this course the student able to:

- Recognize atoms, molecules and ions, atomic theory, structure of the atom, isotopes, chemical formulas, naming compounds, stoichiometry, Avogadro's number, mass spectrometer, empirical formulas, chemical equations, limiting reagents and changes taking place.
- Describe chemical reactions in aqueous solutions and their general proprieties.
- Recall types of chemical reactions (precipitation, acid-base, oxidation-reduction).
- Solve ideal gas equation, stoichiometric data, partial pressures and the kinetic molecular theory of gases,

- Identify quantum theory, electronic structure, Bohr's theory, dual nature of electron, quantum mechanics, and electron configuration, periodic classification periodic variation in physical properties, ionization energy, and electron affinity.
-

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	88	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**	60
2.	**Laboratory/Studio**	28
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		88

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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	To recognize the atomic theory and structure of the atom.	K1, K3	Lecturing	Short quizzes
1.2	To describe different phenomena related to	K1	Solving problems, Homework and assignment	Homework and assignment marks and written exams

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	chemical reactions and its stoichiometry.			
1.3	To list gases laws and their physical properties.	K1, K3	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	K4	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
2.0	Skills			
2.1	To differentiate between protons, neutrons and electrons.	S1	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	To calculate and balance chemical equations.	S1	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	To interpret the ideal gas laws and illustrate chemical calculations.	S1,S3	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini reports, operate electronic mail and Network in communicating with others.	S1, S2, S3	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks Assignments and homework marks
3.0	Values, autonomy, and responsibility			

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
3.1	To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	V1;V2	• Group discussion, assignments and homework • Lab-reports Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.	V2	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	The Study of Change: Science for the twenty-first century, the study of chemistry, the scientific method and hypothesis, a law and theory, matter and substance, mixture, physical means, elements and compounds, classification of matter, The three state of matter, Types of changes, Physical and chemical properties of matter, Extensive and Intensive properties, Measurement, handling numbers, Accuracy and precision	8
2.	Atoms, Molecules and Ions: The atomic theory, Dalton's atomic theory, Cathode ray tube, Millikan's experiment, Types of radioactivity, Thomson's model, Rutherford's experiment, The structure of the atom, Atomic number, Masse number, Isotopes, The periodic table, Molecules and ions, Formulas and models, Chemical formulas, molecular formula, empirical formula, Formula of Ionic compounds, Chemical nomenclature, Naming compounds, Organic chemistry.	10
3	Masse Relationships in chemical reactions (Stoichiometry): The mole, Avogadro's number, Molar mass, Molecular mass, Formula mass, the mass spectrometer, Percent composition and empirical formula, Experimental determination of empirical formulas, Chemical reaction, Chemical equations, Balancing chemical equations, Amounts of reaction and reactants and products, Reaction Yield, Limiting reagents.	10
4	Reaction in aqueous solutions: General proprieties of aqueous solutions, Solution, solute, solvent, An electrolyte and nonelectrolyte, Precipitation reactions, Solubility, Properties of acids, Properties of bases, Arrhenius acid and base, Brønsted acid and base, Neutralization reaction. Oxidation-reduction reactions,	8

	Oxidation number, Types of oxidation-reduction reactions, Solution Stoichiometry, Concentration, dilution, indicators, Equivalence point, Gravimetric analysis, Acid base titrations, Redox titrations.	
5	Gases: Physical characteristics of gases, Units of pressure, Boyle's law, Charles' & Gay-Lussac's Law, Avogadro's law, and The gas laws. The ideal gas equation, Gas stoichiometry, Dalton's law of partial pressures, The kinetic molecular theory of gases, Molecular Speed Distribution, Gas diffusion, Gas effusion, Deviations from ideal behavior.	8
6	Quantum Theory and the Electronic Structure of Atoms: Properties of waves, Line emission spectrum, Bohr's model of the atom, The dual nature of the electron, Schrodinger Wave Equation, Quantum numbers, Atomic Orbitals, Aufbau principle, Hund's rule, Electron Configuration.	8
7	The Periodic Table: Development of the periodic table, ground state electron configurations of the elements, classification of the elements, electron configurations of cations and anions, isoelectronic, effective nuclear charge, atomic radii, ionization energy, electron affinity, diagonal relationships on the periodic table, properties of oxides across a period.	8
Total		**60**

No	List of Experiments	Contact hours
1	Safety and precautioins in the chemistry laboratory.	2
2	Density of liquids ,water , alcohol, oil	2
3	Density of regular and irregular solids	2
4	Preparation of primary standard solutions.	2
5	Standardization of a secondary standard solution.	2
6	The chemical composition by mass percentage	2
7	Stoichiometry: Mass-mass relationship	2
8	Determination of the empirical formula	2
9	Strong acid-strong base titration	2
10	Vinegar Analysis, Mass %	2
11	Reactions in Aqueous Solutions & Precipitation reaction & Limiting reactant	2
12	Redox titration of Fe^{2+}	2
13	Determination of the specific heat of metal	2
14	Revision	2
Total		**28**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Attendance, Participation, Homework	All the semester	10 %
2.	Laboratory	All the semester	30 %
3.	Midterm Exam 1	Around 6^{th} & 7^{th} week	10 %
4.	Midterm Exam 2	Around 11^{th} & 12^{th} week	10%
5.	Final Exam	Around 16-17^{th} week	40 %
6.	Total		100%

*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	***Chemistry***, Raymond CHANG, Mc Graw Hill, 10^{th}Education, 2010, ISBN 9780073511092.
Supportive References	• Chemistry, Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin, 7thEdition, 2006, ISBN: 061852844X • Laboratory Manual for Principles of General Chemistry, J. A. Beran,, 7th Edition, John Wiley & Sons Inc., 2004.
Electronic Materials	•Blackboard •http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true •http://www.chem1.com/acad/webtext/virtualtextbook.html •http://www.shodor.org/UNChem/index.html
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Required Facilities and equipment

Items	Resources
facilities	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.**

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each Laboratory should be equipped with maximum 25 seats • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology equipment (projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (depending on the nature of the specialty)	• Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cyliders, curecibles, dishes, funnels, buchner, buchner flasks) • Appropriate chemicals and solvents (Sodium hydroxide, Barium Chloride, Hydrochloric acid, Sulphuric acid, phenolphthalein, methyl orange, ferric sulphate, ferrous sulphate, potassium permanganate, lead acetate) • Furnace Oven, Analytical balance (3 digits), Drying oven • Filter papers , clamps, stands

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.

Assessment Areas/Issues	Assessor	Assessment Methods
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**

Course Specification

(Bachelor)

Course Title: : **Classical Mechanics (1)**	
Course Code: **PHY 1105**	
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***	

Table of Contents

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 2/ Year 1)					
4. Course General Description:					
This course focuses on basic physics concepts and connections to everyday life. Course topics include linear momentum and collisions, Rotation of a rigid object about a fixed Axis, Angular momentum, Static equilibrium, Universal gravitation, and oscillatory motion. Connections to everyday life and society. While advanced mathematics is not required for this course, basic math with some trigonometry and simple algebra is utilized. Overall goals of this course include students' gaining an appreciation for the physical world, improved critical thinking and reasoning skills. General Physics (1), PHY 1101 and Calculus (1), MAT 1101.					
5. Pre-requirements for this course (if any)**:**					
General Physics, PHY 1101 and Calculus (1), MAT 1101.					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Learn and understand the basic knowledge of Newton's equation of motion, dynamics of a system of particles, the motion in linear and circular motions.
- Describe the concept of momentum in both linear and circular motions.
- Understand the basic concepts of the gravitational force and associated law.
- Understand the nature and causes of oscillations and the dynamics of a system of particles.
- Demonstrate competence with a wide variety of classical mechanics laws and techniques.

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**	-
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 behavior of systems in linear and rotational motions.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline the concepts of the linear, angular momentum and Kepler's laws.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**State the basic knowledge of gravitational force, potential and associated law.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Understand the nature and causes of oscillations.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying mechanics.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and**	**S2, S3**	▪ Problem classes and group tutorial.	▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	analyze problems in physics related the topics covered by the course.		• Homework assignments as well as problems solutions.	• 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	**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.	**Linear Momentum and Collisions:** Linear momentum and its conservation, impulse and momentum, collisions in one-dimension, two-dimensional collisions, the center of mass, motion of a system of particles.	**12**
2.	**Rotation of a Rigid Object about a Fixed Axis:** Angular position, velocity and acceleration, rotational kinematics (rotational motion with constant angular acceleration), angular and linear quantities, rotational kinetic energy, calculation of moments of inertia, torque, relationship between torque and angular acceleration, work and energy in rotational motion.	**12**
3.	**Angular Momentum:** The vector product and torque, angular momentum, angular momentum of a rotating rigid object, conservation of angular momentum.	**8**
4.	**Static Equilibrium:** The conditions of equilibrium, more on the center of gravity, examples of rigid objects in static equilibrium.	**8**
5.	**Universal Gravitation:** Newton's law of universal gravitation. Free-fall acceleration and the gravitational force, Kepler's laws and the motion of planets, gravitational potential energy, energy considerations in planetary and satellite motion.	**10**
6.	**Oscillatory Motion:** Motion of an object attached to a spring, mathematical representation of simple harmonic motion, energy of the simple harmonic motion, the pendulum, damped oscillations, forced oscillations.	**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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	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. and Jewett J.W., ***Physics for Scientists and Engineers with Modern Physics,*** 9th Edition, Brooks/Cole, Belmont, CA, USA (2014).
Supportive References	- Halliday D. and Resnick R., ***Physics***, 9th Edition, John Wiley and sons (2011).
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**

Assessment Areas/Issues	Assessor	Assessment Methods
		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

Course Specification
(Bachelor)

Course Title: **Calculus (2)**	
Course Code: **MAT 1102**	
Program: **Bachelor of Science in Physics**	
Department: **Mathematics and Statistics**	
College: **Science**	
Institution: **Imam Mohammad Ibn Saud Islamic University**	
Version: **2024 – V1**	
Last Revision Date: **08/10/2024**	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
This course focuses on advanced topics in integration and series, essential for applied mathematics. It covers anti-derivatives, the properties of indefinite and definite integrals, and key integration techniques such as substitution, integration by parts, and partial fractions. Students will apply these methods to real-world problems, calculating areas, volumes, and arc lengths. The course also introduces infinite series, exploring convergence tests, and Taylor and Maclaurin series. Additionally, it includes parametric equations and polar coordinates, with applications to conic sections, preparing students for further mathematical analysis.					
5. Pre-requirements for this course (if any)**:**					
MAT 1101 Calculus (1)					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
• To master advanced techniques of integration and apply them to practical problems such as calculating areas, volumes, and arc lengths. • To gain a deep understanding of infinite series, including convergence tests and Taylor/Maclaurin series, and use them for function approximation. • To explore parametric and polar equations, focusing on their applications to plane curves and conic sections within calculus. • To strengthen mathematical skills and knowledge required for more advanced studies in applied mathematics and related disciplines.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	**0**	**0%**

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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Explain the concepts of anti-derivatives, indefinite integrals, and the Fundamental Theorems of Calculus.	K1	Lectures and tutorials	Quizzes and written definitions
1.2	Summarize various techniques of integration, including substitution, integration by parts, and trigonometric techniques.	K2	Interactive workshops and collaborative learning	Homework assignments and in-class exercises
1.3	list appropriate series/ sequence test to decide the convergence or divergence of series/ sequences.	K1, K2	Lecture and class discussions	Exams and problem sets, participation
1.4	Describe the applications of parametric equations, including arc length and surface area calculations.	K2	Mini-Project-based learning and real-life applications	Mini-Projects and presentations
2.0	**Skills**			
2.1	Utilize appropriate integration techniques, including substitution	S1, S2	Problem-based learning,	Direct: Problem sets and

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and integration by parts, to effectively solve complex problems involving definite and improper integrals.		workshops, tutorials, and hands-on practice.	project presentations; Indirect: Self-assessment surveys.
2.2	Construct graphical representations of functions and curves described by parametric equations, accurately determining arc lengths and surface areas using calculus methods.	S4	Hands-on workshops with graphing software, tutorials, and guided practice.	assignments; Class participation and feedback.
2.3	Evaluate the convergence of infinite series by applying various convergence tests, and effectively communicate the results through written explanations and presentations.	S5	Lectures on convergence tests, group discussions, tutorials, and presentations.	Exams and class feedback.
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate ethical responsibility by collaborating effectively with peers, fostering a respectful and inclusive learning environment during group activities and projects.	V1, V3	Group activities, peer review sessions, tutorials, and collaborative projects.	Direct: Group evaluations; peer feedback.
3.2	Cultivate self-directed learning by engaging in independent study and reflection, recognizing the importance of personal responsibility in mastering calculus concepts.	V1, V2	Independent study assignments, self-directed projects, tutorials, and reflective journaling.	Individual assignments; Indirect: Reflective journals and self-assessment.

C. Course Content

No	List of Topics	Contact Hours
1.	**Integration:** Anti-derivatives, Indefinite Integral and its properties, Sums and Sigma Notation, Partitions and Riemann sums, Area under	10

	curves and The Definite Integral, First and Second Fundamental Theorems of Calculus.	
2.	**Integration Techniques:** Integration by Substitution, Integration by Parts, Integration of Rational Functions Using Partial Fractions, Trigonometric Techniques of Integration, Integrals involving logarithmic, exponential, and hyperbolic functions, Improper Integrals.	15
3.	**Applications of Definite Integrals:** Area between curves, Volumes by slicing, Volumes using washers and Cylindrical Shells, Arc Length and Surface Area.	10
4.	Infinite Series: Sequences of Real Numbers, Convergence and Divergence of Infinite Sequences, Formal definition of a convergent sequence, Infinite Series, Basic Infinite Series (geometric series, p-series, alternating series, telescoping series), Convergence Tests for Positive Series (ratio test, root test, comparison and limit comparison test, integral test), Alternating Series, Absolute and Conditional Convergence, Power Series, Differentiation ad Integration of power series, Taylor and Maclaurin Series, Convergence of Taylor series, Applications of Taylor and Maclaurin Series.	20
5.	**Parametric equations:** Plane Curves and Parametric equations, Calculus with Parametric Equations, motion applications; Arc Length of Parametric Curves; Surface Area of Parametric Curves, Introduction to polar coordinates, Conversion between Cartesian and polar coordinates, Graphing polar equations,	20
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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	***Calculus***, 4th Edition; R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Supportive References	***Essential Calculus with Application***; Richard A. Silverman, Dover Publications, 1989. ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6th Edition, 1994. ***Calculus: Early Transcendentals***, 7th Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008. ***Schaum's Outline of Calculus***, 6th Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of integration,infinite series and parametric equations. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students' assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Introduction to Probability and Statistics**
Course Code:	**STA 1111**
Program:	**Bachelor of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**7 October 2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (………)					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (……….)					
Level 2 / Year 1					

4. Course General Description:

This course describes the most important ideas, theoretical results, and examples of descriptive statistics, counting, random variables, probability distributions, simple linear regression and sampling distribution. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned. The use of Microsoft Excel software is essential for the descriptive statistics and linear regression.

5. Pre-requirements for this course (if any)**:**

MAT 1101

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

- To develop students' abilities to analyze and interpret data using various statistical methods, including measures of central tendency, variability, and correlation.
- To find the linear regression lines of scattered points in the plane.
- To equip students with a solid understanding of the fundamental concepts of probability, including events, sample spaces, and the axioms of probability.
- To familiarize students with common probability distributions (e.g., binomial, geometric, hypergeometric, normal) and their applications in real-world scenarios.
- Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	*Traditional classroom*	60	100%
2	E-learning	0	0%
3	**Hybrid** • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	6
3.	Field	0
4.	Tutorial	24
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	**To state the principles of descriptive.**	K1, K2	2 lecture hours per week 2 tutorial hours per week Self-study	**Direct:** Practical assessments Regular Exams Homework assignments
1.2	**To demonstrate an understanding of basic probability concepts and theorems.**	K1, K2	2 lecture hours per week 2 tutorial hours per week Self-study	**Direct:** Practical assessments Homework assignments
1.3	**To define some special distributions (discrete and continuous)**	K1, K2	2 lecture hours per week 2 tutorial hours per week Self-study	**Direct:** Practical assessments Regular Exams Homework assignments
2.0	Skills			
2.1	**To analyze data sets using appropriate statistical methods.**	S1, S3	2 lecture hours per week 2 tutorial hours per week Self-study Real-life problems	**Direct:** Practical assessments Regular Exams Homework assignments
2.2	**To solve problems involving probability and randomness.**	S1, S3	2 lecture hours per week 2 tutorial hours per week Self-study Real-life problems	**Direct:** Practical assessments Regular Exams Homework assignments
2.3	**To evaluate critically the results and methodologies**	S3, S4	Group discussions and debates on the interpretation	**Direct:** Practical assessments Homework assignments
3.0	Values, autonomy, and responsibility			
3.1	**To operate effectively in team-based assignments involving descriptive statistics and probability.**	V1, V2, V3	Group discussions and debates on the interpretation	**Direct:** Homework assignments Mini-projects

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	**To illustrate statistical concepts and results in written and oral formats**		2 tutorial hours per week Self-study Real-life problems	**Direct:** Homework assignments Mini-projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Descriptive Statistics:** Definitions, Need of Statistics & Statistical Problem-Solving Methodology & Introduction to Data Collection, Data Organization and Frequency Distributions, Graphic Presentations of Frequency Distributions, Computing Measures of Central Tendency, Computing Measures of Dispersion and Relative Position. ***Applications using Microsoft Excel***.	**10**
2.	**Simple Linear Regression and Correlation:** Correlation, Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model. ***Applications using Microsoft Excel***.	**8**
3.	**Probability:** Some Basic Considerations, Events, Counting Sample Point, Interpretations of Probability, Addition Rules, Conditional Probability, Multiplication and Total Probability Rules, Independence, Bayes' Theorem.	**10**
4.	**Random Variables and Probability Distribution:** Concept of Random Variable, Discrete Random Variables and Probability Distributions, Continuous Random Variables and Probability Distributions, Mean of Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear combinations of Random Variables.	**12**
5.	**Some Discrete Probability Distributions:** Bernoulli & Binomial Distribution, Hypergeometric Distribution, Geometric and Negative Binomial Distributions, Poisson Distribution.	**10**
6.	**Some Continuous Probability Distributions:** Continuous Uniform Distribution, Gamma and Exponential Distribution, Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial.	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**HomeWorks, Quizzes, Mini projects**	**During the term**	**20%**
2.	**First Midterm**	**Week 5-6**	**20%**
3.	**Second Midterm**	**Week 10-11**	**20%**
4.	**Final Exam**	**Week 16-17**	**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	***Probability & Statistics for Engineers & Scientists***, 8th Edition, R. Walpole, R. Myers, S. Myers, K. Ye, Pearson Education International, 2007. **(Main Reference)**
Supportive References	▪ ***Introduction to Probability and Statistics***; 14th Edition, W. Mendenhall, R. J. Beaver, Barbara M. Beaver, Duxbury Press, 2013. ▪ ***Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. ▪ ***Data Analysis with Microsoft Excel***, 3rd Edition, Kenneth N. Berk, Patrick Carey, Duxbury Press, 2010.
Electronic Materials	**Course Website: Learning Management Systems (Blackboard)**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **R-Project**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Student and teaching staff**	**Surveys and Questionnaires**
Effectiveness of Students assessment	**Course Coordinator**	**Peer Reviews**
Quality of learning resources	**Students and teaching staff**	**Classroom Observations**
The extent to which CLOs have been achieved	**Student Representatives**	**Student Performance Evaluations (exams, projects) CLOs Excel sheet.**
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	(08/10/2024) 05/04/1446

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024

TP-153

Course Specification

— (Bachelor)

Course Title:	Waves & Optics
Course Code:	PHY 1240
Program:	Bachelor of Science in Physics.
Department:	Physics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	4
Last Revision Date:	*29/09/2024*

Table of Contents

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 3/ Year2)					
4. Course General Description:					
This course is an introduction to waves and optics associated with physical phenomena. It is designed to analyze various situations or phenomena associated with waves, optics and modern physics using basic principles. Topics covered in waves and geometrical optics include: The Laws of geometric optics and image formation, Interference of light waves, diffraction patterns and polarization, Wave motion, Sound waves, Superposition and standing waves.					
5. Pre-requirements for this course (if any)**:**					
Classical Mechanics (1), PHY 1105 and Calculus (2), MAT 1102					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Analyze various situations or phenomena associated with waves and optics.
- Understand the laws of geometrical optics.
- Apply the characteristics of waves to light phenomena.
- Provide the fundamental concepts of wave motion, sound waves, waves interference, and superposition of standing waves.
- Develop critical thinking and analytical problem-solving skills.

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		

No	Mode of Instruction	Contact Hours	Percentage
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	**State the physical principles that describe waves and geometrical optics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describethe wave propagation of light, interference, diffraction, polarization of light waves, and electromagnetic nature of light.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the laws of refraction and reflection, and describe the principles of some optical instruments**	**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**	**S2, S3**	▪ Problem classes and group tutorial.	▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	analyze problems in physics related the topics covered by the course.		• Homework assignments as well as problems solutions.	• 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	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**			
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.	**The Laws of Geometric Optics and Image Formation:**Reflection, Refraction, Dispersion and prism, Total internal reflection, Images formed by flat mirror, Images formed by spherical mirrors, Images formed by refraction, Thin lenses.	**15**
2.	**Interference of Light Waves:** Conditions for interference, Young's double-slit experiment, Intensity distribution of the double-slit interference pattern, Change of phase due to reflection, Interference in thin films.	**15**
3.	**Diffraction Patterns and Polarization:** Introduction to diffraction patterns, Diffraction patterns from narrow slits, Resolution of single-slit and circular apertures, The diffraction grating, Polarization of light waves.	**15**
4.	**Wave Motion:** Propagation of a disturbance, Sinusoidal waves, The Speed of waves on strings, Reflection and transmission, Rate of energy transfer by sinusoidal waves on strings, The linear wave equation.	**15**
5.	**Sound Waves:** Speed of sound waves, Periodic sound waves, Intensity of periodic sound waves, The Doppler effect.	**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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	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	- Jenkins F.A. and White H.E., ***Fundamentals of Optics,*** 4th edition, McGraw-Hill (2001). - Hecht E., ***Optics,*** 4th Edition, Addison-Wesley (2004).
Supportive References	- Raymond A. Serway, and John W. Jewett, ***Physics for Scientists and Engineers (with modern physics)*** – Brooks Cole – 8th Edition (July 21, 2003)
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	**Multimedia associated with the text book and the relevant websites.**

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**

Assessment Areas/Issues	Assessor	Assessment Methods
		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

Course Specification

(Bachelor)

Course Title: **Thermal Physics**	
Course Code: **PHY 1230**	
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***	

Table of Contents

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 3/ Year2)					
4. Course General Description:					
Thermal physics is a core subject in physics, applicable to all its subfields. This course covers the basic principles of thermodynamics including some applications. Fundamental principles are taught in depth, and mathematical tools are presented to equip students for other applications. The First and Second laws of thermodynamics are introduced, along with the concepts of temperature, internal energy, heat, entropy and the thermodynamic potentials. Applications of thermodynamic concepts to topics such as heat engines, the expansion of gases and changes of phase are considered. The Third Law, and associated properties of entropy, is introduced. The kinetic theory of gases completes the course.					
5. Pre-requirements for this course (if any)**:**					
General Physics, PHY 1101 and Calculus (2), MAT 1102					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
• Demonstrate the basic concepts of the principles of thermodynamics. • State the basic principles of kinetic theory of gases for ideal and real gases. • Apply these principles in conjunction with elementary mathematical techniques to solve simple problems in the basic four thermodynamic laws. • Assess whether a solution to a given problem is physically reasonable.					

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	**Demonstrate the basic knowledge of the kinetic theory of gases.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Define and describe the laws of thermodynamics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the basic concepts of the special functions.**	**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.
2.3	**Communicate in a clear and concise manner**	**S4, S5**	• Lectures. • Class discussions.	▪ Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	orally, and using IT for acquiring and analyzing information.		• Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ 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.	**Nature of Thermodynamics and Equations of State:**Definitions: System, Surroundings, Boundary, Open system, Closed system, Isolated system, Extensive property, Intensive property, State of a system at equilibrium, Processes (quasi-static, reversible, irreversible, adiabatic, isobaric, isothermal, isochoric, cyclic), Heat reservoir. Temperature and the zero law of thermodynamics, Equation of state of an ideal gas, Van Der Waals' equation for a real gas, Expansivity and compressibility.	**14**
2.	**First Law of Thermodynamics and Applications:**Exact and inexact differentials, Work (reversible and irreversible processes), Adiabatic work and internal energy, Heat, Mechanical equivalent of Heat, Heat capacity, Mayer's equation, Enthalpy and heats of transformation, Relationships involving enthalpy, Gay-Lussac-Joule experiment, Joule-Thomson experiment.	**12**
3.	**Second Law of Thermodynamics and Applications:** Different statements of the second law (Kelvin statement and Clausius statement) Heat engines and the Carnot cycle Irreversible processes, Carnot's theorem, Clausius inequality and the second law, Entropy change in reversible and irreversible processes, Entropy change of the surroundings for a reversible process, TdS equations, Entropy change of an ideal gas, Entropy change for a liquid or solid, Entropy change for a liquid or solid.	**12**
4.	**Thermodynamic Potentials and the Third law of Thermodynamics:**Legendre transformation, Definition of the thermodynamic potentials, Maxwell relations, Helmholtz function, Gibbs function, Chemical potential, Phase equilibrium, Mixing processes, Statements of the third law, Equivalence of the statements, Consequences of the third law.	**12**

5.	**Kinetic Theory of Gases: Basic assumptions:** Molecular flux, Gas pressure and the ideal gas law, Equipartition of energy, Specific heat capacity of an ideal gas, Distribution of molecular speeds, Mean free path and collision frequency.	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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	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	- Roy B. N, ***Fundamental of classical and statistical thermodynamics,*** J. Wiley& Sons, UK (2002). - Schvoder D.V, ***An introduction to thermal physics,*** Adison Wesley Longman USA (2000). - Russell L.D, ***Classical thermodynamics,*** Inter Edition Saunders College Publ., USA (1993).
Supportive References	Kittel C. and Kroemer H., ***Thermal Physics,*** W. H. Freeman and Company, New York (1980).
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.**

Items	Resources
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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title: Calculus (3)	
Course Code: MAT 1203	
Program: Bachelor of Science in Physics	
Department: Mathematics and Statistics	
College: Science	
Institution: Imam Mohammad Ibn Saud Islamic University	
Version: 2024 – V1	
Last Revision Date: 08/10/2024	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3 / Year 2					
4. Course general Description:					
This module covers advanced topics in multivariable calculus and vector analysis, including vectors in space, dot and cross products, and equations of lines and planes. Students will explore vector-valued functions, partial derivatives, optimization techniques, and multiple integrals in various coordinate systems. By the end, students will be able to analyze and solve complex problems in higher dimensions, with applications in physics and engineering.					
5. Pre-requirements for this course (if any)**:**					
MAT 1102 Calculus (2)					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
This course plays a crucial role in the Applied Mathematics program by providing essential mathematical tools and techniques that underpin advanced studies and practical applications in various scientific and engineering disciplines.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Describe parametric and polar curves in plane and recognize regions and quadric surfaces in space.**	**K1, K2**	**lecture hours\week** **tutorial hours\week** **Self-study**	**Regular Exams** **Assignments** **Short Quizzes**
1.2	**Express double and triple integrals in different coordinate systems. in rectangular, polar, cylindrical, and spherical.**	**K1, K2**		
2.0	**Skills**			
2.1	**Apply the computational and conceptual principles of vector calculus, including partial derivatives and multiple integrals, to the solutions of various problems**	**S1, S2**	**Self-study** **Real-life problems**	**Participations** **Short Quizzes**
2.2	**Interpret, clearly and precisely both orally and in writing, calculus operations on vector-valued functions including limits, derivatives, integrals, curvature, and the description of motion in plane and space.**	**S4**	**Self-study**	**Participations**
2.3	**Illustrate figures in different coordinates using a CAS and some online solvers.**	**S5**	**Real-life problems**	**Short Quizzes**
2.4	**Calculate arc length /surface/volume of regions in 2 and 3 dimensions, in Cartesian, polar, cylindrical, and spherical**	**S3**	**Self-study**	**Participations**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	coordinate systems, directional derivatives, equations of tangent planes, and gradient vectors.			
3.0	**Values, autonomy, and responsibility**			
3.1	**listen to the teacher's explanation of the Mathematics reasoning and illustration of 3D figures.**	**V1, V3**	**Class discussion**	**Participation**
3.2	**Show attitude of support the use of computers in learning/teaching mathematics**	**V1, V2**	**Problem solving, Class discussion**	**Homework and Mini-projects and presentation**

C. Course Content

No	List of Topics	Contact Hours
1.	**Vectors and Geometry of Space:** Vectors in Space, Dot Product, Cross Product, Equations of Lines and Planes in Space, Quadratic Surfaces in Space.	**20**
2.	**Vector-Valued Functions:** Vector-Valued Functions, Calculus of Vector Functions, Motion in Space, Curvature, Tangent and Normal Vectors.	**10**
3.	**Functions of several variables:** Functions of Several Variables, Limits and Continuity, Partial Derivatives, Differentiability, The Total Derivative, The Directional Derivatives and Gradient, Tangent Plane and Linear Approximation, Taylor's Theorem in Severable variables, Chain Rule, Maxima and Minima, Method of Lagrange Multipliers.	**25**
4.	**Multiple Integrals:** Double Integrals in Cartesian Coordinates, Areas and Volumes, Polar Coordinates, Double Integrals in Polar Coordinates, Surface Area, Triple Integrals in Cartesian Coordinates, Cylindrical and Spherical Coordinates, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables in Multiple Integrals.	**20**
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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	*Calculus*, 4th Edition; R. T. Smith, R. B. Minton, McGraw-Hill, 2012**. (Main Reference)**
Supportive References	***Advanced Engineering Mathematics, 8th Edition, E. Kreyszig, John Wiley & Sons, INC, 1998.*** ***Calculus, 6th Edition, O. Swokowski, et al, PWS Pub. Co., 1994.*** ***Calculus Early Transcendentals, 7th Edition; C. Henry Edwards, David E. Penney, Prentice Hall, 2008.*** ***Calculus, 1st Edition, F. Ayres & E. Mendelson, Schaum's Outline McGraw-Hill, 1999.***
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of geometry in plane and space, area and volume.

Items	Resources
	• **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Introduction to Linear Algebra
Course Code:	MAT 1221
Program:	Bachelor of Science in Physics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	2024 – V1
Last Revision Date:	08/10/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 4 / Year 2					
4. Course general Description:					
This course describes the most important ideas, theoretical results, and examples of matrices, vector spaces, linear transformations, eigenvalues and eigenvectors. The course includes the essential fundamentals of these topics. The emphasis is on calculations.					
5. Pre-requirements for this course (if any)**:**					
None.					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
To provide students with a good understanding about matrices concept and methods of linear algebra To let students be familiar with basics of vector spaces and linear transformations. To connect linear algebra to other fields.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**100%**
2	E-learning	**0**	**0%**
3	Hybrid • Traditional classroom • E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain the processes of Gauss elimination, matrix operations, and the concept of matrix inverses.	K2	Lecture and guided problem-solving sessions	Quizzes and written assignments
1.2	Summarize the properties of determinants and their applications, including Cramer's Rule and evaluating determinants.	K2	Interactive workshops and group discussions	Homework assignments and in-class exercises
1.3	Identify key concepts of vector spaces, including linear dependence, basis, and dimension.	K1	Lecture discussions and visual demonstrations	Exams and problem sets
1.4	Describe the fundamentals of eigenvalues and eigenvectors, including diagonalization and their applications.	K2	Project-based learning and collaborative work	Projects and presentations
2.0	Skills			
2.1	Find inverse of a square matrix by using its determinant and extension matrix to solve some world-real problems.	S1, S2	Self-study Real-life problems	Participations Short Quizzes
2.2	State, clearly and precisely both orally and in writing, the general solution of at most a 4×4 linear system using appropriate method of linear algebra matrix including Gaussian elimination and matrix inversion.	S4	Regular Exams	Participations
2.3	Use CAS and online solver to manipulate matrices.	S5	Assignments	Short Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.4	Compute eigenvalues and eigenvectors of square matrix to produce the diagonalization of the matrix.	S3	Short Quizzes	Participations
3.0	**Values, autonomy, and responsibility**			
3.1	Work individually and in group	V1, V3	Class activities	Individual and group coursework
3.2	Show attitude of support the use of computers in Matrix manipulation.	V1, V2	Class discussion	participation

C. Course Content

No	List of Topics	Contact Hours
1.	**Matrices and Gauss Elimination:** Linear Systems and Matrices (Gauss Eliminations, Echelon & Reduced Echelon Forms, Matrix Operations, Matrix Inverses), Determinants (Minor & Cofactors, Evaluating Determinants, Cramer's Rule, Adjoints & Matrix Inverses).	**20**
2.	**Vector Spaces:** Spaces Vector Spaces and Subspaces, Euclidean Vector Spaces $\mathbb{R}n$, Linear Dependence & Independence, Basis and Dimensions of Vector Space, Change of a Basis.	**15**
3.	**Linear Transformations:** Definition and Basics, The Kernel and the Image, Linear Transformation Matrix, Nonsingular Transformations and their Inverses.	**10**
4.	**Eigenvalues and Eigenvectors:** Characteristic Polynomial, Eigenvalues, Eigenvectors, Diagonalization, Triangulation, Matrix Powers. Inner Product Space, Angle and Orthogonality in Inner Product Spaces, Gram–Schmidt Process.	**15**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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	*Elementary Linear Algebra;* **11th Edition; H. Anton, C. Rorres, Wiley, 2014. (Main Reference)**
Supportive References	*Linear Algebra with Application,* **5th Edition; W. K. Nicholson, McGraw- Hill, 2006.** *Linear Algebra with Application,* **4th Edition; O. Bretscher; Pearson Ed. Int., 2009.** *Linear Algebra, Schaum's Outline,* **S. Lipschutz, M. Lipson, McGraw-Hill 3rd Edition, 2000**
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting matrix computation. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)

Course Specification

(Bachelor)

Course Title: : **Electricity and Magnetism**	
Course Code: **PHY 1221**	
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***	

Table of Contents

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 4/ Year 2)					
4. Course General Description:					
This course covers the foundation of electricity and magnetism. In this course, students will develop solid and systematic problem-solving skills, and to lay the foundations for further studies in physics. It begins with electric fields, Gauss' law, electric potential. Capacitance and dielectrics are introduced, and then the course moves to the magnetic field, faraday's law, inductance, alternating current circuits. This course is designed to provide students with a working knowledge of the elementary physics principles mentioned above, as well as their applications, and to enhance their conceptual understanding of physical laws.					
5. Pre-requirements for this course (if any)**:**					
General Physics, PHY 1101 and Calculus (3), MAT 1203.					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
• Provide the basic concepts and build a strong foundation in the principles of electricity and magnetism. • Analyze different physical situations and phenomena in terms of the fundamental laws of electricity and magnetism. • Understand how these principles are applied in the world around us. • Demonstrate competence with a wide variety of mathematical tools and techniques.					

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**	-
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 behavior of systems in linear and rotational motions.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline the concepts of the linear, angular momentum and Kepler's laws.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**State the basic knowledge of gravitational force, potential and associated law.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying mechanics.**	**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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Electric Fields:** Electric charges, Coulomb's law, the electric field, electric field of a continuous charge distribution, motion of charged particles in a uniform electric field.	**8**
2.	**Gauss's Law:** electric field lines, electric flux, Gauss's law, application of Gauss's law to various charge distributions, conductors in electrostatic equilibrium.	**8**
3.	**Electric Potential:** Potential energy and electric potential, electric potential difference in a uniform electric field, electric potential due to point charges, obtaining the value of the electric field from the electric potential, electric potential due to continuous charge distributions, electric potential due to charged conductor, application of electrostatics.	**8**
4.	**Capacitance and dielectrics:** Definition of capacitance, calculating capacitance for parallel plate capacitors, connection of capacitors, energy stored in a charged capacitor, capacitors with dielectrics, RC circuits.	**8**
5.	**Sources of the Magnetic Field:** The Biot-Savart's law, the magnetic force between two parallel conductors, Ampere's law, the magnetic field of a solenoid, magnetic flux, Gauss's law in magnetism, displacement current and the generalized Ampere's law.	**8**
6.	**Faraday's law:** Faraday's law of induction, motional emf, Lenz's law, induced emfs and electric fields, generators and motors, Eddy currents.	**8**
7.	**Inductance:** Self-inductance, RL circuits, energy in a magnetic field, mutual inductance, oscillation in an LC circuit, the RLC circuit.	**8**

8.	**Alternating Current Circuits:** AC sources, Resistors in an AC circuit, Inductors in an AC circuit, Capacitors in an AC circuit, the RLC series circuit, Power in an AC circuit, resonance in a series RLC circuit, the transformer.	**4**
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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. and Jewett J.W., ***Physics for Scientists and Engineers with Modern Physics,*** 9th Edition, Brooks/Cole, Belmont, CA, USA (2014).
Supportive References	- Halliday D. and Resnick R., Physics, 9thEdition, John Wiley and sons (2011).
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

Course Specification

(Bachelor)

Course Title: **Mathematical Physics (1)**	
Course Code: **PHY 1233**	
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***	

Table of Contents

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 4/ Year2)

4. Course General Description:

This course aims to teach how to use a mathematical methods (tools) to solve and explain many problems in physical sciences. The mathematical methods covered in this course include ordinary differential equations, Laplace and Fourier transforms, special function. 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 solve and explain different problems in physics.

5. Pre-requirements for this course (if any):

Calculus (3), MAT 1203

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

- Learn and understand the basic knowledge of ordinary differential. equations, Laplace and Fourier transforms, and special functions.
- 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.
- Apply mathematical concepts and techniques into the different 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		

No	Mode of Instruction	Contact Hours	Percentage
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	**State the basic knowledge of ordinary differential equations and methods for their solution.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the Laplace and Fourier transforms.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the basic concepts of the special functions.**	**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.
2.3	**Communicate in a clear and concise manner**	**S4, S5**	• Lectures. • Class discussions.	▪ Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	orally, and using IT for acquiring and analyzing information.		• Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ 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.	**First order differential equations:** Definitions, Separable equations, Homogeneous equations, Linear differential equations, Exact differential equations, Integrating Factor. Applications.	**14**
2.	**Second order linear differential equations with constants coefficients:** Definitions: difference between linear and non-linear, Homogeneous equations with constant coefficients Non-homogeneous equations. Variation of parameters (general method). Applications.	**14**
3.	**Integral Transforms:**Laplace transforms (LTs), properties of LT, Laplace transform of derivatives, Inverse Laplace transform. Applications.	**12**
4.	**Fourier series and Fourier transforms:**Fourier Sine – Cosine transform-complex Fourier transform. Fourier transform – inversion theorem-Fourier transform of derivatives, Convolution theorem, momentum representation. Applications.	**10**
5.	**Special Functions:**Introduction, The factorial function, Definition of the Gamma function; Recursion relation, The Gamma function of negative numbers, Some important formulas involving gamma functions, Beta functions, Beta functions in terms of Gamma functions, The simple pendulum, The error function, Asymptotic series, Stirling's formula, Elliptic integrals and functions.	**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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20%**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	-Chow T., ***Mathematical Methods for Physicists: A Concise Introduction***, Cambridge University Press (2000). - -Riley K.F., Hobson M.P., and Bence S.J., ***Mathematical Methods for Physics and Engineering***, 3th Edition, Cambridge University Press, 2006.
Supportive References	Boas M.L. ***Mathematical Methods in the Physical Sciences***, 3rd Edition, John Wiley (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.**
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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Classical Mechanics (2)
Course Code:	PHY 1203
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*

Table of Contents

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 3/ Year2)					

4. Course General Description:

This course deals with fundamental concepts and principles in classical mechanics, applied to particles, systems of particles and rigid bodies. Vector calculus is used extensively to explore topics. The Lagrangian formulation of mechanics is introduced to show its powerful problemsolving ability. Modern notation and terminology are used throughout in support of the course objectives: to facilitate students' transition to advanced physics and the mathematical formalism needed for the quantum theory of physics.

5. Pre-requirements for this course (if any)**:**

Classical Mechanics (1), PHY 1105 and Calculus (3), MAT 1203

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Understand the notions of configuration space, generalized coordinates space in mechanics.**
- **Explain various aspects of classical dynamics.**
- **Obtain the Euler-Lagrange equations from the variational principle.**
- **Understand the relation between Lagrange's equations and Newton's laws.**
- **Use Lagrange's equations to solve complex mechanical problems.**
- **Obtain the Hamiltonian formulation of a mechanical system.**
- **Develop problem solving and critical thinking skills.**

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)**	
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	**Demonstrate and describe the behavior of principle's variations.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the central-force motion and the motion in a non-inertial reference frame.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**State the basic knowledge of Lagrangian and Hamiltonian dynamics.**	**K1, K2**	• Lectures. • Class discussions. Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Outline the basic knowledge of dynamics of rigid bodies.**	**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**	**S2, S3**	▪ Problem classes and group tutorial.	▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	analyze problems in physics related the topics covered by the course.		Homework assignments as well as problems solutions.	
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Coordinate Systems and Transformation:** Cartesian coordinates; circular cylindrical coordinates; spherical coordinates.	**10**
2.	**Some Methods in the Calculus of Variations:** Euler's equation, functions with several dependent variables, Euler's equation when auxiliary conditions are imposed.	**8**
3.	**Lagrangian and Hamiltonian Mechanics:** Hamiltonian's principle, generalized coordinates, Lagrange's equations of motion in generalized coordinates, Lagrange's equations with undetermined multipliers, equivalence of Lagrange's and Newton's equations, a theorem concerning the kinetic energy, conservation theorems, canonical equations of motion–Hamiltonian mechanics.	**15**
4.	**Central Force Motion:** Reduced mass, conservation theorems-first integrals of the motion, planetary motion-Kepler's problem.	**10**
5.	**Motion in a non-inertial reference frame:** Rotating coordinate systems, centrifugal and Coriolis forces, motion relative to the earth.	**9**
6.	**Mechanics of rigid Bodies:** Inertia tensor, angular momentum, principal axes of inertia, moments of inertia for different body coordinate systems, Eulerian angles, Euler's equations for a rigid body.	**8**
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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	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	- Fowles G.R. and Cassiday G., ***Analytical Mechanics, 7th Edition,*** Brooks Cole Publishing (2004). - Goldstein H., Poole C., and Safko J., ***Classical Mechanics,*** 3rd Edition, Addison-Wesley (2000).
Supportive References	- Thornton S.T. and Marion J.B., **Classical Dynamics of Particles and Systems,** 5th Edition, Thomas Learning Inc. (2004).
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

Course Specification
(Bachelor)

Course Title: **Waves & Optics Laboratory**	
Course Code: **PHY 1282**	
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***	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (Level 4/ Year2)					
4. Course General Description:					
Significant experiments chosen from light, optical instruments and polarization and other related topics. Attention is given to laboratory techniques and data analysis. Every class will have a short lecture introducing the procedures, concepts, formulas and instructions relevant to the experiment. The lecture will also cover what is expected in the lab-report; don't be late. Attendance and participation is mandatory. Experiments will usually be performed in groups, but each student will turn in an individual lab report.					
5. Pre-requirements for this course (if any)**:**					
Waves & Optics, PHY 1240					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Observe and analyze physical data relevant to some of the experiments in optics and wave.
- Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
- Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.
- Instruct students in the competent use of laboratory equipment to collect and record data, apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the physical world

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**0**
2.	**Laboratory/Studio**	**30**
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	**Recognize the scientific method of inquiry to draw conclusions based on light wave and associated characteristics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the theoretical bases of light optics experiments.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the theoretical bases of laws of imaging and optical instruments experiments.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	Skills			
2.1	**Analyze experiments according to the plan besides the learning from lab lecture.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	**Explain and use information from the output of experiment to draw conclusions.**	**S2, S3**	▪ Problem classes and group tutorial. ▪ Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Summarize conclusions and write reports.**	**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.
2.4	**Communicate in a clear and concise manner orally, paper and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • 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. ▪ Feedback and explanations.
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.	**Introduction**	5
2.	**Experiment 1:** Reflection and refraction of light.	5
3.	**Experiment 2:** Laws of imaging.	5
4.	**Experiment 3:** Optical instruments.	5
5.	**Experiment 4:** Newton's rings in transmitted monochromatic light.	5
6.	**Experiment 5:** Interference at a Fresnel's mirror with an He-Ne laser.	5
7.	**Experiment 6:** Diffraction at a single slit.	5
8.	**Experiment 7:** Diffraction at a double slit.	5
9.	**Experiment 8:** Diffraction grating spectrometer.	5

10.	**Experiment 9:** Rotation of the plane of polarization with sugar solutions.	**5**
11.	**Revision.**	**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**	**35 %**
2.	**Midterm Exam 1**	**6th week**	**7.5 %**
3.	**Midterm Exam 2**	**12th week**	**7.5 %**
4.	**Final Exam**	**15th week**	**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	
Supportive References	
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	• Laboratory Manual supplied by the Department of Physics. • Laboratory Manual is available at the website of the Department of Physics.

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**

Course Specification

(Bachelor)

Course Title: **Thermal Physics & mechanics Laboratory**	
Course Code: **PHY 1283**	
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***	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 4/ Year 2)					

4. Course General Description:

This course is designed to aid students in the development of core practical skills in Physics. The course includes a series of experiments exploring fundamental concepts in thermal physics and mechanics. Every class will have a short lecture introducing the procedures, concepts, formulas and instructions relevant to the experiment. The lecture will also cover what is expected in the lab-report; don't be late. Attendance and participation is mandatory. Experiments will usually be performed in groups, but each student will turn in an individual lab report.

5. Pre-requirements for this course (if any):

Thermal physics, PHY 1230

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

- Observe and analyze physical data relevant to some of the experiments in thermal physics and mechanics.
- Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
- Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.
- Instruct students in the competent use of laboratory equipment to collect and record data, apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the physical world.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**0**
2.	**Laboratory/Studio**	**30**
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	**Recognize the scientific method of inquiry to draw conclusions based on verifiable evidence such as expansion of solids and liquids.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.2	**Describe the theoretical bases of specific heat of solids, specific vaporization heat of liquids and latent heat of solids experiments.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Discussion. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.3	**Describe the concepts of the law experiments in thermal Physics and mechanics.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report.	▪ Participation. ▪ Report evaluation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			Performing lab. experiments at the scheduled times.	▪ Lab experiment check. ▪ Exams.
2.0	**Skills**			
2.1	**Analyze experiments according to the plan besides the learning from lab lecture.**	**S1; S2**	• Using the multimedia and visual materials, Lab manual and the theoretical bases of the course. Interaction between students in the lab course community and discussions in the lab.	Analyze experiments according to the plan besides the learning from lab lecture.
2.2	**Explain and use information from the output of experiment to draw conclusions.**	**S2; S3**	Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	Explain and use information from the output of experiment to draw conclusions.
2.3	**Summarize conclusions and write reports.**	**S3; S4**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Summarize conclusions and write reports.
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.	**Experiment 1:** Inscription in the lab and distribution of the group.	5
2.	**Experiment 2:** Path-time diagrams of rotational motion: Measurements the angular velocity, angular acceleration.	5
3.	**Experiment 3:** Conservation of Energy by using Maxwell's Wheel.	5
4.	**Experiment 4:** Laws of Gyroscopes / 3-axis gyroscope.	5
5.	**Experiment 5:** Damped and Forced Oscillations – Pohl's Torsional Pendulum: part 1.	5
6.	**Experiment 6:** Damped and Forced Oscillations – Pohl's Torsional Pendulum: part 2.	5
7.	**Experiment 7:** Determining the Specific Heat Capacity of Solids.	5
8.	**Experiment 8:** The thermal expansion of solid bodies : Measuring the linear thermal expansion.	5
9.	**Experiment 9:** Boyle s law: verification of Boyle s law , and measuring the atmospheric pressure.	5
10.	**Experiment 10:** Determining the volumetric expansion coefficient of water as liquid.	5
11.	**Experiment 11:**The latent heat of water	5
12.	**Revision**	5
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**	**35 %**
2.	**Midterm Exam 1**	**6th week**	**7.5 %**
4.	**Midterm Exam 2**	**11th week**	**7.5 %**
5.	**Final Exam**	**15th week**	**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	
Supportive References	-Laboratory Manual supplied by the Department of Physics. - Laboratory Manual is available at the website of the Department of Physics. Multimedia associated with The Labe manual and the relevant websites

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**

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هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title: **Modern Physics**	
Course Code: **PHY 1250**	
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***	

Table of Contents

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 4/ Year2)

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)**:**

Wave & Optics, PHY 1240

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	20 %
2.	Midterm Exam 1	6thweek	20 %
4.	Midterm Exam 2	12thweek	20 %
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**

Course Specification
(Bachelor)

Course Title: :	**Quantum Mechanics (1)**
Course Code:	**PHY 1312**
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***

Table of Contents

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 course provides an introduction to the concepts and formalism of quantum mechanics. Primary emphasis is on the time-independent Schrödinger equation and its applications to simple systems such as the harmonic oscillator, the square-well potential, Delta-function potential, and the hydrogen atom without spin. The postulates of quantum mechanics will be developed in the formalism of operator observables acting on a linear state space of wave functions, in analogy with finite dimensional matrix operations on vectors..

5. Pre-requirements for this course (if any)**:**

Modern Physics, PHY 1250

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Know the main features of the historical development of quantum mechanics.**
- **Acquire knowledge of the core aspects of quantum mechanics.**
- **Learn how to use the tools of quantum mechanics.**
- **Apply foundational mathematics to quantum mechanics.**
- **Learn the techniques to solve, through discussion and reading, a wide range of specific theoretical problems including their backgrounds and implications.**

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	Outline the background and main features of the historical development of quantum mechanics.	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	State the historical importance of De Broglie's hypothesis, Schrödinger's wave function, and Born's probabilistic interpretation of the wave function.	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	Describe and solve the Schrödinger equation in the standard one-dimensional examples- infinite and finite square wells, infinite well potentials, free particle, harmonic oscillator, and hydrogen atom.	K1, K2	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.4	**Define and describe the Hilbert space, Dirac notation, and Basic postulates of Quantum Mechanics.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
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	**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.	**Introduction (Historical Background)**: Development of the quantum theory, Experiments that led to the formulation of quantum mechanics, Wave-particle duality.	**4**
2.	**Wave Function:** Schrödinger equation, Statistical interpretation, Probability, Normalization, Fourier transform, Momentum, Position and momentum operators, Expectation value, Eherenfest's theorem, Uncertainty principle.	**16**

3.	**Time-Independent Schrödinger Equation:**Introduction, Method of separation of variables, Stationary states, Hamiltonian, Linear combination, Infinite square well, Harmonic oscillator, Free particle, Delta-function potential, Finite square well, Hydrogen atom.	20
4.	**Formalism& Mathematical background:**Hilbert space; vectors; Inner product; Linear transformation, Observables; Hermitian operators; Determinate states, Eigenfunctions of a Hermitian operator; Discrete spectra; Continuous spectra, Generalized statistical interpretation, The Uncertainty principle; Proof the generalized uncertainty principle; The Minimal-uncertainty wave packet; The Energy-time uncertainty principle, Dirac notation; Matrix elements; Ket; Bra; Dual space; Projection operator.	20
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
4.	**Midterm Exam 2**	**12th week**	**20 %**
5.	**Final Exam**	**16th week**	**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**

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***

Table of Contents

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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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**

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*	

Table of Contents

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	**Define key electrical concepts-current, voltage, and resistance.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**State the basic scientific principles of electrical and electronic devices.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the characteristics, operation and application of a broad range of electronic components, devices and equipment.**	K1, K2	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	Skills			
2.1	**Explain and summarize the basic knowledge gained from studying electronics course.**	S1, S2	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
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, 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.	**AC Fundamentals:** The Sine wave –Average and RMS values–The J operator – Polar and rectangular forms of complex numbers – Phasor diagram – Complex impedance and admittance- Concept of voltage and current sources – KVL and KCL- Application to AC circuits R, C, L, RL, RC, RLC - Resonance: Series resonance and parallel resonance RLC circuits.	8
2.	**Introduction to Semiconductor:** Atomic structure, semiconductors, conductor, Insulators, conduction in semiconductor, Pure semiconductor, recombination of electrons and holes Intrinsic and extrinsic semiconductors, N and P- type semiconductors, Mobility, Drift Velocity, Energy band gap. The potential barrier, Work function, Different type of electron emission, Applications of continuity equation for the study of junction behavior – Avalanche and zener breakdown.	8
3.	**PN Junction:** Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of: Junction diode, Zener diode, Tunnel diode and Varactor diode. Filter considerations.	8
4.	**Rectifiers:** Half wave and full wave and bridge rectifiers - power, efficiency and ripple factor for half wave and full wave rectifiers, Regulation – Harmonic components in rectified output.	6
5.	**Silicon Controlled Rectifier (SCR):** Structure and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control.	5

6.	**Bipolar Junction Transistor (BJT):** PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect- CB, CC, CE configurations (cut off, active, and saturation regions) CE configuration as two port network – Alpha and Beta of a transistor, Biasing and load line analysis – Fixed bias and self-bias arrangement. Transistor action, Transistor as an amplifier, Operating point, Load line, expressions for current gain, voltage gain, input impedance, output impedance and power gain. Power amplifier - power BJT - Thermal resistance - Maximum power- Class A, Class B, Class AB and Class C amplifiers -Basic operational amplifier- Differential amplifier.	8
7.	**Operational Amplifier fundamentals:** Characteristics – OpAmp parameters - inverting amplifier-non-inverting amplifier - unity follower - summing amplifier- difference amplifier. Differentiator, integrator, comparator using OP-Amps.	6
8.	**Field Effect Transistor (FET):** Field-Effect Transistors (FET): Construction and classification, Principle of operation, Characteristic curves, Characteristic parameters of the FET, Effect of temperature on FET, Common source amplifier, Common drain amplifier, Classification of MOSFET & UJT. Application of FET as voltage variable resistor and MOSFET as a switch – Advantages of FET over transistor.	5
9.	**Optoelectronic Devices:** Structure and operation of PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display.	3
10.	**Digital Electronics:** Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables – Positive and negative logic – Logic families and their characteristics – RTL, DTL, ECL, TTL and CMOS- Universal building blocks NAND and NOR gates.	3
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Floyd T. L., ***Electronic Devices, Prentice Hall***, 9th Edition (2011).
Supportive References	- Horowitz P. and Hill W., ***The Art of Electronics, Cambridge University Press***, 2nd Edition (1989).

	- Boylestad R.L. and Nashelsky L., ***Electronic Devices and Circuit Theory,*** Pearson Education (2005).
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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title	**Electronics**
Course Code:	**PHY 1324**
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*

Table of Contents

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 course introduces the characteristics and applications of semiconductor devices and circuits. Emphasis is placed on analysis, selection, biasing, and applications. Upon completion, students should be able to construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment. This course covers the concepts, equations and construction of analogue and electronics circuits and it includes amplification, filtering, oscillation, voltage regulation, and other analog circuits. It deals also with semiconductor devices used in industrial applications such as the basic theory, application, and operating characteristics of semiconductor devices.					
5. Pre-requirements for this course (if any)**:**					
Electricity & Magnetism , PHY 1221					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Understand the basic principles of circuit theorems.**
- **Develop and enhance the students' knowledge and understanding of the concepts of electronics.**
- **Appreciate semiconductor technologies and their use in basic circuits.**
- **Get a lot of practical experience in building all kinds of electronic circuits.**

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	**Define key electrical concepts-current, voltage, and resistance.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**State the basic scientific principles of electrical and electronic devices.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the characteristics, operation and application of a broad range of electronic components, devices and equipment.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Outline formulates for solving electronic problems and analyzing electronic circuits.**	**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 electronics 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, 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.	**AC Fundamentals:** The Sine wave –Average and RMS values–The J operator – Polar and rectangular forms of complex numbers – Phasor diagram – Complex impedance and admittance- Concept of voltage and current sources – KVL and KCL- Application to AC circuits R, C, L, RL, RC, RLC - Resonance: Series resonance and parallel resonance RLC circuits.	8
2.	**Introduction to Semiconductor:** Atomic structure, semiconductors, conductor, Insulators, conduction in semiconductor, Pure semiconductor, recombination of electrons and holes Intrinsic and extrinsic semiconductors, N and P- type semiconductors, Mobility, Drift Velocity, Energy band gap. The potential barrier, Work function, Different type of electron emission, Applications of continuity equation for the study of junction behavior – Avalanche and zener breakdown.	8
3.	**PN Junction:** Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of: Junction diode, Zener diode, Tunnel diode and Varactor diode. Filter considerations.	8

4.	**Rectifiers:** Half wave and full wave and bridge rectifiers - power, efficiency and ripple factor for half wave and full wave rectifiers, Regulation – Harmonic components in rectified output.	6
5.	**Silicon Controlled Rectifier (SCR):** Structure and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control.	4
6.	**Bipolar Junction Transistor (BJT):** PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect-CB, CC, CE configurations (cut off, active, and saturation regions) CE configuration as two port network – Alpha and Beta of a transistor, Biasing and load line analysis – Fixed bias and self-bias arrangement. Transistor action, Transistor as an amplifier, Operating point, Load line, expressions for current gain, voltage gain, input impedance, output impedance and power gain. Power amplifier - power BJT - Thermal resistance - Maximum power- Class A, Class B, Class AB and Class C amplifiers -Basic operational amplifier- Differential amplifier.	8
7.	**Operational Amplifier fundamentals:** Characteristics – OpAmp parameters - inverting amplifier-non-inverting amplifier - unity follower - summing amplifier-difference amplifier. Differentiator, integrator, comparator using OP-Amps.	6
8.	**Field Effect Transistor (FET):** Field-Effect Transistors (FET): Construction and classification, Principle of operation, Characteristic curves, Characteristic parameters of the FET, Effect of temperature on FET, Common source amplifier, Common drain amplifier, Classification of MOSFET & UJT. Application of FET as voltage variable resistor and MOSFET as a switch – Advantages of FET over transistor.	6
9.	**Optoelectronic Devices:** Structure and operation of PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display.	4
10.	**Digital Electronics:** Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables – Positive and negative logic – Logic families and their characteristics – RTL, DTL, ECL, TTL and CMOS- Universal building blocks NAND and NOR gates.	4
	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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
4.	**Midterm Exam 2**	**12th week**	**20 %**
5.	**Final Exam**	**16th week**	**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	- Floyd T. L., ***Electronic Devices, Prentice Hall***, 9th Edition (2011).
Supportive References	- Horowitz P. and Hill W., ***The Art of Electronics, Cambridge University Press***, 2nd Edition (1989). - Boylestad R.L. and Nashelsky L., ***Electronic Devices and Circuit Theory***, Pearson Education (2005).
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

Course Specification
(Bachelor)

Course Title:	**Electromagnetism Laboratory**
Course Code:	**PHY 1381**
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*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 4/ Year2)					

4. Course General Description:

Fundamental experiments in electricity and magnetism will be the focus of this Lab. Every class will have a short lecture introducing the procedures, concepts, formulas and instructions relevant to the experiment. The lecture will also cover what is expected in the lab-report; don't be late. Attendance and participation is mandatory. Experiments will usually be performed in groups, but each student will turn in an individual lab report.

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):

- **Observe and analyze physical data relevant to some of the experiments in electricity and magnetism.**
- **Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.**
- **Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.**
- **Instruct students in the competent use of laboratory equipment to collect and record data, apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the physical world.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**0**
2.	**Laboratory/Studio**	**30**
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	**Recognize the scientific method of inquiry to draw conclusions based on verifiable evidence.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the theoretical bases of capacitors.**	**K1, K3**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the theoretical bases of magnetic field laws using inductors characteristics experiments.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.4	**Describe the theoretical bases of resistor-inductor-capacitor (RLC) RLC circuits and associated electrical behavior experiments.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Analyze experiments according to the plan besides the learning from lab lecture.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Explain and use information from the output of experiment to draw conclusions.**	**S2, S3**	▪ Problem classes and group tutorial. ▪ Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Summarize conclusions and write reports.**	**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.
2.4	**Communicate in a clear and concise manner orally, paper and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • 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. ▪ Feedback and explanations.
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.	**Introduction.**	6
2.	**Experiment 1:** Determining the capacitance of a plate capacitor.	4
3.	**Experiment 2:** Parallel and Series Connection of Capacitors.	4
4.	**Experiment 3:** The RC Circuit.	6
5.	**Experiment 4:** Measuring the Magnetic Field for a Straight Conductor and on Circular Conductor Loops.	6
6.	**Experiment 5:** The Magnetic Field of an Air Coil.	6
7.	**Revision.**	5
8.	**Experiment 6:** Electron Charge-to-Mass Ratio.	4
9.	**Experiment 7:** RL Circuits.	4
10.	**Experiment 8:** Alternating Current with Coil and Ohmic Resistors.	6
11.	**Experiment 9:** Determining the Capacitive Reactance of a Capacitor in an AC Circuit.	4
12.	**Revision**.	5
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**	**35 %**
2.	**Midterm Exam 1**	**6th week**	**7.5 %**
4.	**Midterm Exam 2**	**12th week**	**7.5 %**
5.	**Final Exam**	**15th week**	**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	
Supportive References	
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	• Laboratory Manual supplied by the Department of Physics. • Laboratory Manual is available at the website of the Department of Physics.

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

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

Course Specification
(Bachelor)

Course Title:	Quantum Mechanics (2)
Course Code:	PHY 1313
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*

Table of Contents

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/ Year 3)					
4. Course General Description:					
A continuation of PHY 1312, this course introduces quantum mechanics in three-dimensional systems, perturbation and approximation methods, and scattering theory.					
5. Pre-requirements for this course (if any)**:**					
Quantum Mechanics (1), PHY 1312					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

At the end of this course, students will be able to:

- **Apply the concept of quantum Mechanics to quantitatively predict behavior of the quantum physical systems.**
- **Choose the appropriate mathematical techniques.**
- **Deal with conceptually rich and technically difficult theoretical problems.**
- **Solve through discussion and reading, a wide range of specific theoretical problems, including their backgrounds and implications.**

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 Schrödinger equation in three dimensions and quantization of angular momentum.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline the background and main features of perturbation method.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Define and write the WKB approximation for solving the eigenvector equation.**	**K1, K2**	• Lectures. • Class discussions. Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. Homework.
1.4	**Describe the scattering theory.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying the 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**	**S4, S5**	• Lectures. • Class discussions.	▪ Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	orally, and using IT for acquiring and analyzing information.		• Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ 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.	**Quantum Mechanics in Three Dimensions:** Introduction, Schrödinger equation in spherical coordinates, Method of separation of variables, Angular equation, Azimuthal quantum number, magnetic quantum number, radial equation, Effective potential, Infinite spherical well, Hydrogen atom, Angular momentum, Eigenvalues, Eigen functions, Spin. Pauli spin matrices, Stern-Gerlach experiment, Addition of angular momenta.	**14**
2.	**Time-Independent Perturbation Theory:** Nondegenerate perturbation theory, First-order corrections, Second-order corrections, Degenerate perturbation theory, Fine structure of Hydrogen, Stark effect, Zeeman effect, Hyperfine splitting.	**14**
3.	**WKB Approximation:** Classical region, Tunneling, Connection Formulas.	**10**
4.	**Time-Dependent Perturbation Theory:** Quantum dynamics, perturbed system, Time-Dependent Perturbation Theory, Two-Level systems, Emission and absorption of radiation, incoherent perturbation, spontaneous emission.	**12**
5.	**Scattering:** Introduction, Classical scattering theory, Quantum scattering theory, Partial wave analysis, Phase shifts, Born approximation.	**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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	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	- Griffiths D.J., ***Introduction to Quantum Mechanics***, 2nd Edition, Pearson Prentice Hall, NJ, USA (2004).
Supportive References	- Gasiorowicz S., ***Quantum Physics,*** 3rd Edition, Wiley, NJ, USA (2003). - Liboff R.L., ***Introductory Quantum Mechanics,*** Addison Wesley(2002).
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

Course Specification

(Bachelor)

Course Title: **Statistical physics**	
Course Code: **PHY 1332**	
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 6/ Year 3)					
4. Course General Description:					
This course presents the mathematics and quantum mechanics needed to understand statistical thermodynamics. It covers several important topics, including a mathematically sound presentation of statistical thermodynamics; the kinetic theory of gases including transport processes; and thorough, modern treatment of the thermodynamics of magnetism.					
5. Pre-requirements for this course (if any)**:**					
Thermal Physics, PHY 1230 and Quantum Mechanics (1), PHY 1312					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

At the end of the course, students will be able to:

- **Define and discuss the concepts of macro state and microstate of a model system.**
- **Discuss the Boltzmann distribution and the role of the partition function.**
- **Define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltzmann distribution.**
- **Apply the Fermi-Dirac distribution to the calculation of thermal properties of electrons in metals.**
- **Apply the Bose-Einstein distribution to the calculation of properties of black body radiation.**

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	33
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	**Outline the background and main features of the historical development of quantum mechanics.**	**K1, K2**	• Lectures. • Tutorials. Class discussions.	▪ Exams. ▪ Participation. Discussions.
1.2	**State the historical importance of De Broglie's hypothesis, Schrödinger's wave function, and Born's probabilistic interpretation of the wave function.**	**K1, K2**	• Lectures. • Tutorials. Class discussions.	▪ Exams. ▪ Homework. Quizzes.
1.3	**Describe and solve the Schrödinger equation in the standard one-**	**K1, K2**	• Lectures. • Class discussions. Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	dimensional examples- infinite and finite square wells, infinite well potentials, free particle, harmonic oscillator, and hydrogen atom.			Homework.
1.4	**Define and describe the Hilbert space, Dirac notation, and Basic postulates of Quantum Mechanics.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.5	**Outline the Laws of thermodynamics and understand their statistical foundations.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Values, autonomy, and responsibility**			
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	**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.	**Statistical Thermodynamics:** Coin-tossing experiment. System of distinguishable particles. Thermodynamic probability and entropy. Quantum states and energy levels. Density of quantum states.	8
2.	**Classical Statistics of Maxwell-Boltzmann:** Boltzmann statistics. The Boltzmann distribution. Partition function. Dilute gases and the Maxwell-Boltzmann distribution. The connection between classical and statistical thermodynamics. Thermodynamic properties from the partition function. Partition function for a gas. Properties of a monatomic ideal gas. Applicability of the Maxwell-Boltzmann distribution. Distribution of molecular speeds. Equipartition of energy.	12
3.	**Quantum statistics:** The Fermi-Dirac distribution. The Bose-Einstein distribution. Comparison of the distributions.	10
4.	**Bose-Einstein and Fermi-Dirac Gases:** Blackbody radiation and properties of a photon gas. Bose-Einstein condensation. Properties of a boson gas. Application to liquid helium. The Fermi energy. The calculation of the chemical potential. Free electrons in a metal. Properties of a fermion gas. Application to white dwarf stars.	10
5.	**The heat Capacity of a diatomic gas and of a solid:** The quantized linear oscillator. Vibrational modes of diatomic molecules. Rotational modes of diatomic molecules. Electronic excitation. The total heat capacity. Einstein theory of the heat capacity of a solid. Debye's theory of the heat capacity of a solid.	10
6.	**The Thermodynamic of Magnetism:** Para magnetism. Properties of a spin ½ paramagnet. Adiabatic demagnetization. Negative temperature. Ferromagnetism.	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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Asheley H. Carter, ***Classical and Statistical Thermodynamics,*** Prentise Hall (2000).
Supportive References	- Lokanathan S. and Gambhir R.S., ***Statistical and Thermal Physics: an introduction,*** P. H. I. (1991). - Patharia R. K., ***Statistical Mechanics,*** Oxford: Butterworth (1996). - Mandel F., ***Statistical Physics,*** 2nd Edition, John Wiley (1988).
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**

Course Specification

(Bachelor)

Course Title: : **Atomic Physics**	
Course Code: **PHY 1362**	
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***	

Table of Contents

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/ Year 3)					
4. Course General Description:					

Using the quantum approach to the subject of atomic physics, this course keeps the mathematics to the minimum needed for a clear and comprehensive understanding of the material. Beginning with an introduction and treatment of atomic structure, the course goes on to deal with quantum mechanics, atomic spectra and the theory of interaction between atoms and radiation. This course covers the following topics: the hydrogen atom, the hydrogen atom-fine structure, two-electron atoms, many-electron atoms, interaction with static external fields, interaction with static external fields, and hyperfine structure.

5. Pre-requirements for this course (if any)**:**

Quantum Mechanics (1), PHY 1312

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Understand the concepts of a good quantum number and simultaneous observability.**
- **Understand the quantum numbers, including their physical significance, and quantum mechanical states of the hydrogen atom.**
- **Understand time independent perturbation theory including its derivation and be able to apply it to simple systems, including the Stark-Effect and Zeeman Effect.**
- **Know about the origins of fine structure in atomic spectra.**
- **Understand the exchange degeneracy and how this affects the excited states of helium.**
- **Understand the Periodic table from the viewpoint of the electronic structure.**
- **Understand and be able to apply to simple cases time dependent perturbation theory.**
- **Understand the derivation of and be able to apply the selection rules for the interaction of electric dipole radiation and atoms.**

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	**State the basic principles of quantum mechanics in the physics of atoms.**	**K1, K2**	• Lectures. • Tutorials. Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the basic concepts related to atomic structure and atomic features.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the basic concepts of interaction between atom and electric and magnetic field.**	**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. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	gained from studying the course.			
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	**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.	**The hydrogen atom:** The Schrödinger equation, Stationary states, Expectation values, Solution of Schrödinger's equation for a Coulomb field, The quantum numbers ℓ and m_ℓ, The hydrogen energy spectrum.	**12**
2.	**The hydrogen atom-fine structure:** Electron spin, The interaction terms, The vector model, The Lamb shift.	**8**
3.	**Two-electron atoms:** Electrostatic interaction and exchange degeneracy, The ground state of helium, The excited states of helium, Electron spin functions and the Pauli exclusion principle, The periodic system.	**10**
4.	**Many-electron atoms:** The central field, Thomas-Fermi potential, The LS coupling approximation, allowed terms in LS coupling, Fine structure in LS coupling, The j-j coupling approximation.	**10**
5.	**Interaction with static external fields:** Zeeman effect in LS coupling, Quadratic Stark effect, Linear Stark effect.	**10**
6.	**Hyperfine structure:** Magnetic dipole interaction, Determination of nuclear spin from magnetic hyperfine structure, Determination of μ_I from magnetic hyperfine structure, Magnetic hyperfine structure in two-electron	**10**

	spectra, Electric quadrupole interaction, Zeeman effect of hyperfine structure.	
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Woodgate G. K., ***Elementary Atomic Structure,*** McGraw-Hill (1983).
Supportive References	- Jones D. G. C. ***Atomic Physics,*** Chapman and Hall (1997). Foot C.J., ***Atomic Physics,*** Oxford (2005).
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

Course Specification
(Bachelor)

Course Title:	**Electronics Laboratory**
Course Code:	**PHY 1382**
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: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 6/ Year 3)					

4. Course General Description:

This laboratory course is designed to provide students with fundamental concepts of Electronic Circuits for lab experience. Emphasis is placed on analysis, selection, biasing, and applications. Upon completion, students should be able to construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment. Every class will have a short lecture introducing the procedures, concepts, formulas and instructions relevant to the experiment. The lecture will also cover what is expected in the lab-report; don't be late. Attendance and participation is mandatory. Experiments will usually be performed in groups, but each student will turn in an individual lab report.

5. Pre-requirements for this course (if any):

Electronics, PHY 1324

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

- Observe and analyze physical data relevant to some of the experiments in electronics.
- Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
- Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.
- Instruct students in the competent use of laboratory equipment to collect and record data, apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the physical world.

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**	**0**
2.	**Laboratory/Studio**	**30**
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	**Recognize the scientific method of inquiry to draw conclusions based on verifiable evidence such as semiconducting p-n junctions and its characteristics.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.2	**Describe the theoretical bases of transformation the alternative voltage (ac) to direct voltage (dc) using the rectification behavior of the diodes and their various circuits experiments.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Discussion. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	**Describe the theoretical bases of voltage regulation using Zener diodes and their electrical, electronic circuits' experiments and bipolar transistor characteristics experiments.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. • Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
2.0	**Skills**			
2.1	**Analyze experiments according to the plan besides the learning from lab lecture.**	**S1; S2**	• Using the multimedia and visual materials, Lab manual and the theoretical bases of the course. • Interaction between students in the lab course community and discussions in the lab.	Analyze experiments according to the plan besides the learning from lab lecture.
2.2	**Explain and use information from the output of experiment to draw conclusions.**	**S2; S3**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	Explain and use information from the output of experiment to draw conclusions.
2.3	**Summarize conclusions and write reports.**	**S3; S4**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Summarize conclusions and write reports.
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.	**Introduction.**	8
2.	**Experiment 1:** Recording the current-Voltage characteristic of a diode.	6
3.	**Experiment 2:** Half-wave rectifier circuit.	6
4.	**Experiment 3:** Full-wave rectifier circuit	6
5.	**Experiment 4:** Capacitor filter circuit.	4
6.	**Revision.**	4
7.	**Experiment 5:** Zener-diode characteristics.	4
8.	**Experiment 6:** Voltage stabilization with Zener diode.	4
9.	**Experiment 7:** Bipolar transistor characteristics.	4
10.	**Experiment 8:** Field Effect Transistor (FET).	4
11.	**Revision.**	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	35 %
2.	Midterm Exam 1	6th week	7.5 %
3.	Midterm Exam 2	11th week	7.5 %
4.	Final Exam	15th week	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	
Supportive References	-Laboratory Manual supplied by the Department of Physics. - Laboratory Manual is available at the website of the Department of Physics.

	- Multimedia associated with The Labe manual and the relevant websites
Electronic Materials	- **https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	- Laboratory Manual supplied by the Department of Physics. Laboratory Manual is available at the website of the Department of Physics.

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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Computer Applications in Physics
Course Code:	PHY 1335
Program:	Bachelor of Science in Physics.
Department:	Physics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	1
Last Revision Date:	*26/09/2024*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 6/ Year 3)					
4. Course General Description:					
This course offers a foundational understanding of MATLAB as a computational tool in the field of physics. It emphasizes the application of MATLAB to solve real-world physics problems, equipping students with essential skills for analysis and modeling across diverse physical scenarios.					
5. Pre-requirements for this course (if any):					
Mathematical Physics (2), PHY 1334					
6. Co-requisites for this course (if any): None					
7. Course Main Objective(s):					
• Develop a foundational understanding of MATLAB as a computational tool for physics. • Apply MATLAB to solve real-world physics problems. • Gain proficiency in data analysis, visualization, and simulation of physical phenomena.					

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 basic knowledge of MATLAB.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline simple computer programmes to solve problems in physics.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
2.0	Skills			
2.1	**Explain and summarize the basic knowledge gained from studying computer applications in 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.
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.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
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.	**Introduction to MATLAB:** Overview of MATLAB Interface, Basic Programming in MATLAB.	15
2.	**Fundamental Tools for Physics in MATLAB:** Vectors and Matrices, Plotting and Visualization, Symbolic Mathematics, Symbolic Mathematics.	15
3.	**Data Analysis and Fitting**: Data Import and Export in MATLAB, Curve Fitting and Optimization.	10
4.	**Physical problems:** Classical Mechanics, Electricity and Magnetism, Waves and optics, Modern Physics and Quantum Mechanics.	20
	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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	Mathematical Methods for Physics: Using MATLAB and Maple by J. R. Claycomb, Mercury Learning and Information, 2018.
Supportive References	- MATLAB for Engineers and Scientists by Amos Gilat, 6th Edition, John Wiley & Sons, 2017. - One Hundred Physics Visualizations Using Matlab by Dan Green, World Scientific, 2013.

	- More Physics with Matlab by Dan Green, World Scientific Publishing Company, 2015. - Computational Physics by Nicholas Giordano and Hisao Nakanishi, 2nd Edition, Pearson Education India, 2012
Electronic Materials	https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx MATLAB Documentation and Tutorials. Physics-related MATLAB examples on MathWorks.
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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Solid State Physics**
Course Code:	**PHY 1461**
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***

Table of Contents

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 7/ Year 4)					
4. Course General Description:					
This course integrates theory of Solid State Physics with experimental demonstrations in the Research Physics Lab. The course will provide a valuable theoretical introduction and an overview of the fundamental applications of the physics of solids. This course includes theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors, diamagnetism and paramagnetic, ferromagnetism and antiferromagnetic.), based on the classical and quantum physics principles.					
5. Pre-requirements for this course (if any):					
Quantum Mechanics (2), PHY 1313					
6. Co-requisites for this course (if any):					
7. Course Main Objective(s):					

- Understand basic physical concepts and mathematical tools used to describe solids.
- Develop knowledge and understanding the fundamental applications of the physics of solid.
- Describe the theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials.
- Learn the techniques to solve, through discussion and reading, a wide range of specific theoretical problems including their backgrounds and implications.

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	**State the fundamental applications of the physics of solids.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe and state the lattice dynamics, phonons and thermal properties.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the structure and physical properties (mechanical, electrical, optical & thermal) of materials.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	Skills			
2.1	**Explain and summarize the basic knowledge gained from studying the course.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
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	**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.	**Crystal Structure:** Periodic array of atoms; fundamental types of lattices; index systems for crystal planes, simple crystal structures; direct imaging of atomic structure; non-ideal crystal structures.	**12**
2.	**Wave Diffraction and the Reciprocal Lattices:** Diffraction of waves by crystals; scattered wave amplitude; Brillouin zones; Fourier analysis of the basis.	**14**
3.	**Binding in Crystals:** Basic types of binding, examples.	**6**
4.	**Phonons-Crystal Vibrations:** Vibrations of crystals with monoatomic basis; two atoms per primitive basis; quantization of elastic waves; phonon momentum; inelastic scattering by phonons.	**10**
5.	**Phonons-Thermal Properties:** Phonon, heat capacity; an harmonic crystal interactions; thermal conductivity.	**8**
6.	**Free electron Fermi gas:** Energy level in One dimension, effect of temperature on the Fermi-Dirac distribution, Free electron gas in three dimensions, Heat capacity of the electron gas, electrical conductivity and Ohm's law.	**10**
7.	**Semiconductor crystals:** Band Gap, equations of Motion, intrinsic Carrier Concentration, impurity Conductivity and Thermoelectric Effects.	**6**

8.	**Introduction to superconductivity.**	4
9.	**Introduction to magnetism:** Diamagnetism, Paramagnetic, Ferromagnetism and Antiferromagnetic.	5
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Kittel C., ***Introduction to Solid State Physics***, 8th Edition, John Wiley & Sons, NY (2004).
Supportive References	- Ashcroft N.W. and Mermin N. D., Solid State Physics, Rinehart and Winston, NY (1976).
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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAA

2024
TP-153

Course Specification
(Bachelor)

Course Title: :	**Nuclear Physics**
Course Code:	**PHY 1464**
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***

Table of Contents

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 7/ Year 4)					

4. Course General Description:

This course introduces basic nuclear physics, including nuclear decays and reactions and nuclear structure, while covering the essential areas of basic research and practical applications. It provides fundamental principles that underline nuclear science and its applications, as well as mathematical tools needed to grasp these concepts. Applications to nuclear science will be used to illustrate these principles. Discussions of theory are reinforced with examples which illustrate and apply the theoretical formulism, thus aiding students in their reading and analysis of current literature.

5. Pre-requirements for this course (if any)**:**

Quantum Mechanics (1), PHY 1312

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- Learn and understand the basic properties of the nucleus.
- Understand the role of conservation laws in decay processes and reactions.
- Learn the principles of nuclear physics related to fission and fusion.
- Compare and construct different reaction mechanisms in relation to cross-sections, excitation functions, and angular distributions.
- Summarize and account for the main aspects of some applications of nuclear 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	**Define and recall the basic nuclear concepts and nuclear properties.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the force between nucleons.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the main nuclear models.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Demonstrate basic knowledge of radioactive decay.**	**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 the 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	**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.	**Basic Nuclear Concepts and Nuclear Properties:** History and overview, Some introductory terminology, Nuclear properties, Units and dimensions, The nuclear radius, Mass and abundance of nuclides, Nuclear binding energy, Nuclear angular momentum and parity, Nuclear electromagnetic moments.	**12**
2.	**The force between nucleons:** The deuteron, Proton-proton and neutron-neutron interactions, Properties of the nuclear force.	**12**
3.	**Nuclear Models:** The shell model, Even-Z, Even-N nuclei and collective structure.	**12**
4.	**Radioactive Decay:** The radioactive decay law, Production and decay of radioactivity, Growth of daughter activities, Types of decay, Natural radioactivity, Units for measuring radiation.	**12**
5.	**Nuclear Reactions:** Types of reactions and conservation laws, Energetics of nuclear reactions, Isospin, Reaction cross section, Experimental	**12**

	techniques, Coulomb scattering, Nuclear scattering, Direct reactions. Fusion and Fission.	
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Krane K.S., ***Introductory Nuclear Physics,*** Wiley (1988).
Supportive References	- Burcham W.E. and Jobes M., ***Nuclear and Particle Physics,*** 2nd Edition, John Wiley & Sons Inc (1995). - Knoll G.F., ***Radiation Detection and Measurements,*** 2nd Edition, Wiley (2010). - M Guran A. C and Zimmerman W.B., ***The Quantum World of Nuclear Physics,*** World Scientific (2005).
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

Course Specification
(Bachelor)

Course Title **Fluid Mechanics**	
Course Code: **PHY 1404**	
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***	

Table of Contents

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 7/ Year4)					
4. Course General Description:					
This course covers the basic concepts and principles of modern fluid mechanics. It examines the fundamental aspects of fluid motion including important fluid properties, regimes of flow, pressure variations in fluids at rest and in motion, methods of flow description and analysis. The course consists of examples and text involving everyday situations to reinforce the concept that fluid mechanics is an important part of our world as well as enabling students to master problem solving skills.					
5. Pre-requirements for this course (if any)**:**					
Mathematical Physics (2), PHY 1334					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Understand the fundamental a fluid mechanics fundamental, including concepts of mass and momentum conservation.
- Apply the Bernoulli equation to solve problems in fluid mechanics.
- Apply control volume analysis to problems in fluid mechanics.
- Use potential flow theory to solve problems in fluid mechanics.
- Gain a knowledge of laminar and turbulent boundary layer fundamentals.

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		

No	Mode of Instruction	Contact Hours	Percentage
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		55

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 basic concepts and principles of fluid mechanics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Define and interpret fluid statics, kinematics and dynamics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Apply the concepts of the continuity, energy and momentum equations and flow measurements in fluid flows.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. Homework.
1.4	**Demonstrate basic knowledge of fluid mechanics of water waves and particle displacement.**	**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**	**S2, S3**	▪ Problem classes and group tutorial.	▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	analyze problems in physics related the topics covered by the course.		Homework assignments as well as problems solutions.	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	**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.	**Fluid Mechanics Basics:** Flow, Pressure, Properties of fluids, Viscosity.	**10**
2.	**Statics:** Hydostatic pressure, Manometer –pressure measurement. Hydrostatic forces on submerged surfaces.	**10**
3.	**Kinematics:** Particle paths and streamlines, material derivatives, continuity equation, incompressibility and stream-function, analysis of motion relative to a point (in -2D), irrotational flow, velocity potential, complex potential.	**12**
4.	**Momentum and energy in inviscid flow:** Body forces and stresses Euler's momentum equation, hydrostatics, Brenoulli's theorem and its applications, Kelvin's circulation theorem.	**10**
5.	**Potential flow:** Uniform stream, line-source, dipole, line-vortex, modeling of flow round cylinders.	**10**
6.	**Linear water waves:** Particle paths, phase and group velocity.	**8**
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
4.	**Midterm Exam 2**	**12th week**	**20 %**
5.	**Final Exam**	**16th week**	**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	- Young D.F., Munson B.R., Okiishi T.H. and Huebsch W.W., ***Introduction to Fluid Mechanics,*** SI Version, 5th Edition, Wiley (2011).
Supportive References	- ***Robert W.F., Alan T.M, and Pritchard P.J., Introduction*** to fluid mechanics, 6th Edition, Wiley (2004). - Prieve D.C., ***A Course in Fluid Mechanics with Vector Field Theory,*** Web Draf (2000). - Chorin A. and Marsden J.E., ***A Mathematical Introduction to Fluid Mechanics,*** 4th Edition, Springer-Verlag Publishing Company (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

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

Course Specification

(Bachelor)

Course Title:	**Computational Physics**
Course Code:	**PHY 1436**
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***

Table of Contents

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 8/ Year 4)					
4. Course General Description:					
Computers and computation are extremely important components of physics and should be integral parts of a physicist's education. Furthermore, computational physics is reshaping the way calculations are made in all areas of physics. This course covers the different types of computational problems using a programming language with exercises developed around problems of physical interest.					
5. Pre-requirements for this course (if any)**:**					
Computer Application in Physics, PHY 1335					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Learn and understand the basic knowledge of computational methods used in physics.**
- **Formulate a physical problem in a manner suitable for computational solution.**
- **Construct a working, structured program in programming language that includes standard numerical procedures to solve a physical problem.**
- **Employ appropriate numerical method to interpolate and extrapolate data collected from physics experiments.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• 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**	**30**
3.	**Field**	
4.	**Tutorial**	**0**
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	**Outline the computational methods in solving problems in physics.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.2	**Describe and state the interpolation, extrapolation and data fitting, numerical ordinary and partial differential equations, numerical integration, and matrix algebra.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report. • Performing lab. experiments at the scheduled times.	▪ Discussion. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.3	**Implement numerical algorithms into MATLAB and visualize the results of the computations.**	**K1;K2**	• Supervision by lab instructor • Submitting an individual lab report.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			Performing lab. experiments at the scheduled times.	▪ Exams.
1.4	**Outline the computational methods in solving problems in physics.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.1	**Explain and summarize the basic knowledge gained from studying computational physics.**	**S1; S2**	• Using the multimedia and visual materials, Lab manual and the theoretical bases of the course. Interaction between students in the lab course community and discussions in the lab.	▪ Analyze experiments according to the plan besides the learning from lab lecture.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2; S3**	Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Explain and use information from the output of experiment to draw conclusions.
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S3; S4**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Summarize conclusions and write reports.
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.	**Introduction:** Overview - A Programming Language: Computer algorithms and languages, Using different software's, Applications: Newton and Kepler laws.	7
2.	**Finding roots of equations:** Bisection method- Newton's method- fixed point method, Algebraic and transcendental equations, Rearrangement of the equation.	8
3.	**Interpolation:** Polynomial interpolation, linear interpolation, quadratic interpolation, Lagrange interpolation, Newton difference method.	5
4.	**The method of least squares (Data Fitting)** Linear least squares; non-linear least squares.	5
5.	**Numerical Integration:** One dimensional integral: Rectangle rule; Trapezium rule; Simpson's rule; Gaussian integration.	6
6.	**Numerical solution of linear system (Matrix Algebra):** Simultaneous linear equations; Gaussian elimination; Pivoting, LU and cholesky.	5
7.	**Iterative method:** Jacobi, Gauss–Seidel iteration; convergence and matrix norm, tridiagonal matrices.	6
8.	**Numerical solution of Differential equations:** Difference equations; Euler and Picard methods; Taylor series solutions; System of equations, Runge– Kutta methods, Higher-order equations.	6
9.	**Finite differences method for ordinary differential equations**	6
10.	**Introduction to PDEs:** First order linear PDEs -Second order linear PDEs.	6
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	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	**Final Exam**	**16th week**	**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	- Chow T., Mathematical Methods for Physicists: A Concise Introduction, Cambridge University Press (2000).
Supportive References	-Pang Tao, An Introduction to Computational Physics, Cambridge University Press, (2006). -Richard Fitzpatrick, Computational Physics Texas University Press (2006).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	- Laboratory Manual supplied by the Department of Physics. Laboratory Manual is available at the website of the Department of Physics.

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, ...)**

Assessment Areas/Issues	Assessor	Assessment Methods
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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Solid State Physics & Modern Physics Laboratory
Course Code:	PHY 1481
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: (2)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (Level 8/ Year 4)					
4. Course General Description:					
This course provides laboratory work at the advanced undergraduate level. The course emphasizes experimental techniques, procedures and formal report writing. Laboratory experiments reinforce or extend the work of the lecture portion of the course. The course includes experimental description of crystal and electronic structure, lattice dynamics, and optical properties of different materials.					
5. Pre-requirements for this course (if any)**:**					
Solid State Physics, PHY 1461					
6. Co-requisites for this course (if any)**:**					

7. Course Main Objective(s):

- Observe and analyze physical data relevant to some of the experiments in solid state physics and Modern Physics.
- Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
- Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.
- Instruct students in the competent use of laboratory equipment to collect and record data,
- Apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the physical world.

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**	**0**
2.	**Laboratory/Studio**	**30**
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	**Recognize the scientific method of inquiry to draw conclusions based on verifiable evidence of crystallography.**	**K1; K2**	• Supervision by lab instructor • Submitting an individual lab report. Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
1.2	**Describe the theoretical bases of transport phenomena of charged carrier experiments.**	**K1; K2**	• Supervision by lab instructor • Submitting an individual lab report. • Performing lab. experiments at the scheduled times.	▪ Discussion. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	**Describe the theoretical bases of photoconduction process in semiconductors experiments.**	**K1; K2**	• Supervision by lab instructor • Submitting an individual lab report. • Performing lab. experiments at the scheduled times.	▪ Participation. ▪ Report evaluation. ▪ Lab experiment check. ▪ Exams.
2.0	**Skills**			
2.1	**Analyze experiments according to the plan besides the learning from lab lecture.**	**S1; S2**	• Using the multimedia and visual materials, Lab manual and the theoretical bases of the course. Interaction between students in the lab course community and discussions in the lab.	Analyze experiments according to the plan besides the learning from lab lecture.
2.2	**Explain and use information from the output of experiment to draw conclusions.**	**S2; S3**	Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	Explain and use information from the output of experiment to draw conclusions.
2.3	**Summarize conclusions and write reports.**	**S3; S4**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Summarize conclusions and write reports.
2.4	**Communicate in a clear and concise manner orally, on paper and using IT for acquiring and analyzing information.**	**S4; S5**	• Lectures. • Class discussions. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Communicate in a clear and concise manner orally, on paper and using IT for acquiring and analyzing information.
3.0	**Values, autonomy, and responsibility.**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Reports. ▪ Presentations. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	works, as well as solve problems independently.			

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction.**	5
2.	**Experiment 1:** Diffraction of electron in a polycrystalline lattice (Debye-Scherrer diffraction).	5
3.	**Experiment 2:** Plank's constant (h)	5
4.	**Experiment 3:** Bragg reflection: diffraction of x-rays at a monocrystal.	5
5.	**Experiment 4:** Investigating the Hall effect in silver.	5
6.	**Revision.**	5
7.	**Experiment 5:** Recording the current-voltage characteristics of a CdS photoresistor.	5
8.	**Experiment 6:** Determination of the Specific Charge of the Electron.	5
9.	**Experiment 7:** Electron spin resonance (ESR).	5
10.	**Revision.**	10
Total		**55**

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**	**35 %**
2.	**Midterm Exam 1**	**6th week**	**7.5 %**
4.	**Midterm Exam 2**	**11th week**	**7.5 %**
5.	**Final Exam**	**15th week**	**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	
Supportive References	-Laboratory Manual supplied by the Department of Physics.

	- Laboratory Manual is available at the website of the Department of Physics. Multimedia associated with The Labe manual and the relevant websites
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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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NCAAA

2024
TP-155

Field Experience Specification
(Bachelor)

Course Title:	**Field Training**
Course Code:	**PHY 1496**
Program:	**Bachelor of Science in Physics.**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	1
Last Revision Date:	***26/09/2024***

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A. Field Experience Details:

1. Credit hours: (4).		
2. Level/year at which Field Experience is offered: (4/2 or 8/4.).		
Field training is required as well as for the exit- point.		
3. Time allocated for Field Experience activities		
(12) Weeks	(24 = 2days/week) Days	(192h= 8h/day) Hours
4. Corequisite (or prerequisites, if any) to join Field Experience		
<u>Bachelor's Degree Requirements</u>: **Students must accumulate a minimum of 120 credits.** **<u>Exit-Point Requirements:</u>** **Students must complete at least 54 credits.**		
5. Mode of delivery		
☒ In-person/onsite	☐hybrid (onsite/online)	☐Online

B. Field Experience Course Learning Outcomes (CLOs), Training Activities and Assessment Methods

Code	Learning Outcomes	Aligned PLO Code	Training Activities	Assessment Methods	Assessment Responsibility
1.0	Knowledge and understanding				
1.1	Demonstrate knowledge of the context of the professional career before graduation.	K1	Participation with the field supervisor at the workplace	Discussions/ Debate, Specific Rubric	Supervisor/teac hing staff
1.2	Demonstrate an understanding of a range of professional interests in related fields of Physics program.	K2	Subject-based study essays	Written Short Answer/Lon g Answer/Rep ort, Rubric of Evaluation	Teaching staff
1.3	Label all opportunities for learning,	K2	Oral Test	Presentation, Written	Supervisor/teac hing staff

Code	Learning Outcomes	Aligned PLO Code	Training Activities	Assessment Methods	Assessment Responsibility
	development and mentoring throughout the duration of the training. development and mentoring throughout the duration of the training.			Report, Student Discussion Evaluation	
2.0	**Skills**				
2.1	Apply what has been learned in the classroom to real-world situations.	S1	Workplace Performance	Oral Presentations, Portfolio, Student Diary/Journey	Supervisor/teaching staff
2.2	Acquire new skills by becoming accustomed to critical and innovative for problem solving, thinking analysis and making practical decisions with confidence and rigor.	S1, S2	Written Research Questions	Reflection, Student Portfolio	Supervisor/teaching staff
2.3	proficiently communicate oral and written information in a manner that reflects professional social work skills.	S5	Written Tasks	Discussion, Evaluation of Reports and Emails	Supervisor/teaching staff
2.4	Deal with the various pressures that he/she may face in the labor market.	S1, S3	Participation with the field supervisor	Direct Observation	Supervisor
2.5	Proficiently interact with other professionals.	S4	Participation with the field supervisor	Direct Observation	Supervisor
3.0	**Values, autonomy, and responsibility**				
3.1	Develop discipline, self and social responsibility	V1, V2	Discussion, Behavior	Portfolio, Direct Observation	Supervisor/teaching staff

Code	Learning Outcomes	Aligned PLO Code	Training Activities	Assessment Methods	Assessment Responsibility
3.2	Apply ethical principles of the profession.	V1, V3	Discussion, Behavior	Direct Observation, Portfolio	Supervisor
3.3	Enhance integrity and honesty.	V1	Discussion, Behavior	Direct Observation	Supervisor

*Assessment methods (i.e., practical test, field report, oral test, presentation, group project, essay, etc.).

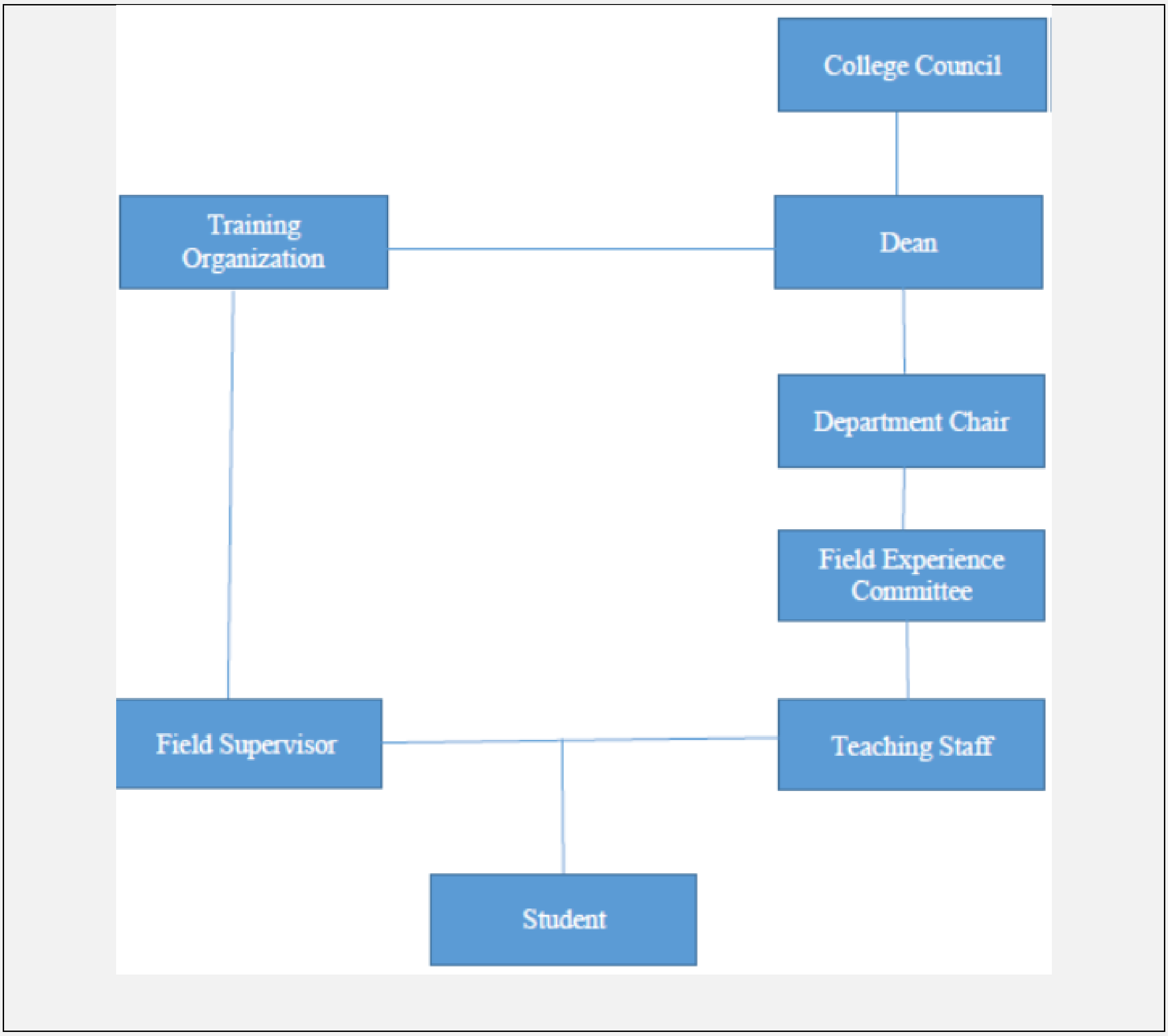
Assessment Methods (tools)

- **Discussions/Debates**: Encourage comprehension and active engagement with key concepts.
- **Written Tasks**: Comprise essays and reports to assess understanding and critical thinking.
- **Oral Presentations**: Evaluate communication skills and the effectiveness of information delivery.
- **Portfolios**: Serve as a record of learning and a means for reflecting on experiences.
- **Direct Observation**: Allow for immediate assessment of skills and professional conduct in real-time situations.
- **Supervisor Evaluation**: Monitors and assesses on-site performance and professional interactions.
- **Instructor Assessment**: Evaluates written assignments, presentations, and overall mastery of the course learning outcomes.

C. Field Experience Administration

1. Field Experience Flowchart for Responsibility

Including units, departments, and committees responsible for field experience identifying by the interrelations.



In addition, the College should develop a comprehensive Field Training Guide (FTG) that serves as a valuable resource for both students and supervisors, enhancing the overall field training experience. This guide will maximize learning opportunities and help ensure successful training outcomes.

Key Roles of the Guide:

- Clarifies Expectations: Outlines the objectives and responsibilities for students and supervisors.
- Provides Structure: Details the procedures, timelines, and necessary documentation.
- Facilitates Learning: Offers resources and best practices for skill development.
- Standardizes Assessment: Defines assessment criteria for consistent evaluation.
- Supports Reflection: Includes prompts for students to reflect on their experiences.
- Serves as a Resource: Provides information about organizations and industry standards.

- Enhances Communication: Outlines protocols for effective collaboration.
- Ensures Compliance: Addresses ethical considerations and legal requirements

2. Distribution of Responsibilities for Field Experience Activities

Activity	Department or College	Teaching Staff	Student	Training Organization	Field Supervisor
Selection of a field experience site	☑		☑		
Selection of supervisory staff	☑				
Provision of the required equipment				☑	
Provision of learning resources				☑	
Ensuring the safety of the site				☑	
Commuting to and from the field experience site		☑	☑		☑
Provision of support and guidance		☑			☑
Implementation of training activities (duties, reports, projects, ...)		☑			☑
Follow up on student training activities		☑			☑
Adjusting attendance and leave		☑			☑
Assessment of learning outcomes		☑			☑
Evaluating the quality of field experience	☑	☑	☑	☑	☑
Others (specify)					

3. Field Experience Location Requirements

Suggested Field Experience Locations	General Requirements*	Special Requirements**
Maaden Saudi Aramco KACST The Zakat, Tax and Customs Authority (ZATCA) Public School Private School General Authority for Statistics	The workplace must be registered and approved by the competent Saudi instances. Legal status as determined by the law in Saudi Arabia. Efficiency and safety.	The field experience location activities must be appropriate and consistent with the mission of Imam university and the requirements for field experience learning outcomes.

* E.g., Provides information technology, equipment, laboratories, halls, housing, learning sources, clinics … etc.
** E.g., Criteria of the institution offering the training or those related to the specialization, such as safety standards, dealing with patients in medical specialties … etc.

4. Decision-Making Procedures for Identifying Appropriate Locations for Field Experience

- **Establish Partnerships:** The college should develop a diverse range of partnerships with potential training organizations that offer high-quality training opportunities.
- **Availability of Partnerships:** A comprehensive list of these partnerships should be accessible on the College of Science website.
- **Partnership Criteria:** The selection of partnerships must align with the specific requirements outlined in this document.
- **Communication with Organizations:** The college should share this document, which includes qualifications and responsibilities, with the training organizations to ensure that they can meet the skills requirements for selecting suitable field supervisors.

5. Safety and Risk Management

Potential Risks	Safety Actions	Risk Management Procedures
Potential Risks depend on the workspace and production activities of the training organization. Potential sources of harm and hazards should	Basic safety rules and tips that need to be followed at the worksite. Safety guidelines must be established and maintained: safety	• Respecting the last updated version of the booklet "Implementation of Risk Management and Safety Culture" published by The Ministry of Labor and Social development. • providing an understanding of how to deal with different types of work-

be identified. This issue should be discussed with Training Organization before starting the training	procedures for laboratory investigations and field trips should be implemented.	training to help reduce exposure risks. • Offering short risk management training at the beginning of training.

D. Training Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student performance, effectiveness and efficiency	Field Supervisor,	Direct and Indirect
Quality of learning resources Effectiveness of Training and assessment. Student performance	Teaching staff	Indirect
Evaluation of the field Experience (workspace, Quality of learning resources, supervisory, achievements, skills, behavior, time)	Student	Indirect

Evaluation areas (e.g., Effectiveness of Training and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Supervisory Staff, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

E. Specification Approval Data

COUNCIL /COMMITTEE	**Quality Unit-Physics Department**
REFERENCE NO.	**Department council No. 06**
DATE	**26/09/2024**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title: **Research Project**	
Course Code: **PHY 1498**	
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***	

Table of Contents

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: (Level8/Year4)					
4. Course General Description:					
To demonstrate a student's work ethic, level of initiative, determination and approach to problem solving, give an early indication of a physicist's project management skills, as each student is largely responsible for their own program of work, test of general physics ability and plan and carry out a detailed and original piece of scientific research and communicate the results.					
5. Pre-requirements for this course (if any)**:**					
Solid State Physics, PHY 1461					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
Organization of research including logistics, recording, archiving, numerical analysis and presentation of data, interpretation and presentation of results in the form of a dissertation, develop important skills in summarizing a research area.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%

No	Mode of Instruction	Contact Hours	Percentage
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**	**60**
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		44

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 and learn to handle a scientific project.**	**K1, K2**	• Lectures. • Office hours.	▪ Participation. ▪ Discussions.
1.2	**Describe and state good project management skills.**	**K1, K2**	• Lectures. • Office hours.	▪ Participation. ▪ Discussions.
1.3	**Define and carry out a detailed and original piece of scientific research and communicate the results.**	**K1, K2**	• Lectures. • Office hours.	▪ Participation. ▪ Discussions.
2.0	**Skills**			
2.1	**Develop the students' ability to distinguish between different physical phenomena related to project.**	**S1, S2**	• Practical work. project.	Reports.
2.2	**Show ability to deal with various sources of**	**S2, S3**	• Discussion. • Tasks and missions.	▪ Discussions. ▪ Assignments.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	knowledge and the ability to exploit and to estimate the time.			
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S4, S5**	• Discussion. • Mini projects provide opportunity to students to work in groups and to use the library. • Tasks and missions.	▪ Reports. ▪ Presentation s. ▪ Assignments.
2.4	**Outline and develop the logical thinking related to the problems.**	**S2**	• Interactive discussions (special assignments in some courses will require students to search for data and/or information on their own). • Projects.	▪ Reports. ▪ Presentation.
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. Office hours.	▪ Participation. ▪ Discussion. Mini-project(s).
3.2	**Respect intellectual property rights and scientific integrity, and take responsibility for professional development.**	**V2, V3**	• Small team tasks • Open discussion. • Office hours.	▪ Reports. ▪ Presentation s ▪ Assignments. ▪

C. Course Content

No	List of Topics	Contact Hours
	Bibliography	6
	Experimental measurements and/or theoretical work.	40
	Writing of the final report	12

Total	60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	The final year project is compulsory and 100% based on continuous assessment, i.e. it must be passed at the end semester examinations.	weekly	The final year project is an assessment of performance away from a formal examination
2.	1st Report written by supervisor on the advancement of the student's project	4th week	25 %
3.	2nd Report written by supervisor on the advancement of the student's project	10th week	25 %
4.	Written report Evaluation by supervisor	15th week	20 %
5.	Final evaluation of Oral/ Written report by examination committee	16th week	30 %

*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	
Supportive References	
Electronic Materials	
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	- **Student.**	- **Indirect (The students complete the evaluation forms at the end of term. Final exam is evaluated by the second examiner)**
Effectiveness of Students assessment	- **Supervisor** - **Evaluators**	- **Direct (exams, HW, project, ...)**
Quality of learning resources	- **Faculty** - **Students**	- **indirect (surveys)**
The extent to which CLOs have been achieved	- **Advisor** - **Evaluators** - **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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title Solar Energy	
Course Code: PHY 1427	
Program: Bachelor of Science in Physics.	
Department: Physics	
College: Science	
Institution: Imam Mohammad Ibn Saud Islamic University	
Version: 1	
Last Revision Date: *26/09/2024*	

Table of Contents

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 7 or 8/ Year4)					

4. Course General Description:

In the solar energy course, you will learn to design a complete photovoltaic system. This course introduces the technology that converts solar energy into electricity, heat and solar fuels with a main focus on electricity generation. Photovoltaic (PV) devices are presented as advanced semiconductor devices that deliver electricity directly from sunlight. This course explores the advantages, limitations and challenges of different solar cell technologies, such as crystalline silicon solar cell technology, thin film solar cell technologies and the latest novel solar cell concepts as studied on lab-scale.

5. Pre-requirements for this course (if any)**:**

PHY 1324

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Give the student a basic knowledge of solar energy.**
- **Explain the various concepts to convert solar energy in to electricity, heat and solar fuels.**
- **Explain the physical working principles of photovoltaic conversion in solar cells.**

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		

No	Mode of Instruction	Contact Hours	Percentage
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	**Recognize the scientific method of inquiry to conclude concepts of solar energy conversion.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. Discussions.
1.2	**Describe the scientific method of inquiry to conclude concepts of photovoltaics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the scientific method of inquiry to conclude concepts solar cell applications.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**State the scientific method of inquiry to conclude concepts of thin film solar cells.**	**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**	**S2, S3**	▪ Problem classes and group tutorial. • Homework assignments as well	▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	physics related the topics covered by the course.		as problems solutions.	
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Solar Energy Conversion:** Photovoltaic, Photo electrochemical, Photothermal, Thermoelectric systems, Solar insulation, World energy demand, Current energy consumption from different sources, Environmental and health effects Sustainable energy, Production and storage.	**8**
2.	**Photovoltaics (PV):** Fundamentals of solar cells, Types of solar cells, Semiconducting materials, Band gap theory, Absorption of photons, Excitons and photoemission of electrons, Band engineering, Solar cell properties and design, p-n junction photodiodes, Depletion region, Electrostatic field across the depletion layer, Electron and holes transports, Device physics, Charge carrier generation, Recombination and other losses, I-V characteristics, Output power, Single junction and triple-junction solar panels, Metal-semiconductor heterojunctions, Semiconducting materials for solar cells.	**8**
3.	**Solar Cell Applications:** PV cell interconnection, module structure and module fabrication, equivalent circuits, Load matching, Efficiency, Fill factor, Optimization for maximum power, Design of stand-alone PV systems, System sizing, Device structures, Device construction, Installation, Measurements; DC to AC conversion, Inverters, On-site storage, Grid connections, Solar cell manufacturing processes, Material resources, Chemistry, Environmental impacts; Low cost manufacturing processes.	**8**
4.	**Optical Engineering:** Optical design, Anti-reflection coatings, Beam splitters, Surface structures for maximum light absorption, Operating	**10**

	temperature versus conversion efficiency, Types of solar energy concentrators, Fresnel lenses and Fresnel reflectors, Operating solar cells at high incident energy for maximum power output.	
5.	**Thin film Solar Cells:** Single crystal, Polycrystalline and amorphous silicon solar cells, Cadmium telluride thin-film solar cells, Conversion efficiency, Current trends in photovoltaic research and applications, Nanotechnology applications, Quantum dots, Solution based processes solar cell production.	**10**
6.	**Photoelectrochemical Cells for Hydrogen Production:** Photoelectrochemical electrolysis, Photoelectrochemical cells for hydrogen production, Solar-to hydrogen efficiency, Hydrogen storage, Hydrogen economy.	**8**
7.	**Solar thermal conversion:** Low, Medium and high temperature collectors, Types of solar energy collectors, Heat storage, Storage media, Steam accumulator, Other storage systems, Heat exchangers and applications of stored energy.	**8**
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**	**20 %**
2.	**Midterm Exam 1**	**4th week**	**20 %**
3.	**Midterm Exam 2**	**6th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	Green M. A., ***Solar Cells: Operating Principles, Technology and system Applications,*** Published by the University of New South Wales, ISBN 0 85823 580 3 (1998).
Supportive References	Physics of Solar Energy by C. Julian Chen, John Wiley & Sons Inc, 2011**.**
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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Fundamentals of Photonics
Course Code:	PHY 1440
Program:	Bachelor of Science in Physics.
Department:	Physics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	1
Last Revision Date:	*26/09/2024*

Table of Contents

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 7 or 8/ Year 4)					
4. Course General Description:					

This course provides the essential background in photonics necessary to understand modern photonic and optoelectronic phenomena and devices based on classical and quantum properties of radiation. It covers Electromagnetic optics, polarization and crystal optics, guided-wave optics, fiber optics, photons in semiconductors, semiconductors in photon sources and detectors, nonlinear optics, electro-optics, and acousto-optics, quantum theory of light, matter and its interaction, classical and quantum noise, lasers and laser dynamics, and semiconductor optoelectronics and nonlinear optics.

5. Pre-requirements for this course (if any)**:**

Electronics, PHY 1324

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Introduce students to basic principles and fundamentals of photonics.**
- **Understand the knowledge of semiconductor lasers and provides a general knowledge of optical devices employing electro-optic, acousto-optic, and nonlinear effects.**
- **Present a solution to a physics problem in a clear and logical written form.**

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	**Recognize the scientific method of inquiry to conclude the concepts of photons optics and atoms.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the scientific method of inquiry to conclude the concepts of laser and laser amplifiers.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the scientific method of inquiry to conclude the concepts**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	photonic in semiconductors.			
1.4	**Describe the scientific method of inquiry to conclude the concepts of electro-optics, nonlinear optics and acousto-optics.**	**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.
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Photons Optics and Atoms:** Photon, Photon streams, Quantum states of light, Atoms, Molecules, Solids, Interaction of Photons with atoms, thermal light, Luminescence light.	**12**

2.	**Laser Amplifiers and Laser:** Laser amplifier, Amplifier power source, Amplifier nonlinear, Amplifier Noise, Theory of laser oscillation, Pulsed Laser.	8
3.	**Photonic in Semiconductors:** Semiconductors, Interactions of photons with electrons and holes, Light-emitting diodes, Semiconductors laser amplifier, Semiconductor injection lasers, Properties of semiconductors photo-detectors, Photon-conductors, Photon-diodes, Noise in photon-detectors.	12
4.	**Electro-Optics:** Principles of electro-optics, Electro-optics of anisotropic media, Electro-optics of Liquid crystals, Photorefractive materials.	8
5.	**Nonlinear Optics:** Nonlinear optical media, Second-order nonlinear optics, Third-order nonlinear optics, Coupled-wave theory of three-wave mixing, Coupled-wave theory of four-wave mixing, Anisotropic nonlinear media, Dispersive nonlinear, Optical solitons.	12
6.	**Acousto-Optics:** Interaction of Light and Sound, Acousto-optic devices, Acousto-optics of anisotropic media.	8
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	Bahaa E. A.S. and Malvin C.T., ***Fundamentals of Photonics,*** 2nd Edition, Wiley (2007).
Supportive References	
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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title **Laser Physics**	
Course Code: **PHY 1445**	
Program: **Bachelor of Science in Physics**	
Department: **Physics**	
College: **Science**	
Institution: **Imam Mohammad Ibn Saud Islamic University**	
Version: 1	
Last Revision Date: ***26/09/2024***	

Table of Contents

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 7 or 8/ Year4)					

4. Course General Description:

This course provides a clear, up-to-date, and comprehensive introduction to the physical and principles of laser operation and design. Simple explanations, based throughout on key underlying concepts, lead from the basics of laser action to advanced topics in laser physics. The course is aimed to give students practical skills and certain degree of confidence for working with lasers and/or using laser-based equipment in future.

5. Pre-requirements for this course (if any)**:**

Atomic physics, PHY 1362

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Understand the fundamental of laser physics and provide an overview of the physics of modern optical technology.**
- **Full knowledge of the description to describe the interaction of light with matter.**
- **To understand some applications of lasers and the associated physics.**
- **Deep understanding about laser device design and its performance.**
- **Laser applications in different disciplines such as of military, medical and industrial.**

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	**Recognize the scientific method of inquiry to conclude concepts of ordinary Light and Lasers.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the scientific method of inquiry to conclude concepts of the Laser Action.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the scientific method of inquiry to conclude concepts of laser Oscillator.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Describe the scientific method of inquiry to conclude concepts of**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	properties of laser radiations.			▪ Homework.
1.5	**Describe the scientific method of inquiry to conclude concepts of Laser System.**	**K1, K2**	• Lectures. • Class discussions. Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying laser 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.
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Ordinary Light and Lasers:** Nature of the Light, Brief history of Lasers, Interaction of radiation with matter, Energy levels, Population density, Boltzmann distribution, Transition life-times, Allowed and forbidden transitions, Stimulated absorption, Spontaneous emission and stimulated emission, Einstein's coefficients, Einstein's relations.	**12**

2.	**Laser Action:** Condition for large stimulated emission, Population inversion, Condition for light amplification, Gain co-efficient, Threshold gain coefficient, Line shape function, Active medium, Metastable states, Pumping schemes: three level and four level.	12
3.	**Laser Oscillator:** Optical feedback, Round trip gain, Threshold gain, Critical population inversion, Optical resonator, Condition for steady state oscillations, Cavity resonance frequencies.	12
4.	**Properties of Laser Radiations:** Laser Line-width, Laser frequency stabilization, Beam Divergence, Beam coherence, Brightness, Focusing properties of laser radiation, Laser modes, Doppler broadening, Broadening small signal gain, 3 level laser and 4 level rate equations Q-switching.	12
5.	**Laser System:** Active medium. Excitation mechanism feedback mechanism. Atom Gas: Helium-Neon laser (He-Ne). Ion gas, Argon ion laser (Ar+). Molecular Gas: Carbon dioxide laser (CO2). Nitrogen laser (N2). Solid state lasers: Ruby laser. Neodymium YAG and Nd glass laser. Diode laser: (semiconductor laser, injection laser) - Liquid Laser: Dye laser.	12
6.	**Ordinary Light and Lasers:** Nature of the Light, Brief history of Lasers, Interaction of radiation with matter, Energy levels, Population density, Boltzmann distribution, Transition life-times, Allowed and forbidden transitions, Stimulated absorption, Spontaneous emission and stimulated emission, Einstein's coefficients, Einstein's relations.	12
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
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	- Silfvast W.T., ***Laser Principles,*** 2nd Edition, Cambridge, ISBN 0-521-83345-0, (2004).
Supportive References	- Masilamani V. and Azzeer A.M., ***Laser: The Light Extraordinary,*** Anuradha Agencies (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, 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

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title	**Atomic and Molecular Spectroscopy**
Course Code:	**PHY 1447**
Program:	**Bachelor of Science in Physics.**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	1
Last Revision Date:	***26/09/2024***

Table of Contents

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 7 or 8/ Year4)					

4. Course General Description:

The main aim of this course is to introduce the student to spectroscopy in a clear manner which avoids, as far as possible, the mathematical aspects of the subject. After explaining the theory behind spectroscopy, the course then goes on to look at the different techniques, such as rotational, vibrational and electronic spectroscopy. It encompasses both high resolution (structural) and low resolution (analytical) spectroscopy, demonstrating their close interrelationship.

5. Pre-requirements for this course (if any)**:**

Atomic Physics, PHY 1362

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Give the basic principles and applications of atomic and molecular spectroscopy.**
- **Familiarize students with fundamental concepts of atomic structure.**
- **Acquaint with the different types of molecular spectra.**

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	**Recognize the scientific method of inquiry to conclude concepts atomic structure.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the scientific method of inquiry to conclude concepts of Structure of molecules.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the scientific method of inquiry to conclude concepts of emission and absorption of electromagnetic radiation.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**State the scientific method of inquiry to conclude concepts of Spectrum.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.5	**Describe the scientific method of inquiry to conclude concepts of combined techniques.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.6	**Recognize the scientific method of inquiry to conclude concepts of the Spectroscopy.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying Atomic and Molecular Spectroscopy**	**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	**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.	**Atomic Structure:** Historical notes, Models of atoms, spectral line series, orbitals electron shells, energy term of atoms.	8
2.	**Structure of molecules:** Quantum states of molecules, molecular orbital's, vibration and rotation energetic levels.	8
3.	**Emission and absorption of electromagnetic radiation:** Quantum transitions, Spontaneous and simulated emission, absorption of radiation, spectral line, Röntgen and characteristic radiation.	8
4.	**Spectrum:** Splitting of energy levels, Zeeman and Stark effect Separation methods: classification of separation methods, principles of chromatography, liquid and gas chromatography.	8

5.	**Combined techniques:** Mass spectrometer, Fourier transformation in mass spectrometry.	8
6.	**Spectroscopy:** Classification of methods, basic principles of spectroscopy. Emission, absorption and diffraction spectroscopic methods, basic blocks of a spectrometric line, Lambert-Beer Law.	8
7.	**Atomic absorption spectroscopy:** Basic scheme, sources of radiation, atomizer, monochromator, applications of AAS.	6
8.	**Atomic emission spectroscopy:** Basic scheme, sources of radiation, inductively coupled plasma, fluorescence spectroscopy, fluorescence quenching.	6
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Michael Holl J., ***Basic Atomic and Molecular Spectroscopy,*** Royal Society of Chemistry (2002).
Supportive References	- Svanberg S., ***Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications,*** 4th Edition, Springer (2001).
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.

Items	Resources
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**

Course Specification

(Bachelor)

Course Title **Introduction to Plasma Physics**	
Course Code: **PHY 1449**	
Program: **Bachelor of Science in Physics**	
Department: **Physics**	
College: **Science**	
Institution: **Imam Mohammad Ibn Saud Islamic University**	
Version: 1	
Last Revision Date: ***26/09/2024***	

Table of Contents

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 8/ Year4)

4. Course General Description:

This course offers both a simple and intuitive discussion of the basic concepts of the plasma physics and controlled fusion and an insight into the challenging problems of current research. In a wholly lucid manner the course covers single-particle motions, fluid equations for plasmas, wave motions, diffusion and resistivity, Landau damping, plasma instabilities and nonlinear problems. For students, this outstanding text offers a painless introduction to this important field.

5. Pre-requirements for this course (if any)**:**

Electromagnetic Fields, PHY 1321

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- Describe, and perform simple calculations involving, the motion of charged particle in electric and magnetic field and how deduce the complete set equations of plasma when it is considered as fluid.
- Strengthen an understanding of the concepts and principles through a broad range of the interesting applications to the real world.

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		

No	Mode of Instruction	Contact Hours	Percentage
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	**Recognize the scientific method of inquiry to conclude concepts of ordinary Light and Lasers.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the scientific method of inquiry to conclude concepts of the Laser Action.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the scientific method of inquiry to conclude concepts of laser Oscillator.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Describe the scientific method of inquiry to conclude concepts of properties of laser radiations.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.5	**Describe the scientific method of inquiry to conclude concepts of Laser System.**	**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 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.
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction:** Occurrence of Plasmas in Nature, Definition of Plasma, Concept of temperature, Debye Shielding, Plasma parameter, Criteria for plasmas, Applications of plasma physics.	**8**
2.	**Single-Particle Motions:** Introduction, Uniform E and B fields, Nonuniform B field, Nonuniform E field, Time- Varying E Field, Time-varying B field, Summary of guiding center drifts, Adiabatic invariants.	**8**
3.	**Plasmas as Fluids:** Introduction, Relation of plasma physics to ordinary electromagnetic, Fluid equation of motion, Fluid Drilts perpendicular to B, Fluid Drilts parallel to B, Plasma Approximation.	**8**
4.	**Waves in Plasmas:** Representation of waves, Group velocity, Plasma oscillations, Electron plasma Waves, Sound waves, Ion waves, Validity of the plasma approximation, Comparison of ion and electron waves, Electrostatic electron oscillations perpendicular to B, Electrostatic ion waves perpendicular to B, Lower Hybrid frequency, Electromagnetic waves with Bo = 0, Experimental applications, Electromagnetic waves	**12**

	perpendicular to Bo, Cutoffs and resonances, Electromagnetic waves parallel to Bo, Experimental consequences, Hydromagnetic waves, Magnetosonic waves, Summary of elementary plasma waves, CMA Diagram.	
5.	**Diffusion and Resistivity:** Diffusion and mobility in weakly ionized gases, Decay of a plasma by diffusion, Steady state solutions, Recombination, Diffusion across a magnetic Field, Collisions in fully ionized plasmas, Single-fluid MHD equations, Diffusion in fully ionized plasmas, Solutions of the diffusion equation, Bohm diffusion and neoclassical diffusion.	8
6.	**Equilibrium and Stability:** Introduction, Hydromagnetic equilibrium, concept of ß, Diffusion of magnetic Field into a plasma classification of instabilities, Two-Stream instability The "Gravitational" instability, Resistive drift Waves The Weibel instability.	8
7.	**Kinetic Theory:** Meaning of f(v), Equations of kinetic Theory, Derivation of the fluid Equations, Plasma oscillations and Landau damping, Meaning of Landau damping, A physical derivation of Landau damping, BGK and Van Kampen modes, Experimental verification, Ion Landau damping, Kinetic effects in a magnetic field.	8
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
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	Chen F.F., ***Introduction to Plasma Physics and Controlled Fusion,*** Volume 1, Springer (2006).
Supportive References	
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

Course Specification
(Bachelor)

Course Title **Semiconductor Physics**	
Course Code: **PHY 1426**	
Program: **Bachelor of Science in Physics.**	
Department: **Physics**	
College: **Science**	
Institution: **Imam Mohammad Ibn Saud Islamic University**	
Version: 1	
Last Revision Date: *26/09/2024*	

Table of Contents

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 7 or 8/ Year4)					
4. Course General Description:					
This course provides the basics and principles of semiconductor devices. The major objective is to familiarize the students with the basic principles of operation of modern semiconductor devices such as p-n junction diode, light emitting diodes, JFET transistor, bi-polar transistors, etc.					
5. Pre-requirements for this course (if any)**:**					
Electronics, PHY 1324					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
At the end of this course the student will be able to: • Provide undergraduate students with a wide background and the ability to deal with advanced concepts in semiconductor devices. • Describe the basic devices of semiconductor for the specific application. • Provide the different parameters of semiconductor devices. • Discuss aspects of the effects of semiconductors on the physical science. • Develop critical thinking and analytical problem-solving skills.					

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		

No	Mode of Instruction	Contact Hours	Percentage
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	**Outline the basics and principles of semiconductor devices.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. Discussions.
1.2	**Outline the physical insight in the properties of semiconductors.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.3	**Describe the key principles and applications of Semiconductor Physics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
2.0	Skills			
2.1	**Explain and summarize the basic knowledge gained from studying semiconductor physics 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**	**S4, S5**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Participation and activities of students in the

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	using IT for acquiring and analyzing information.		• Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	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.	**Generalities on Semiconductors:** Introduction presents a summary of the physics and properties of semiconductors, energy bands in semiconductors, electronic structure; electrons in periodic structures, effective mass and semiconductor band gap.	**12**
2.	**Charge Carrier Population:** Intrinsic concentrations; doped semiconductors, N-type and P-type semiconductors, Fermi level at equilibrium.	**10**
3.	**Electrical Conductivity:** Carrier transport phenomena, Quasi-classical approach, carrier mobility for a non-degenerate electron gas, high field transport and hot carrier effects.	**10**
4.	**p-n junction:** Space charge distribution, electronic energy bands in the space charge region; p-n junction under an applied voltage; p-n junction capacitance.	**10**
5.	**Metal-Semiconductor Contacts:** Band structure and electronic properties, metal-semiconductor devices.	**10**
6.	Transistors: Bipolar transistor, JFET transistor	**8**
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	20 %
2.	Midterm Exam 1	4thweek	20 %
3.	Midterm Exam 2	6thweek	20 %
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	Sze S. M., Physics of Semiconductor Devices, Wiley-Interscience (1969).
Supportive References	- Pierret R.F., Semiconductor Device Fundamentals, 2nd Edition (1996). - Yu P.Y., and Cardona M., Fundamentals of Semiconductors, Physics and Materials Properties, 2nd Edition, Springer, Berlin, (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, 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**

Course Specification

(Bachelor)

Course Title	**Introduction to Radiation Physics**
Course Code:	**PHY 1469**
Program:	**Bachelor of Science in Physics.**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	1
Last Revision Date:	***26/09/2024***

Table of Contents

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 7 or 8/ Year4)					

4. Course General Description:

This course offers students a comprehensive coverage of the major concepts that underlie the origins and transport of ionizing radiation in matter. Understanding atomic structure and the physical mechanisms of radiation interactions is the foundation on which much of the current practice of radiological health protection is based. The course covers the detection and measurement of radiation and the statistical interpretation of the data. The procedures that are used to protect man and the environment from the potential harmful effects of radiation are thoroughly described. Basic principles are illustrated with an abundance of worked examples that exemplify practical applications.

5. Pre-requirements for this course (if any)**:**

Nuclear Physics, PHY 1464

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- Differentiate between an ionized and non-ionized radiation.
- Deep understand the principals of interaction radiation with matter.
- Full knowledge of the different units of exposure, dose absorbed dose.
- Understand some applications of radiation in medicine.
- Understanding biological effects of Radiation.

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	**Define and recall the basic knowledge of Radiation Physic.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Recognize the interaction of ionizing radiation with matter.**	K1, K2	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Recall the different radiation detection methods.**	K1, K2	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**State the concepts of the biological Effects of Radiation.**	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 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.
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Radioactive Decay:** Activity, Exponential decay, Specific activity, Serial radioactive decay, Natural radioactivity, Radon and radon daughters.	**8**
2.	**Interaction of Heavy Charged Particles with Matter:** Energy-loss mechanism, Maximum energy transfer in a single collision, Single-collision energy-loss spectra, Stopping power, Semiclassical calculation of stopping power, Bethe formula for stopping power, Mean excitation energies, Stopping power of water for protons, Range, Slowing-down time.	**8**
3.	**Interaction of Electrons with Matter:** Energy-loss mechanism, Collisional stopping power, Radiative stopping power, Radiation yield, Range, Slowing-down time, Examples of electron tracks in water.	**8**
4.	**Interaction of Photons with Matter:** Interaction mechanisms, Photoelectric effect, Energy-momentum requirements for photon absorption by an electron, Compton effect, Pair production, Photonuclear reactions, Attenuation coefficients, Energy-transfer and energy-absorption coefficients, Calculation of energy absorption and energy transfer.	**80**

5.	**Neutrons, Fission and Criticality:** Neutron sources, Classification of neutrons, Interactions with matter, Elastic scattering, Neutron-proton scattering energy-loss spectrum, Reactions, Energetics of threshold reactions, Neutron activation, Fission, Criticality.	**8**
6.	**Methods of Radiation Detection:** Ionization in gases, Ionization in semiconductors, Scintillation, Photographic film, Thermo-luminescence, Other methods, Neutron detection.	**8**
7.	**Radiation Dosimetry:** Quantities and units, Measurement of exposure, Measurement of absorbed dose, Measurement of X- and gamma-ray dose, Dose measurements for charged-particle beams, Dose calculations, Other dosimetric concepts and quantities.	**8**
8.	**Biological Effects of Radiation:** Biological effects, Radiation biology, Dose-response relationship, Factors affecting dose response.	**4**
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	Turner J.E., ***Atoms, Radiation, and Radiation Protection,*** Wiely-VCH Verlag GmbH & Co. KGaA (2007).
Supportive References	Attix F.H., ***Introduction to Radiological Physics and Radiation Dosimetry,*** Wiely-VCH Verlag GmbH & Co. KGaA(1986).
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**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Selected Topics in Applied Physics (1)
Course Code:	PHY 1471
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*

Table of Contents

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 7/ Year 4)					
4. Course General Description:					
The feature of this course will be determined according to local national or international economic developments, significant recent research in the field, technological changes affecting skill requirements, employment demand, government policies on higher education or on matters affecting the fields for which students are being prepared, national or international developments in professional practice in the field.					
5. Pre-requirements for this course (if any)**:**					
Atomic Physics, PHY 1362					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
Selected Topics in Physics (STP) will highlight a specific topic in physics, which will be selected by the Department council. The STP course will feature rapidly developing current trends in the selected research area or, from a specific viewpoint, topics of interest in applied physics and its related inter-disciplines. A decision of the selected areas planned for future issues will be decided in the Department of Physics by the Department Council.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	15/week	100%

No	Mode of Instruction	Contact Hours	Percentage
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	**Apply of the fundamental principles to particular areas.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Select of subjects which students' study in greater depth, learning of current developments at the frontiers of the subject.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline knowledge of the principles of operations to particular areas.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Knowledge and skills in advanced mathematics and its application in physics.**	**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 the 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	**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
	Depending of the selected subject	
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**	**20 %**
2.	**Midterm Exam 1**	**6thweek**	**20 %**
4.	**Midterm Exam 2**	**12thweek**	**20 %**
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	
Supportive References	
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	Laboratory Manual supplied by the Department of Physics. Laboratory Manual is available at the website of the Department of Physics.

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

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Education & Training Evaluation Commission
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2024
TP-153

Course Specification

(Bachelor)

Course Title:	**Selected Topics in Applied Physics (2)**
Course Code:	**PHY 1472**
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***

Table of Contents

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 8/ Year 4)					
4. Course General Description:					
The feature of this course will be determined according to local national or international economic developments, significant recent research in the field, technological changes affecting skill requirements, employment demand, government policies on higher education or on matters affecting the fields for which students are being prepared, national or international developments in professional practice in the field.					
5. Pre-requirements for this course (if any)**:**					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
Selected Topics in Physics (STP) will highlight a specific topic in physics, which will be selected by the Department council. The STP course will feature rapidly developing current trends in the selected research area or, from a specific viewpoint, topics of interest in applied physics and its related inter-disciplines. A decision of the selected areas planned for future issues will be decided in the Department of Physics by the Department Council.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%

No	Mode of Instruction	Contact Hours	Percentage
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	**Apply of the fundamental principles to particular areas.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Select of subjects which students' study in greater depth, learning of current developments at the frontiers of the subject.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline knowledge of the principles of operations to particular areas.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Knowledge and skills in advanced mathematics and its application in physics.**	**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 the 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	**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
	Depending of the selected subject	
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	
Supportive References	
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	Laboratory Manual supplied by the Department of Physics. Laboratory Manual is available at the website of the Department of Physics.

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

هيئة تقويم التعليم والتدريب
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2024
TP-153

Course Specification
(Bachelor)

Course Title:	Introduction to Operations research
Course Code:	MAT 1253
Program:	Bachelor of Science in Physics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	2024 – V1
Last Revision Date:	08/10/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Program	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: Level 6-8 / Year 3-4					
4. Course general Description:					
This course covers key operations research techniques, focusing on linear programming, the Simplex Method, duality, and sensitivity analysis. Students will explore special models like transportation and assignment problems, as well as integer linear programming applications, including the Traveling Salesman Problem. Practical problem-solving is emphasized through the use of TORA software.					
5. Pre-requirements for this course (if any)**:**					
MAT 1222					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
The Introduction to Operations Research course plays a vital role in the BSc degree program in Applied Mathematics by equipping students with essential optimization techniques and decision-making tools. It enhances their analytical skills and prepares them for practical applications in fields like economics, engineering, and logistics.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify a Linear Programming Problem and its formulation.	K1	3lecture hours\week 2tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
1.2	Summarize techniques of operations research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	K1, K2	3lecture hours\week 2tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
2.0	**Skills**			
2.1	Solve proposed real-life problems by applying the methodology and tools of Operations Research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	S1, S2	Self-study Real-life problems	Participations Short Quizzes
2.2	Model in mathematical language understandable operational research problems from the verbal description of the real system.	S4	Self-study Real-life problems	Participations Short Quizzes
2.3	Use of TORA software to solve and online solver to solve some to solve the proposed models..	S5	Self-study Real-life problems	Participations Short Quizzes
2.4	Employ clearly, the best strategy Solve linear programming problems	S3	Self-study	Participations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	using appropriate techniques and optimization solvers.		Real-life problems	Short Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	work individually.	V1, V3	Class discussion	Participation
3.2	Relate well to others and maintain good relationships;	V1, V2	Class discussion Team work	Homework and Mini-projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Linear programming:** Overview, Linear programming formulations, Graphical Linear Programming Solution, Graphical Sensitivity analysis.	8
2.	**The Simplex Method:** Standard Linear Programming, Determination of Basic Feasible Solutions; The Simplex Algorithm.	8
3.	**Special Cases of the Simplex:** Degeneracy, Alternative optimum, Unbounded solution, Infeasibility.	6
4.	**Duality and Sensitivity Analysis:** Formulation of the Dual Problem, Relationship between Optimal Primal and Optimal Dual Solutions, Economic interpretation of Duality, Dual Simplex and Sensitivity Analysis.	10
5.	**Special linear programming models:** The transportation model, The assignment model.	8
6.	**Introduction to Integer Linear Programming:** Illustrative applications, Branch and Bound algorithm, Application to the Traveling Salesman Problem.	10
7.	**Tora Software:** Use of TORA software to solve exercises and problems from all course chapters.	10
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15	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	***Operations Research: An Introduction,*** H. Taha, Prentice Hall, 8th Edition, 2006. **(Main Reference)**
Supportive References	***Introduction to Operations Research,*** F. Hillier and G. Lieberman, 7th Edition, McGraw Hill, 2001
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of Linear programing methods.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential linear programing
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of discrete optimization. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title	Introduction to Nanophysics
Course Code:	PHY 1473
Program:	Bachelor of Science in Physics.
Department:	Physics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	1
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 7 or 8/ Year 4)					
4. Course General Description:					
Introduction to nanotechnology provides a self-contained introduction to the physical concepts, techniques and applications of nanoscale systems by covering its entire spectrum from the latest examples right up to single-electron and molecular electronics. This course discusses the interdisciplinary nature of nanotechnology and how the different basic sciences merge to create the field and it provides a background of the understanding, motivation, implementation, impact, future, and implications of nanotechnology. The course will also discuss specific applications of nanotechnology in electronic devices, and energy production.					
5. Pre-requirements for this course (if any)**:**					
Atomic Physics, PHY 1362					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
• Initiate students with new concepts in nanoscience. • Provide the student with a clear and logical presentation of the basic concepts of nanophysics. • Describe, and perform simple calculations involving, the quantization in different dimensions (3D, 2D, 1D and 0D). • Strengthen an understanding of the concepts and principles through a broad range of the interesting applications in nanotechnology.					

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 and learn basic theoretical concepts of nanophysics allowing working in research and development in nanotechnology.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Outline the rapidly developing field of nanoengineered materials with special focus on their electronic properties**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Recognize the studies of various phenomena in small-size devices.**	**K1, K2**	• Lectures. • Class discussions. Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**State aspects of the electronic properties of**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	materials, as well as fabrication processes.			▪ 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.
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. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Generalities on Nanotechnology:** Definitions, Comparison between units, History, Richard Feynman, Norio Taniguchi, Fundamental concepts, Bottom-up and top-down, Importance of nanosystems, Quantification, Specific surface area.	**10**
2.	**Principle Synthesis Techniques of Nanosystems:** Generalities on germination mechanism, Activation energy of nucleation, Critical germ dimension, Stability of the germ, Chemical techniques, Free nanoparticles,	**12**

	Metallic salt reduction, Sol-gel, Solvo-thermal, Physical techniques, Thermal evaporation, Milling, Pulse laser deposition (PLD), Electrical discharge, Sputtering, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD).	
3.	**Quantification:** Free electron and electrons in solid, Gaz of electrons, Description of free electrons in solid, Concept of effective mass, Quantification condition, Born Van Kerman (BVK) conditions, Energy levels of free electron in solid, State densities in different structures 3D, 2D, 1D and 0D, Applications of systems 0D and 1D.	**10**
4.	**Porosity and Texture of Materials:** Divided state, Specific surface area, Generalities on textural characterizations of porous solids, Gurwitsch equation, Porosity.	**10**
5.	**Characterization techniques:** Scanning electron microscopy (SEM), Transmission electron microscopy, Adsorption-desorption characterization methods, Photoluminescence, Electronic characterization, Magnetic characterizations.	**10**
6.	**Some applications:** Quantum effects in opto-electronic devices, Photo catalytic processes, Gaz sensors.	**8**
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**	**20 %**
2.	**Midterm Exam 1**	**6th week**	**20 %**
3.	**Midterm Exam 2**	**12th week**	**20 %**
4.	**Final Exam**	**16th week**	**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	- Wolf E. L., ***Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience,*** 2nd Edition; Wiley (2006). - Binns C., ***Introduction to Nanoscience and Nanotechnology***, Wiley (2010). Cao G. and Wang Y., ***Nanostructures and Nanomaterials: Synthesis, Properties and Application,*** 2nd Edition, World Scientific (2011).

Supportive References	
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