EEE 471 Radar Theory

Course Code	Course Name	Semester	
EEE 471	Radar Theory	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	5
3	-- / --		

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. İsmail Hakkı ALTAŞ
Course Objectives	At the end of the course, students: - Will learn the basics of radar principles. - Will be able to establish and solve radar and jamming equations. - Will understand the basic radar types and radar signal processing techniques. - Will be able to select radar type according to the operational requirements. - Will be able to explain different radar concepts, such as pulse compression, clutter, and detection.
Course Content	- Introduction to Radar Systems (Definitions and Nomenclature) - A General Survey on Radar Theory - Pulsed Radars (The Radar Range Equation, Low/High PRF Radar Equation - Surveillance Radar Equation, Jamming Equation, Bistatic Radar Equation) - Radar Losses and Noise Figure - Continuous Wave (CW) Radars - Radar Signals and Signal Processing - Linear Systems and Complex Signal Representation - Discrete Time Systems and Signals - The Matched Filter Radar Rx - Pulse Compression - Radar Clutter
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☒ Discussion ☒
Prerequisites/ Corequisites	---

Work Placement(s)	---

Textbook/References/Materials

- Bassem R. Mahafza, Radar Systems Analysis and Design Using MATLAB, Third Edition, deciBel Research Inc. Huntsville, Alabama, USA, 2013.
- Merrill I. Skolnik, Introduction to Radar Systems, Second Edition, McGraw-Hill International Edition, 1981.

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

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction to Radar Systems	
2	Pulsed Radar Equations	
3	Radar Equation with Jamming	
4	Radar Equation with Jamming	
5	Radar Losses	
6	Noise Factor	
7	Continuous Wave Radars	
8	Midterm Exam	
9	Spectral Display of Radar Signals	
10	Discrete-Time Systems and Signals	
11	Matched Filter Radar Receiver	
12	Matched Filter Radar Receiver	
13	Pulse Compression	
14	Pulse Compression	
15	Radar Clutter	
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance	--	--
Lab	--	--
Practice	--	--
Fieldwork	--	--
Course-specific internship	--	--
Quiz/Studio/Criticize	2	15%
Homework	1	15%
Presentation / Seminar	--	--
Project	--	--
Report	--	--
Seminar	--	--
Midterm Exam	1	20%
Final Exam	1	50%
	Total	**100%**
Contribution of Midterm Studies to Success Grade		50%
Contribution of End of Semester Studies to Success Grade		50%
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab	0	0	0
Practice	0	0	0
Fieldwork	0	0	0
Course-specific Work Placement	0	0	0
Out-of-class study time	14	2	28
Quiz/Studio/Criticize	2	5	10
Homework	1	10	10
Presentation / Seminar	0	0	0
Project	0	0	0
Report	0	0	0
Midterm Exam and Preparation for Midterm	1	15	15
Final Exam and Preparation for Final Exam	1	20	20
Total Workload			**125**
Total Workload / 25			**125/5**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Will learn the basics of Radar principles.
L2	Will be able to establish and solve radar and jamming equations.
L3	Will learn the basic structures of the radar components, and radar losses.
L4	Will be able to select radar type according to the operational requirements.
L5	Will be able to explain radar signal processing techniques.

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	4	4		4	4											-
L2	4	4		4	4											-
L3	3	3	3	3												-
L4		3	3	3												-
L5	3	3	3													-
															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.