



Course unit English denomination	Transmission Electron Microscopy: From Chemistry and Materials Science to Biology
SSD	CHEM-02/A
Teacher in charge (if defined)	AMENDOLA Vincenzo
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	06-07/2026
Course delivery method	<input type="checkbox"/> In presence <input type="checkbox"/> Remotely <input checked="" type="checkbox"/> Blended
Language of instruction	English
Mandatory attendance	<input checked="" type="checkbox"/> Yes (80 % minimum of presence) <input type="checkbox"/> No
Course unit contents	<p>The course aims at providing an overview of the various characterization techniques relying on transmission electron microscopy (TEM) and their relevance in various fields of Chemistry, Materials Science and Biological Sciences.</p> <p>The contents will start with the fundamentals of electronic optics and TEM structure, with special emphasis on the two TEM instruments available at the University of Padova. Then the different imaging and analytical modalities (TEM, HRTEM, BF, DF, SAED, EDX, EELS, STEM, etc.) and the types of TEM equipment (standard, cryo, corrected, in situ, etc.) will be discussed with application examples. Practical sessions on software for TEM data analysis and a visit to the TEM facilities of UniPd will be also performed.</p> <p>At the end of the course, the PhD students will become aware of the technical possibilities made available by modern TEM equipment at UniPd and, in general, in the contemporary scientific panorama, and will develop individual skills for analysis and manipulation of data collected by direct access to the UniPd facilities.</p>
Learning goals	<p>Knowledge:</p> <ul style="list-style-type: none">- Fundamental principles of electron optics and the structural components of TEM.- Understanding of TEM imaging and analytical techniques (e.g., TEM, HRTEM, BF, DF, SAED, EDX, EELS, STEM).- Types and functionalities of advanced TEM instruments (e.g., cryo-TEM, aberration-corrected TEM, in situ TEM).- Practical applications of TEM in Chemistry, Materials Science, and Biological Sciences.- Capabilities and specific features of the TEM facilities at the University of Padova. <p>Skills:</p>



	<ul style="list-style-type: none">- Operate TEM-related software for data analysis and image processing in normal TEM, diffraction, STEM and EDX modes.- Interpret and analyze TEM data across various imaging and spectroscopic techniques.- Identify the appropriate TEM method for specific scientific investigations.- Navigate and utilize the TEM facilities at the University of Padova effectively. <p>Competencies:</p> <ul style="list-style-type: none">- Critically evaluate TEM data and derive meaningful scientific conclusions.- Design experimental strategies using TEM for multidisciplinary research.- Collaborate effectively with facility experts and interdisciplinary teams.- Adapt and apply TEM methodologies to address complex research questions.
Teaching methods	Frontal teaching
Course on transversal, interdisciplinary, transdisciplinary skills	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Available for PhD students from other courses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Students external to the PhD Course admitted upon evaluation of the CV by the teachers
Prerequisites (not mandatory)	Background in at least one of the disciplines or topics related to the course (Chemistry, Pharmaceutical Sciences, Biology, Materials Science, Electron Microscopy)
Examination methods	Written reports on the practical activities carried out during the course
Suggested readings	Slides/articles provided by the teacher
Additional information (not mandatory)	The course will be divided in three 8-hours modules spread over the teaching sessions, each made of a passive lesson part and a practical part. Whenever possible, international guest speakers will be invited to cover specialized topics.