E/M & E/M Wave Propagation

<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>E/M & E/M Wave Propagation
EN-GC-302-4</td><td colspan="3">1st (Undergraduate)</td><td>2nd</td><td>FALL Semester</td></tr>
<tr><th>Name / e-mail of lecturer(s)</th><th colspan="2">Weekly Hours</th><th>ECTS</th><th>module type (comp., opt.)</th><th>mode of delivery (face to face, distance learning)</th></tr>
<tr><td rowspan="2">Prof. Stylianos Savaidis
(ssavaid@teipir.gr)</td><th>Lect.</th><th>Lab.</th><th></th><th></th><th></th></tr>
<tr><td>2</td><td></td><td>4</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/en/teaching/undergraduate-courses/em-waves-a-em-wave-propagation-/lectures.html</td></tr>
<tr><td>learning outcomes</td><td colspan="5">Upon successful completion of this course module, students are expected to:

1. List the different types of EM field sources and explain what kind of Electric, Magnetic or Electromagnetic fields originate from each type of source.
2. Explain the qualitative conclusions arising from the Maxwell equations
3. Compute Electric, Magnetic or Magnetic fields using both the Integral and the Differential form of the Maxwell Equations.
4. Describe the wave equation in media with and without sources / losses.
5. Explain how a plane wave satisfies the wave equation in media with and without field sources / losses.
6. List the basic wave propagation mechanisms such as free space propagation, reflection, transmission, diffraction, scattering.
7. Explain the key characteristics of the above mentioned propagation mechanisms with respect to the field amplitude, the field phase and the direction of wave propagation.
8. Compute the field amplitude, the field phase and the direction of wave propagation taking into account the above mentioned propagation mechanisms.
9. Discuss the potential presence of the different propagation mechanisms in different types of radio links.</td></tr>
<tr><td>prerequisites and co-requisites:</td><td colspan="5">N/A</td></tr>
<tr><td>recommended optional programme components</td><td colspan="5">N/A</td></tr>
<tr><td>module description</td><td colspan="5">Theory
1. Field Sources (electrical charges, magnetic dipoles, DC and AC currents) and Electric, Magnetic and Electromagnetic fields.
2. Integral Maxwell Equations: Gauss Law Electric and Magnetic Fields.
3. Integral Maxwell Equations: Faraday and Ampere - Maxwell Laws.
4. Computing Electric, Magnetic and Electromagnetic fields using the Integral</td></tr>
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<tr><td></td><td>Maxwell equations' formalism.
5. Differential Maxwell equations and Boundary Conditions.
6. Computing Electric, Magnetic and Electromagnetic using the differential Maxwell equations' formalism.
7. Wave Equation in lossless / lossy media with or without sources. The plain wave as a solution of the wave equation.
8. Overview Presentation of the basic EM wave propagation mechanisms
9. Free Space Propagation
10. Reflection and Transmission from a plane interface
11. Diffraction and Fresnel zones.
12. Scattering from small obstacles and rough surfaces
13. Radio link types and Propagation Mechanisms

<u>Laboratory</u>
N/A</td></tr>
<tr><td>recommended or required bibliography:</td><td>1. S. P. Savaidis, A. Skountzos, Electromagnetism and Electromagnetic Wave transmission, Synchroni Ekdotiki Eds., Athens, Greece, 2010 (in greek).
2. S. Paktitis, A. Nasiopoulis, Introduction to Electromagnetic Wave Propagation, ION Eds., Athens, Greece, 2008 (in greek).
3. I. RFoumeliotis, I. Tsalamegkas, Electromagnetic Fields (Parts A & B), Tziolas Eds., Thessaloniki, Greece, 2010 (in greek).</td></tr>
<tr><td>planned learning activities and teaching methods:</td><td>Face to face lectures

<table><tr><th>Learning Activity</th><th>Load (hours)</th></tr><tr><td>Lectures</td><td>52</td></tr><tr><td>Reading of books and papers</td><td>16</td></tr><tr><td>Self study and preparation for the exams</td><td>52</td></tr><tr><td>Total</td><td>120</td></tr></table></td></tr>
<tr><td>assessment methods and criteria:</td><td>Option A
Final exam (80%)
Homework (20%)

Option B
Final Exam (100%)</td></tr>
<tr><td>language of instruction:</td><td>Greek and English</td></tr>
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