Antennas – Radio Links – RADAR

<table>
<tr><th>module title
module code</th><th colspan="3">level of module</th><th>year of study</th><th>semester/trimester when the module is delivered</th></tr>
<tr><td>Antennas - Radio Links - RADAR
EN-SplC-603-8</td><td colspan="3">1st (Undergraduate)</td><td>3rd</td><td>SPRING Semester</td></tr>
<tr><th rowspan="2">Name / e-mail of lecturer(s)</th><th colspan="2">Weekly Hours</th><th rowspan="2">ECTS</th><th rowspan="2">module type (comp., opt.)</th><th rowspan="2">mode of delivery (face to face, distance learning)</th></tr>
<tr><th>Lect.</th><th>Lab.</th></tr>
<tr><td rowspan="2">Prof. Stylianos Savaidis
ssavaid@teipir.gr
Assist. Prof. Stylianos Mitilineos
smitil@teipir.gr</td><td>4</td><td>4</td><td>8</td><td>Compulsory</td><td>Face to face</td></tr>
<tr><td>module web Page</td><td colspan="5">http://electronicstaff.teipir.gr/savaidis/index.php/el/teaching/-/-/antennas.html
http://www.electronics.teipir.gr/personalpages/Mytilinaios/index.htm</td></tr>
<tr><td>learning outcomes</td><td colspan="5">The aim of the course module is to provide students with:
• Understanding of the electromagnetic analysis methods applied to antennas analysis and design.
• Understanding of the fundamental antenna parameters.
• Understanding of analysis and design principles for the following types of antennas: Linear Wire Antennas, Loop Antennas, Array Antennas, Aperture Antennas, Horn Antennas and Reflector Antennas.
• Ability to perform operation and/or design calculations, as well as installation activities, for the aforementioned types of antennas.
• Understanding of antenna measurement procedures.
• An understanding of the basic radio propagation mechanisms.
• An understanding of the 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.
• Ability to carry out radio planning and installation procedures for the aforementioned radio communication links.
• Understanding of the basic operation and design</td></tr>
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	principles for the various types of radar systems. • Ability to perform operation, design and installation choices for the various types of radar systems. • Knowledge of typical radar implementations.
prerequisites and co-requisites:	E/M & Electromagnetic Wave Propagation (3rd Semester)
recommended optional programme components	Antennas Fundamentals. Antenna Design. Antenna and RF Feeding Systems. Propagation. Radio Channels. Radar Systems.
module description	*Theory* 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* 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 +

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<tr><td></td><td>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</td></tr>
<tr><td>recommended or required bibliography:</td><td><u>Essential reading</u>
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.

<u>Recommended Books</u>
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.</td></tr>
<tr><td>planned learning activities and teaching methods:</td><td>Lectures and Laboratory Experiments

<table><tr><th>Learning Activity</th><th>Load (hours)</th></tr><tr><td>Lectures</td><td>104</td></tr><tr><td>Lab Experiments</td><td>52</td></tr><tr><td>Group Lab reports</td><td>26</td></tr></table></td></tr>
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<tr><td>Group case studies</td><td>26</td></tr>
<tr><td>Self study and reading of papers</td><td>32</td></tr>
<tr><td>Total</td><td>240</td></tr>
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<tr><td>assessment methods and criteria:</td><td>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.</td></tr>
<tr><td>language of instruction:</td><td>Greek and English</td></tr>
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