COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2606003	**SEMESTER**	6
COURSE TITLE	Antennas - Radio Links - RADAR		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures	4	8
Laboratory	4	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialisation Course
PREREQUISITE COURSES:	Electromagnetism and Electromagnetic Wave Propagation (3rd Semester)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://www.electronics.teipir.gr

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of this course module students possess advanced knowledge, skills and competences in the subject of Antennas, Radio Links and RADAR that enable them to:

(As to the Antennas part of the course:)

- Understand, explain and apply the electromagnetic analysis methods applied to antennas analysis and design,
- Understand and interpret the fundamental antenna parameters,
- Carry out analysis and design for the following types of antennas: Linear Wire Antennas, Loop Antennas, Array Antennas, Aperture Antennas, Horn Antennas and Reflector Antennas.
- Perform operations and/or design calculations, as well as installation activities, for the

aforementioned types of antennas.
- Understand, apply and demonstrate skill in performing antenna measurement procedures.

(*As to the Radio Links part of the course:)*
- Understand and explain by drawing diagrams the basic radio propagation mechanisms.
- Understand, state and discuss radio propagation effects occurring in the following types of radio communication links: Line of Sight fixed terrestrial radio links, Earth to Space (Satellite) radio links and Land Mobile radio links.
- Carry out radio planning and installation procedures for the aforementioned radio communication links.

(*As to the RADAR part of the course:)*
- Understand, explain and apply the basic operations and design principles for the various types of radar systems.
- Perform operations of design and select the appropriate type for installation among for the various types of RADAR systems.
- Know, understand, apply and evaluate the performance of typical RADAR implementations.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

Lectures

W1. Overview of Electromagnetic theory fundamentals. Antennas analysis and design.
W2. Overview of the fundamental Antenna parameters.
W3. Linear Wire Antennas, Loop Antennas, Array Antennas.
W4. Aperture Antennas, Horn Antennas and Reflector Antennas.
W5. Introduction to Antenna Measurements

W6. Radio propagation theory. Atmospheric propagation phenomena. Ground propagation phenomena.
W7. Radio Link Availability and Link Budget Calculations.
W8. Radio planning procedures. Land mobile radio links.
W9. Radar fundamentals and design principles.
W10. Pulse and continuous wave Radar systems.
W11. MTI Radar systems. CW-frequency Radar systems.
W12. SAR Radar systems.
W13. Problem solving – preparation for exams.

Laboratory Experiments

W1. Introduction to Antennas I + Radar Pulses
W2. Introduction to Antennas II + Doppler Effect and Radar Systems
W3. Introduction to Antennas III + Tracking Radar System
W4. Antenna radiation patterns and gain + Slot Arrays
W5. Empirical Design of Yagi-Uda antennas + Propagation Attenuation Factor
W6. Antenna Optimization and EM-CAD Introduction I + Propagation Over Ground Plane
W7. Antenna Optimization and EM-CAD Introduction II + Line of Sight Propagation and Diffraction
W8. Written Exams
W9. Design and Development of Yagi-Uda Antenna I + Passive Reflectors and Non-Line-of-Sight Radio Links
W10. Design and Development of Yagi-Uda Antenna II + Attenuation, Large and Small Scale Fading I
W11. Design and Development of Yagi-Uda Antenna III + Attenuation, Large and Small Scale Fading II
W12. Design and Development of Yagi-Uda Antenna IV + Attenuation, Large and Small Scale Fading III
W13. Laboratory Assessment Tests

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of electronic presentation with multimedia content in class, • Student support through the course webpage and the departmental e-learning platform, • Electronic communication of instructors and students, through the course webpage and by e-mail. • Use of special software for antenna design in the lab. • Use of special software for antenna coverage measurements in the lab.
TEACHING METHODS *The manner and methods of teaching are*	Lectures, Laboratory experiments, study.

described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	***Semester workload (hours)***
Lectures	52
Study for lectures	52
Laboratory experiments	52
Report on lab experiments – group or personal	52
Study and preparation for exams	32
Course Total	***240***

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

Final grade = Theory part grade x 60% + Lab part grade x 40%

Theory Part grade:

- Final exam (80%)
- Homework optional (20%)

Lab part grade:

- Average of all grades received at each weekly Lab Experiment
- Elements graded are reports, projects and oral examinations.

(5) ATTACHED BIBLIOGRAPHY

Essential reading

1. KRAUS, J., *Antennas,* Tziolas Publications (translated into Greek).
2. BALANIS, C.A., *Antenna Theory, Analysis and Design,* Wiley.
3. SAUNDERS, S. R., Antennas and Propagation for Wireless Communication Systems, John Wiley.
4. BARTON, D., *Modern Radar System Analysis*, Artech House.
5. SAVVAIDIS, S., Lecture Notes and Laboratory Manual Notes.

Recommended Books

6. RUDGE, A.W., MILNE, K., OLVER, A.D. and P. KNIGHT, *The Handbook of Antenna Design,* Volume I, Peter Peregrinus Ltd, on behalf of IEE, London.
7. FYKIORIS, J., *Introduction to Antenna Theory,* Sellountos Publications (in Greek).
8. BERTONI, H.L., *Radio Propagation for Modern Wireless Systems,* Prentice Hall.
9. FREEMAN, R., *Radio System Design for Telecommunications (1-100 GHz)*, John Wiley.
10. RAPPAPORT, T. S., *Wireless Communications: Principles & Practice*, Prentice Hall.
11. NITZBERG, R., *Radar Signal Processing and Adaptive Systems*, Artech House.