George Mason University
Graduate Course Approval/Inventory Form

Please complete this form and attach a copy of the syllabus for new courses. Forward it as an email attachment to the Secretary of the Graduate Council. A printed copy of the form with signatures should be brought to the Graduate Council Meeting. Complete the Coordinator Form on page 2, if changes in this course will affect other units.

Please indicate:  X NEW  ____ MODIFY  ____ DELETE

Local Unit:  SCS

Graduate Council Approval Date:

Course Designation:  NANO

Course Number:  510

Full Course Title: Strategies for Nanocharacterization

Abbreviated Course Title (24 characters max.): Nanocharacterization

Credit hours: 3  Program of Record: Graduate Certificate in Nanotechnology and Nanoscience

Repeatable for Credit?  D=Yes, not within same term  T=Yes, within the same term  N=Cannot be repeated for credit

Up to ___ hours maximum  Up to ___ hours maximum

Activity Code (please indicate):  Lecture (LEC)  Lab (LAB)  Recitation (RCT)

STU  Internship (INT)  Independent Study (IND)  Seminar (SEM)

Catalog Credit Format  3: 3: 0  Course Level:  GF(500-600) X GA(700+)

Maximum Enrollment: 30  For NEW courses, first term to be offered: S05

Prerequisites:  NANO 500 and admission into the Graduate Certificate in Nanotechnology and Nanoscience.

Catalog Description (35 words or less): Introduces various nanocharacterization techniques, with a discussion of which techniques are most useful in various applications. Includes gates and bridges; chemical thermodynamics; kinetics; and solid-state reactions.

APPROVAL SIGNATURES:
Submitted by:  ________________________________  email: ________________

Department/Program:  ________________________________  Date: ________________

College Committee:  ________________________________  Date: ________________

Graduate Council Representative:  ________________________________  Date: ________________
GEORGE MASON UNIVERSITY
Course Coordination Form

Approval from other units:

Please list those units outside of your own who may be affected by this new, modified, or deleted course. Each of these units must approve this change prior to its being submitted to the Graduate Council for approval.

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Graduate Council approval: _______________________________ Date: ____________
Graduate Council representative: __________________________ Date: ____________
Provost Office representative: ____________________________ Date: ____________
Course proposal to the Graduate Council
by
The School of Computational Sciences

1. COURSE DESIGNATION:

NANO 510 Strategies for Nanocharacterization (3: 0: 0)

Prerequisites: NANO 500 and admission into the Graduate Certificate in Nanotechnology and Nanoscience.

Catalog description: Introduces various nanocharacterization techniques, with a discussion of which techniques are most useful in various applications. Spacial resolution and detection methods in several-electron microscopy techniques (SEM, TEM, LEED). Ion-bean techniques, surface techniques and their limitations. Mass spectrometry (MALDI, cluster desorption), as well as STM and AFM techniques. IR and Multiwavelength spectroscopies. Includes gates and bridges; chemical thermodynamics; kinetics; and solid-state reactions. Various nanomaterials are treated such as metals, ionic crystals, and semiconductors. Solid-vapor phase thermal sublimation. Piezolectric and pyroelectric mechanisms. Polar surfaces in nanodevices, and catalytic reactions.

Course Grading: Standard grading options for a graduate course.

2. COURSE JUSTIFICATION:

Course objectives: Students learn the principles of operation and have hands-on laboratory experimental training focused on the advanced analysis and characterization techniques available for studying nano-structures and nano-materials.

Course necessity: This course is needed in order to expose the students to the advanced techniques available for characterizing and studying nanostructures. It also provides students with basic knowledge regarding the principles of operation of these techniques.

Relationship to existing programs: The proposed course serves as part of the sequence of classes applicable to the Graduate Certificate in Nanotechnology and Nanoscience. It provides the basis for the experimental training of students in the Nanotechnology program.

Relationship to existing courses: No other similar course is currently offered at GMU.

3. APPROVAL HISTORY NA

4. SCHEDULING AND PROPOSED INSTRUCTORS

Time of initial offering: Spring 05

Proposed instructors: Dr. John Schreifels or another member of the Nanotechnology faculty.
5. **SAMPLE STUDENT SYLLABUS:**

**NANO 510 Strategies for Nanocharacterization**

**Textbook:**

References to resent literature, Lab handouts, operation manuals, and segments of technical texts.


Hari Singh Najwa “Nanostructure material and nanotechnology” consise Ed (Academic Press)

**Tentative Course Content:** NANO 510. Strategies for Nanocharacterization

- Week 1: Introduction To Analysis and Characterization for Nanostuctures.
- Week 2: Optical Microscopy –Principle of operation resolution limits
- Week 3: Electron Microscopy-Principles of Operation
- Week 4: SEM, TEM, LEED
- Week 5: SEM LAB
- Week 6: Ion Beam techniques
- Week 7: STM and AFM
- Week 8: Surface techniques
- Week 9: Mass Spectrometry
- Week 10: Mass Spectrometry LAB
- Week 11: Spectroscopy-Principles of operation
- Week 12: IR spectroscopy LAB
- Week 13: Gates and Bridges
- Week 14: NanoFabrication Lab Training

**Grading:** Assignments: 30%; Lab 30% midterm 20%; Final: 20%