<table>
<tr><td>Course code</td><td></td></tr>
<tr><td>Type and description</td><td>Elective Course</td></tr>
<tr><td>ECTS credit</td><td>1</td></tr>
<tr><td>Course name</td><td>Advanced Characterization tools in Nanomaterials</td></tr>
<tr><td>Course name in Polish</td><td>Zaawansowane narzędzia do charakteryzacji nanomateriałów</td></tr>
<tr><td>Language of instruction</td><td>English</td></tr>
<tr><td>Course Level</td><td>8 PRK</td></tr>
<tr><td>Course coordinator</td><td>Vignesh Kumaravel</td></tr>
<tr><td>Course instructors</td><td>Vignesh Kumaravel; Deniz Atila; Lekshmi Gopakumari Satheesh Chandran</td></tr>
<tr><td>Delivery methods and course duration</td><td>
<table>
<tr><th></th><th>Lecture</th><th>Tutorials</th><th>Laboratory</th><th>Project</th><th>Seminar</th><th>Other</th><th>Total of teaching hours during the semester</th></tr>
<tr><td>Contact hours</td><td>0</td><td>0</td><td>0</td><td>15</td><td>0</td><td>0</td><td>15</td></tr>
<tr><td>E-learning</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td></td></tr>
<tr><td>Assessment criteria (weightage)</td><td>0</td><td>-</td><td>0</td><td>-</td><td>0</td><td>0,00</td><td></td></tr>
</table>
</td></tr>
<tr><td>Course objective</td><td>1. Acquisition of knowledge on the basic principles in the characterization of nanomaterials.

2. Acquisition of knowledge on the structural, optical, magnetic, and surface features of nanomaterials.

3. Realizing the significance of advanced characterization tools in biomedical, energy, and environmental applications.</td></tr>
<tr><td>Learning outcomes</td><td>After the course, a Ph.D. student will be able to:

1. understand the basic concepts of important characterization techniques in nanotechnology: effects W4, U4, K1

2. utilize the suitable characterization techniques to analyze the materials in their research: effects W4, U4, K1

3. develop the skills in the safety operation procedures, sample preparation, analysis, and interpretation of the data using various sophisticated instrumentation facilities: effects W4, U4, K1

4. apply the acquired knowledge to solve the research problems in multidisciplinary fields.</td></tr>
<tr><td>Assessment methods</td><td>Effects W4 – oral examination

effects K1 – presentation and laboratory

The final evaluation is based on:

Exam - 70%

Seminar Presentation - 20%</td></tr>
</table>

	Laboratory - 10 %
Prerequisites	The basic knowledge in materials science, nanomaterials, and nanotechnology (Graduate in Chemistry, Physics, Biotechnology, Biochemistry, Chemical Engineering, Nanomaterials, Nanoscience, Nanotechnology, Materials Science, and other related disciplines)
Course content with delivery methods	Lectures: 1.) Introduction to X-ray-based characterizations: (Diffraction, Computed tomography, Fluorescence spectroscopy, and Photoelectron spectroscopy) 2.) Introduction to optical characterizations: (UV-visible spectroscopy, Photoluminescence, and surface-enhanced Raman scattering) 3.) Analysis of morphology and topology (Scanning electron microscopy, Transmission electron microscopy, and Atomic force microscopy) 4.) Analysis of thermal properties (Thermogravimetric analysis, Differential thermal analysis, and Differential scanning calorimetry). 5.) Analysis of magnetic property (VSM) 6.) Introduction to surface area analysis Seminar topics of this course will be focused on the utilization of advanced characterization tools in biomedical and environmental applications Laboratory: Powder X-ray diffraction analysis, and UV-vis-diffuse reflectance spectroscopy
Basic reference materials	1) M. Che, J. C. Vedrine, Characterization of Solid Materials and Heterogeneous Catalysts: From Structure to Surface Reactivity, John Wiley & Sons, 2012. 2) D. A. Skoog, F. J. Holter and S. R. Crouch, Principles of Instrumental Analysis, Cengage learning, 2017. 3) Ing. V. -D. Hodoroaba, W. Unger, A. Shard, Characterization of Nanoparticles: Measurement Processes for Nanoparticles, Elsevier, 2019. 4) O. Novais de Oliveira, Jr, F. Marystela, F.L.L. Leite, A.L. Da Róz, Nanocharacterization Techniques, Elsevier, 2017. 5) S. Thomas, R. Thomas, A. K. Zachariah, R.K. Mishra, Thermal and Rheological Measurement Techniques for Nanomaterials Characterization, Vol. 3, Elsevier, 2017.
Other reference materials	1) Z.L Wang (ed), Characterization of Nanophase materials, Wiley-VCH, New York, 2001. 2) R.W. Cahn, E.M. Lifshitz, Concise Encyclopaedia of Materials Characterization, Elsevier, 2016. 3) C. R. Brundle, C. A. Evans Jr., S. Wilson, Encyclopaedia of Materials Characterization, Butterworth - Heinemann Publishers, 1992. 4) R.F. Egerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, Springer Nature, 2016. 5) D. B. Williams, C. B. Carter, Transmission Electron Microscopy: A Textbook for Materials Science, Vol. 2, Springer Science & Business Media, 1996.
Average student workload outside the classroom	35 h
Comments	
Last update	Brak informacji