EEE224 - Electromagnetic Theory

Course Code	Course Name		Semester	
EEE224	Electromagnetic Theory		Fall ☐ Spring ☒ Summer ☐	
Hours			Credit	ECTS
Theory	Practice	Lab	4	5
4	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 electromagnetic theory based on Maxwell's equations for in-depth understanding of electric and magnetic fields, solving electrostatic and magnetostatic problems, pursuing advanced studies in electrical engineering.
Course Content	The course presents Maxwell's equations for static electric and magnetic fields, provides experience in solving electrostatic and magnetostatic problems, and considers electric and magnetic properties of different materials.
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☐ Discussion ☐
Prerequisites/	MATH102

Corequisites	
Work Placement(s)	Room 826

Textbook/References/Materials

- [1] D. K. Cheng, Fundamentals of Engineering Electromagnetics, Pearson New Intl. Edition, 2014
- [2] E. M. Purcell and D. J. Morin, Electricity and Magnetism, Cambridge Univ. Press, 3rd Ed., 2013
- [3] D. J. Griffiths, Introduction to Electrodynamics, Prentice Hall, 1999
- [4] J. D. Jackson, Classical Electrodynamics, 3rd Ed., John Wiley and Sons, 1999
- [5] J. A. Edminister and M. Nahvi, Electromagnetics, Schaum's Outlines Series, 4th Ed., 2014

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

Weekly Schedule

No	Topics	Materials/Notes
1	Electromagnetic Model	[1] Ch. 1
2	Vector Algebra. Coordinate Frames	[1] Ch. 2.1-2.4
3	Vector Calculus. Gradient. Divergence. Gauss's Theorem	[1] Ch. 2.5-2.7
4	Vector Calculus. Curl. Stokes's Theorem	[1] Ch. 2.8-2.11
5	Electrostatics. Coulomb's Law. Gauss's Law	[1] Ch. 3.1-3.4
6	Electric Potential. Material Media.	[1] Ch. 3.5-3.7
7	Boundary Conditions. Electrostatic Energy	[1] Ch. 3.8-3.10
8	Midterm Exam	
9	Electrostatic Problems. Poisson's and Laplace's Equations	[1] Ch. 3.11.1
10	Solutions of Electrostatic Problems.	[1] Ch. 3.11
11	Steady Electric Currents. Ohm's and Kirchhoff's Laws	[1] Ch. 4
12	Static Magnetic Field. Lorentz's Force. Ampere's Circuital Law.	[1] Ch. 5.1-5.2
13	Vector Magnetic Potential. The Biot-Savart Law.	[1] Ch. 5.3-5.7
14	Magnetic Materials, Inductance. Magnetic Energy	[1] Ch. 5.8-5.12
15	Static Field Problem Solving	[1] Ch. 2 - 5
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	2	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	4	64
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	2.5	35
Quiz/Studio/Criticize	5	1	5
Homework	2	2.5	5
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	8	8
Final Exam and Preparation for Final Exam	1	8	8
Total Workload			**125**
Total Workload / 25			**5**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Knowledge of basic laws and properties of electrostatic and magnetostatic fields
L2	Knowledge of the electric and magnetic properties of materials
L3	Knowledge of mathematics needed for solving electric and magnetic field problems
L4	Skills for solving typical electrostatic and magnetostatic problems
L5	Ability to understand new concepts in modern science. Analytical and creative 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					-
L2	5	5	4	3	4	4	4	4	4	3	2					-
L3	5	5	4	4	4	4	4	4	3	2	1					-
L4	5	5	4	4	4	4	4	4	3	2	1					-
L5	5	5	5	5	5	4	5	5	3	2	1					-
															Total	-

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.