<table>
<tr><td>Course Title</td><td colspan="5">Advanced Semiconductor Materials and Devices</td></tr>
<tr><td>Course Code</td><td colspan="5">MME 566</td></tr>
<tr><td>Course Type</td><td colspan="5">Compulsory</td></tr>
<tr><td>Level</td><td colspan="5">Graduate</td></tr>
<tr><td>Year / Semester</td><td colspan="5">Fall Semester</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Matthew Zervos</td></tr>
<tr><td>ECTS</td><td>8</td><td>Lectures / week</td><td>2x1.5 hrs</td><td>Laboratories / week</td><td>--</td></tr>
<tr><td>Course Purpose and Objectives</td><td colspan="5">The objectives of this course is to provide an in-depth overview of semiconductor physics and devices in order to bring all students to the same level and then introduce them to state of the art low dimensional semiconductors with emphasis on materials used in solar cells.

The purpose of this course is to provide to MSc students on Advanced Materials and Nanotechnology a solid scientific background on semiconductor materials and devices related primarily to energy conversion e.g. solar, thermoelectric.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">Upon successful completion of the course, students will
1. Have fundamental knowledge on semiconductors
2. Acquire in-depth knowledge of the p-n junction in equilibrium
3. Understand the workings of a p-n junction under an applied electric field.
4. Understand p-n junction solar cells.
5. Know how to derive the 3D, 2D and 1D Density of States
6. Understand how dimensionality affects the properties of semiconductors
7. Understand how low dimensional semiconductors and devices are grown and fabricated.
8. Know the state of the art semiconductors used in solar cells, their properties advantages and disadvantages.</td></tr>
<tr><td>Prerequisites</td><td colspan="2">NO</td><td>Required</td><td colspan="2">NO</td></tr>
<tr><td>Course Content</td><td colspan="5">Si, Ge III-V semiconductors; intrinsic, n-type and p-type; Carrier transport, Hall effect, resistivity, conductivity, mobility, photoconductivity, The infinite quantum well; derivation of 3D DOS, Fermi Dirac statistics, carrier concentration, law of mass action. Temperature dependence of carrier density and mobility, scattering mechanisms. Energy band diagrams and Fermi level, temperature dependence of Fermi level. The p-n junction in equilibrium , under forward and reverse bias in the dark; The p-n junction as photovoltaic</td></tr>
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	device, open circuit voltage, short circuit current, efficiency, fill factor. Derivation of 2D, 1D, 0D DOS, quantum wells, wires and dots. Bottom-up versus top down growth. Nanowires, Quantum dots, bandgap tuning and absorption application to solar cells.
Teaching Methodology	Lectures Communicative, Collaborative During the first week of the semester, the Syllabus of the course is given by the teacher, which includes information on the course content, expected learning outcomes, assessment and office hours
Bibliography	S.M. Sze, Semiconductor Devices: Physics and Technology, 2002 B.G. Streetman and S.K. Banerjee, Solid State Electronic Devices 6th edition PDF download; https://ebooks.cybernog.com/2017/11/solid-state-electronic-devices-streetman-banerjee-pdf.html
Assessment	Midterm Exam (50%), Final Exam (50%)
Language	English