EEE205 Modern Physics

Course Code	Course Name	Semester	
EEE205	Modern Physics	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	3
3	0 / 0		

Course Details	
Department	Electrical and Electronics Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Lecturer(s)	Prof. Dr. Volodymyr Yurchenko
Course Objectives	The objective is to introduce the students to the ideas and basic laws of modern physics including special relativity, quantum mechanics, quantum physics of matter, nuclear physics, particles and cosmology.
Course Content	The course covers standard topics of special relativity, quantum mechanics, quantum theory of atoms, molecules and solids, metals and semiconductors, electronic devices, superconductivity, nuclear physics, elementary particles, and cosmology.
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☐ Discussion ☐
Prerequisites/	MATH101, PHYS101, PHYS102

Corequisites	
Work Placement(s)	Room 826

Textbook/References/Materials

- [1] D.C. Giancoli, *Physics for Scientists and Engineers with Modern Physics*, 4th Ed., Prentice Hall, 2009
- [2] R.A. Serway and J.W. Jewett, *Physics for Scientists and Engineers with Modern Physics*, 9th Ed., 2014
- [3] D. Halliday and R. Resnick, *Fundamentals of Physics*, 10th Ed. Extended, Editor J. Walker, Wiley, 2018
- [4] S. H. Simon, *The Oxford Solid-State Basics*, 1st Ed., 2013

Course Category				
Mathematics and Basic Sciences	☒		Education	☒
Engineering	☐		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	Light Waves, Interference	[1] Ch. 34, [2] Ch. 37
2	Diffraction, Polarization	[1] Ch. 35, [2] Ch. 38
3	Special Relativity	[1] Ch. 36, [2] Ch. 39
4	Quantum Mechanics: Origin	[1] Ch. 37, [2] Ch. 40
5	Quantum Mechanics: Basic Laws	[1] Ch. 38, [2] Ch. 41
6	Quantum Mechanics: Equations	[1] Ch. 38, [2] Ch. 41
7	Quantum Mechanics: Atoms	[1] Ch. 39, [2] Ch. 42, [4] Ch. 5
8	Midterm Exam	
9	Molecules and Solids - I: Bonding, Molecules	[1] Ch. 40, [2] Ch. 43, [4] Ch. 6-7
10	Molecules and Solids – II: Bonding, Solids	[1] Ch. 40, [2] Ch. 43, [4] Ch. 6-7
11	Electrons in Solids - I: Metals, Semiconductors	[1] Ch. 40, [2] Ch. 43, [4] Ch. 13-16
12	Electrons in Solids - II: Electronic Devices	[1] Ch. 40, [2] Ch. 43, [4] Ch. 17-18
13	Nuclear Physics	[1] Ch. 41, [2] Ch. 44
14	Nuclear Energy	[1] Ch. 42, [2] Ch. 45
15	Particles and Cosmology	[1] Ch. 43-44, [2] Ch. 46
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize	5	5
Homework	5	5
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30
Final Exam	1	60
	Total	**100%**
Contribution of Midterm Studies to Success Grade		40
Contribution of End of Semester Studies to Success Grade		60
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	16	3	48
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	10	1	10
Quiz/Studio/Criticize	5	0	0
Homework	5	1	5
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	6	6
Final Exam and Preparation for Final Exam	1	6	6
Total Workload			**75**
Total Workload / 25			**3**
ECTS Credit			**3**

Course Learning Outcomes	
No	**Outcome**
L1	Knowledge of basic concepts of relativity, quantum mechanics, physics of matter, electronic devices, nuclear physics, particles and cosmology
L2	Understanding the experiments that formed the basis of Modern Physics
L3	Understanding the mathematics used in the elementary presentation of Modern Physics
L4	Ability to formulate, analyze, and solve basic problems in the course of Modern Physics
L5	Ability to understand complicated concepts of modern science. Analytical, creative, and constructive way of thinking

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**					**Total**
L1	5	5	4	3	4	4	5	5	4	3	2					44
L2	5	5	4	3	4	4	4	4	4	3	2					42
L3	5	5	4	4	4	4	4	4	3	2	1					40
L4	5	5	4	4	4	4	4	4	3	2	1					40
L5	5	5	5	5	5	4	5	5	3	2	1					48
															Total	214

i. Sufficient knowledge in the fields of mathematics, natural sciences, and related engineering disciplines; the ability to apply theoretical and practical knowledge in solving complex engineering problems.

ii. The ability to identify, formulate, and solve complex engineering problems; the ability to select and apply appropriate analysis and modeling methods for this purpose.

iii. The ability to design a complex system, process, device, or product to meet specific requirements under realistic constraints and conditions; the ability to apply modern design methods for this purpose.

iv. The ability to select and use modern techniques and tools required for the analysis and solution of complex problems encountered in engineering applications; the ability to effectively use information technologies.

v. The ability to design experiments, conduct experiments, collect data, analyze results, and interpret findings for the investigation of complex engineering problems or discipline-specific research topics.

vi. The ability to work effectively in intra-disciplinary and multidisciplinary teams; the ability to work independently.

vii. The ability to communicate effectively both orally and in writing; proficiency in at least one foreign language; the ability to write effective reports, understand written reports, prepare design and production reports, make effective presentations, and give and receive clear and understandable instructions.

viii. Awareness of the necessity of lifelong learning; the ability to access information, track developments in science and technology, and continuously renew oneself.

ix. Acting in accordance with ethical principles, knowledge of professional and ethical responsibilities, and the standards used in engineering applications.

x. Knowledge of business practices such as project management, risk management, and change management; awareness of entrepreneurship and innovation; knowledge of sustainable development.

xi. Knowledge of the impact of engineering practices on health, environment, and safety at global and societal levels, and awareness of contemporary engineering issues; awareness of the legal consequences of engineering solutions.