PHY6505: MODERN TOPICS IN PHYSICS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Modern Topics in Physics

Subject Code
PHY - Physics
Course Number
6505

Academic Unit
Physics (PHY)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
AP3251/PHY3251 Quantum Physics or equivalent

Equivalent Courses
Nil

Exclusive Courses
PHY8505 Modern Topics in Engineering and Applied Physics

Part II Course Details

Abstract
The aim of the course is to provide students with an introduction to contemporary topics in Applied Physics with technological relevance. The topics match the current research themes of the physics department, including atomic,

molecular, and optical physics; low-dimensional systems; soft matter and biophysics; spectroscopy and imaging; theoretical and computational physics.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Be aware of the current development in selected areas in Applied Physics.	50	x	x	
2	Be able to conduct literature research in selected areas in Applied Physics.	50	x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Provide theories, concepts, examples of modern topics in Applied Physics	1, 2	
2	Students' presentation	The students will have to select a recent topic in Applied Physics and present it to the class.	1, 2	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Quizzes	1	20	-	No
2	Presentation	1, 2	40	-	No
3	Final report	1, 2	40	-	No

Continuous Assessment (%)

100

Assessment Rubrics (AR)

Assessment Task

Quizzes (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Demonstrating the understanding of the course materials.

Excellent

(A+, A, A-) High (excellent accomplishment with creativity and correct understanding)

Good

(B+, B, B-) Significant (good accomplishment with mostly correct understanding

Fair

(C+, C, C-) Moderate (fair accomplishment with some correct understanding)

Marginal

(D) Basic (essential accomplishment with basic understanding)

Failure

(F) Not reaching marginal level

Assessment Task

Presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Understanding the background and development of the selected topics in applied physics; Identifying the current challenges.

Excellent

(A+, A, A-) High (excellent accomplishment of the presentation with style/structure of the presentation, clarity of the presentation, and time-keeping.)

Good

(B+, B, B-) Significant (good accomplishment of the presentation with style/structure of the presentation, clarity of the presentation, and time-keeping.)

Fair

(C+, C, C-) Moderate (fair accomplishment of the presentation with style/structure of the presentation, clarity of the presentation, and time-keeping.)

Marginal

(D) Basic (essential accomplishment of the presentation with style/structure of the presentation, clarity of the presentation, and time-keeping.)

Failure

(F) Not reaching marginal level

Assessment Task

Final report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Understanding the background and development of the selected topics in applied physics; Identifying the current challenges.

Excellent

(A+, A, A-) High (excellent accomplishment with creativity, designed structure, presentation of data and figures, and reasonable conclusions)

Good

(B+, B, B-) Significant (good accomplishment with creativity, designed structure, presentation of data and figures, and reasonable conclusions)

Fair

(C+, C, C-) Moderate (fair accomplishment with creativity, designed structure, presentation of data and figures, and reasonable conclusions)

Marginal

(D) Basic (essential accomplishment with creativity, designed structure, presentation of data and figures, and reasonable conclusions)

Failure

(F) Not reaching marginal level

Assessment Task

Quizzes (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Demonstrating the understanding of the course materials.

Excellent

(A+, A, A-) High (excellent accomplishment with creativity and correct understanding)

Good

(B+, B) Significant (good accomplishment with mostly correct understanding)

Marginal

(B-, C+, C) Moderate (fair accomplishment with some correct understanding)

Failure

(F) Basic (essential accomplishment with basic understanding)

Assessment Task

Presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Understanding the background and development of the selected topics in applied physics; Identifying the current challenges.

Excellent

(A+, A, A-) High (excellent accomplishment of the presentation with style/structure of the presentation, clarity of the presentation, and time-keeping.)

Good

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Assessment Task

Final report (for students admitted from Semester A 2022/23 to Summer Term 2024)

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Understanding the background and development of the selected topics in applied physics; Identifying the current challenges.

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Part III Other Information

Keyword Syllabus

The topics match the current research themes of the physics department, including atomic, molecular, and optical physics; low-dimensional systems; soft matter and biophysics; spectroscopy and imaging; theoretical and computational physics.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Claude Cohen-Tannoudji, Bernard Diu and Franck Laloe, Quantum Mechanics Vols. I and II, John Wiley and Sons 1977.
2	Richard P. Feynman, Feynman Lectures on Physics vol. III Addison Wesley 1965.
3	Scott Aaronson, Quantum Computing Since Democritus Cambridge University Press 2013.
4	Yanhua Shih, An Introduction to Quantum Optics – Photon and Biphoton Physics, CRC Press, 2011.
5	Girish S. Agarwal, Quantum Optics, Cambridge University Press, 2013.
6	Michael Rubinstein and Ralph H. Colby, Polymer Physics, OUP Oxford, 2003.

7	Topological Aspects of Condensed Matter Physics: Lecture Notes of the Les Houches Summer School: Volume 103, August 2014, DOI: 10.1093/acprof:oso/9780198785781.001.0001.