**University of Tehran**
**School of Electrical and Computer Engineering**

<table>
<tr><td>Course:</td><td colspan="10">8101… – Electromagnetic Scattering</td></tr>
<tr><td>Course type:</td><td colspan="10"><table>
<tr><td></td><td colspan="6">EE*</td><td colspan="3">CE*</td><td rowspan="2">Credit: 3</td></tr>
<tr><td></td><td>Com</td><td>E</td><td>P</td><td>B</td><td>Con</td><td>D</td><td>SW</td><td>HW</td><td>IT</td></tr>
<tr><td>Required</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td></td></tr>
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<tr><td>Level:</td><td colspan="10">Undergraduate ☐<br>Graduate ■</td></tr>
<tr><td>Co-requisite(s):</td><td colspan="10">None</td></tr>
<tr><td>Prerequisite(s):</td><td colspan="10">Electromagnetic theory I (8101450)</td></tr>
<tr><td>Prerequisite by topic:</td><td colspan="10">Electromagnetic wave theory, Stochastic processing</td></tr>
<tr><td>Textbook(s):</td><td colspan="10">[1] K. Sarabandi, Theory of Wave Scattering from Rough Surfaces and Random Media, class notes for EECS 730, University of Michigan, Ann Arbor, Jan. 2004.<br>[2] A. Ishimaru, Wave propagation and scattering in random media, IEEE press, 1999.<br>[3] J. A. Kong, Electromagnetic wave Theory, EMW, 2000.</td></tr>
<tr><td>Coordinator:</td><td colspan="10">Mojtaba Dehmollaian, Associate Professor, School of ECE</td></tr>
<tr><td>Goals:</td><td colspan="10">This is a graduate level course covering multiple parts, dyadic Green’s function of multilayer media, scattering from 1-D periodic surfaces, scattering from periodic dielectric layers using Floquet-Fourier series expansion, scattering from rough surfaces (PO, GO, and SPM), target polarimetric scattering responses, scattering from random volume, mixing formulas, single scattering theory, synthetic aperture imaging, and time reversal imaging.</td></tr>
<tr><td>Outcome:</td><td colspan="10">Upon successful completion of the course, students will be able<br>1. to understand the details of number of scattering problems,<br>2. to increase their insight to electromagnetic modeling,<br>3. to apply number of analytical techniques, and<br>4. to understand radar imaging algorithms.</td></tr>
<tr><td>Topics:</td><td colspan="10">1) Dyadic Green’s functions of layered media<br>2) Ewald-Oseen extinction theorem</td></tr>
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| | 3) **Scattering by surfaces** (scattering by periodic surfaces, scattering by random rough surfaces, small perturbation method and Kirchhoff approaches)<br>4) **Scattering by periodic layers**<br>5) **Remote sensing with polarimetric radar** (polarization signature)<br>6) **Waves in random media (**propagation in sparse random media, Born approximation, and statistics of scattered fields from random media, dielectric mixing formulas)<br>7) **Synthetic aperture radar imaging**<br>8) **Time reversal imaging** |
| **Computer usage:** | MATLAB or another programming language of student choice |
| **Assignments:** | 5 HW assignments |
| **Projects:** | One term project<br>Understanding (new) method(s) presented in a journal paper relevant to the course topics and (partial) validation (derivation and simulation) of paper results is regarded as a decent term project. |
| **Grading:** | Assignments: 25%<br>Project: 25%<br>Midterm exams: 25%<br>Final exam: 25% |
| **Further readings:** | [1] L. Tsang, *Scattering of electromagnetic waves*, John Wiley & Sons, 2001.<br>[2] F. T. Ulaby, *Radar polarimetry for geoscience applications*, Artech House, 1990.<br>[3] Class Notes and Some Journal Papers. |
| **Prepared by:** | Mojtaba Dehmollaian |
| **Date:** | August 26, 2017 |

| *EE: Electrical Engineering | | CE: Computer Engineering | |
|---|---|---|---|
| Com | Communications | SW | Software |
| E | Electronics | HW | Hardware |
| P | Power | IT | Information Technology |
| B | Bioelectronics | | |
| Con | Control | | |
| D | Digital System | | |