**COURSE SYLLABUS**

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| **Subject: Nanomaterials Characterisation Techniques (Tools for Spectroscopy)** | **Academic field: Materials Science** |
| **Lecturer: Dr. Nguyen Van Quynh** |  |
| **Phone: 097 332 7073** | **E-mail: nguyen-van.quynh@usth.edu.vn** |
| **Academic year: 3rd** |  |

**COURSE DESCRIPTION**

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| **Credit points** | 3 |
| **Level** | Undergraduate |
| **Teaching time** **Location** | University of Science and Technology of Hanoi |
| **Time Commitment** | Lecture | 26 hrs |
| Exercises | 0 hrs |
| Practicals | 6 hrs |
| Total | 32 hrs |
| **Prerequisites** | Electromagnetism, Chemical physics, Electronic structure of materials. |
| **Recommended background knowledge** | Basic knowledge in physics, chemistry and materials science. |
| **Subject description:** | Nanomaterials Characterisation Techniques (previously known as Tools for Spectroscopy) deals with techniques that characterise structures of material based on their interactions with photons, electrons and atoms. It covers the physics, working principles, instrumentations and applications of the most popular methods including ultraviolet visible spectroscopy, X-ray diffraction, Raman spectroscopy, scanning electron microscopy, scanning force microscopy, etc. Besides regular lectures, students will have oppoturnities to practice at actual laboratories at VAST, based on the availability of the tools.  |
| **Objectives & Out-come** | Objectives of the course are:* To introduce students to various characterisation methods that are being used in materials science research.
* To show students the relationship between materials properties and their corresponding characterisation means in order to select the suitable tools for their future research.
* To show students current trends in surface science research.

As for the out-come of the lecture, students are expected to:* Get the fundamental understanding about the working principals and applications of each method.
* For the practical emphasis, student are expected to be able to use the instruments; prepare samples and perform the experiments; analyze and interpret data.
* Achieve an additional knowledge in materials science, including new trends in materials research. Eventually, they are able to make their own decision on the use of the characterisation tools for their research.
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| **Assessment/ Evaluation** | Attendance/Attitude | 5 % |
| Exercise(s) | 10 % |
| Practicals | 20 % |
| Mid-term test | 15 % |
| Final exam | 50 % |
| **Prescribed Textbook(s)** | [1] Yang Leng, "*Materials Characterization: Introduction to Microscopic and Spectroscopic Methods",* John Wilay & Sons (Asia) Pte Ltd, 2008, ISBN: 978-0-470-82298-2. [2] David Brandon, "*Microstructural Characterization of Materials",* 2nd Ed., John Wiley & Son, Ltd, 2008, ISBN: 978-0-470-02784-4. |

**COURSE CONTENTS & SCHEDULE**

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| **Class**  | **Contents** | **Hours** | **Ref./Resources** | **Assignment(s)**  |
| **Lect.** | **Exr.** | **Prc.** |
| 1 | Introduction to materials characterisation. Optical microscope. | 3 |  |  |  |  |
| 2 | Scanning Electron Spectroscopy | 3 |  |  |  |  |
| 3 | Transmission Electron Microscopy | 3 |  |  |  |  |
| 4 | Scanning Probe Microscopy (AFM + STM | 3 |  |  |  |  |
| 5 | Xray techniques, | 3 |  |  |  |  |
| 6 | FTIR and Raman spectroscopy | 3 |  |  |  |  |
| 7 | Labwork 1: SEM |  |  | 3 |  |  |
| 8 | Labwork 2: AFM |  |  | 3 |  |  |
| 9 | Mass Spectroscopy. Neutron related techniques | 3 |  |  |  |  |
| 10 | Advance Spectroscopy. Technique used in cleanroom | 3 |  |  |  |  |
|  | Final exam |  |  |  |  |  |