

SEMESTER AND YEAR: Spring-2008

COURSE NUMBER, TITLE, CREDIT HOURS:

MATS-535, *ELECTRONIC AND PHOTONIC MATERIALS*, 3 credits

CLASS MEETINGS: MCAR 209, T., Th., 3:00PM to 4:30PM

INSTRUCTOR NAME, TITLE, DEPARTMENT, AND OFFICE HOURS:

Dr. Vladimir I. Gavrilenko, Associate Research Professor,
Center for Materials Research, Department of Physics,
Office hours: M., T., Th., F. 4:30PM to 5:30PM

INSTRUCTOR CONTACT INFORMATION:

Office: Room 515, MCAR
Phone: 823-8052
Email: vgavrilenko@nsu.edu
Office hours: M., T., W., Th. 4:30-5:30
Website:
<http://vigyan.nsu.edu:16080/~cmr/vgavrilenko.htm>

COURSE DESCRIPTION, PREREQUISITES, CO-REQUISITES

A MAT 535 is a three-hour credit, one semester course. The course introduces graduate students to the material science of electronic materials, to the internal structure, chemistry and physics of semiconductors, to the physics of electronic and photonic devices. The course includes how electronic materials and devices are produced and how to control processing to achieve desired materials performance.

Prerequisites are:

1. General Physics
2. General Chemistry
3. MATS 530, Materials Science

COURSE RATIONALE: Modern materials science requires good knowledge of the basic principles of electronic materials, as well as physics of electronic and photonic devices. This course provides students with important links between fundamental disciplines in materials science and practical applications in electronic and photonic devices.

COURSE GOALS and MEASURABLE INTENDED STUDENT LEARNING

OUTCOMES: The main goal is to prepare students for work in both fundamental and applied areas of quickly developing market of electronic and photonic materials science and engineering. Students will learn basic principles of materials engineering, as well as physics of electronic and photonic devices.

PRIMARY METHOD OF INSTRUCTION/METHOD TO ENGAGE STUDENTS

The primary method of instruction is lecture. The lectures are supported by Power-Point demonstrations. Teaching material discussions in the class are simulating students' engagement.

COURSE MATERIALS

REQUIRED TEXT: S. O. Kasap, *Principles of Electronic Materials and Devices*. McGraw Hill, 3d ed. 2006.

RECOMMENDED ADVANCED READING:

D. A. Neamen, *Semiconductor Physics and Devices*. McGraw Hill, 3d ed. 2003.

SUPPLEMENTARY READING:

M. Sze, *Semiconductor Devices, Physics and Technology*, 2d Edition, S. John Wiley & Son, 2002

H. B. Gray, *Electrons and Chemical Bonding*, W. A. Benjamin Inc. NY, Amsterdam, 1965.

C. Kittel, *Introduction to Solid State Physics*, John Willey, NY, 1986

COURSE OUTLINE*

1. Material Science Concepts
2. Electrical and Thermal Conduction
3. Elementary Quantum Physics
4. Modern Theory of Solids

MIDTERM

Spring Break

5. Semiconductors
6. Semiconductor Devices
7. Dielectric Materials and Insulators
8. Magnetic Properties and Superconductivity

FINAL EXAM:

RELATED UNIVERSITY-WIDE AND COURSE SPECIFIC REQUIREMENTS

- | | |
|---|------------------------------|
| • Writing | Basic |
| • Information Technology Literacy | Personal Computer Skills |
| • Quantitative Reasoning | University Mathematics |
| • Scientific Reasoning | |
| • Oral Communications | Basic |
| • Critical Thinking | |
| • Other Competencies or Requirements | Students Scientific Meetings |

EVALUATION / ASSESSMENT METHODS

The achievement evaluation of learning objectives and outcomes will be based on several quizzes during the semester, one midterm, and one final exam.

* The schedule is subject to change at the discretion of the instructor or depending upon the progress of the class

HOMEWORK: Students are expected to complete all homework assignments. In order to receive full credit for homework assignments, the following criteria must be met, in addition to obtain the correct answer:

- Each problem solution must include a sketch of the situation when possible.
- Problem solutions must be presented coherently. Include written statements to explain your approach to the problem and your reason for selecting the equations you use.

GRADING STANDARDS / EVALUATION CRITERIA*

Final grade will be result from the grades for homeworks (30%), midterm (30%), and the final exam (40%). No make-up exams or assignments will be given unless a medical or other emergency approved by the instructor was the reason for missing the exam or the assignment. For any other reason student must first contact the instructor **before** missing an exam or an assignment.

ACADEMIC INTERGITY STANDARDS

- **Attendance:** A student will be permitted one “unexcused” absence per semester hour of credit. Please review the NSU University Catalog.
- **Class participation:** questions and discussions in class are encouraged
- **Student class conduct:** use of the cell phone and/or electronic devices (except calculators and laptops) during the class is not allowed.
- **Students are expected** to be honest in completion of their tasks, exams, and homeworks. Study groups are encouraged; however, plagiarism of homework is unacceptable.

AMERICAN WITH DISABILITIES ACT (ADA) STATEMENT

In accordance with Section 504 of the 1973 Rehabilitation Act and the Americans with Disabilities Act (ADA) of 1990, if you have a disability or think you have a disability, contact Supporting Students through Disability Services (SSDS) for information regarding programs and services to enhance student success.

Location: 2nd Floor/Lyman B. Brooks Library, Room 240

Contact Person: Marian E. Shepherd, Disability Service Coordinator

Telephone: 757-823-2014

UNIVERSITY ASSESSMENT STATEMENT

As part of NSU’s commitment to provide the environment and resources needed for success, students may be required to participate in a number of university-wide assessment activities. The activities may include tests, surveys, focus groups and interviews, and portfolio reviews. The primary purpose of the assessment activities is to determine the extent to which the university’s program and services maintain a high level of quality and meet the needs of students. Students will not be identified in the

* The instructor reserves the right to revise the grading criteria as appropriate and will make reasonable attempts to notify students

analysis of the results. Unless indicated otherwise by the instructor, results from University assessment activities will not be computed in student grades.

ACADEMIC SUPPORT SERVICE

- Numbers of useful books for advanced reading are available in NSU Library.
- Free on-line access to scientific journals and reviews is available through the NSU Library website.
- Supporting materials for the course are available on the instructor's website: <http://vigyan.nsu.edu:16080/~cmr/vgavrilenko.htm>

SUCCESS TIPS

- **Take notes effectively.** A good set of notes can serve you well. Your notes help you remember which concepts your professor stressed and, thus, give you an idea as to what will be covered in the exam. Note taking also helps you concentrate on the lecture.
- **Learn to read actively.** Most of the material you have to learn at university is presented in written form. That's why it's so important to know an active reading technique that will enable you to learn and remember what you read
- **Learn to write effective term-paper.** At University, term papers are very important. Your professors assign them so that they can see how well you understand the material and how effectively you can discuss the pertinent issues. Your goal is to use your papers to convince your professor you deserve the mark you want
- **Use Smart Test-Taking Strategies.** Exams can be stressful situations where you're being evaluated and have to perform under a time limit. The key to managing the stress and performing well is to be a smart test-taker
- **Manage Your Study Time.** As a student at NSU, your schedule is likely a hectic one. Besides attending classes, doing homework and studying for tests and exams, you might also be holding down a part-time job, participating in a team sport, and looking after an apartment. You need to manage your time very efficiently if you are to keep up with your studies and finish your assignments on time.
- **Balance Your Life.** Devoting all of your time to school work may sound like a sure fire way to succeed in your courses, but living only for school can actually lead to burn-out. Conversely, spending too much time on leisure or other activities can lead to major stress (or even failure) when exam time comes. Finding the proper balance between time for school and time for everything else is a crucial step in achieving success
- **Set Career Goals.** Setting career goals is a crucial step towards success. Career goals are the focus and the reason behind all the hard work you're doing now. When you don't have a sense of what you're moving towards, things can seem pretty pointless. Knowing how a particular assignment relates in the long run to your future career can be the motivation you need to actually do it.
- **Deal with Personal Issues.** Life has a way of handing us ups and downs when we least expect them. This means that sometimes your life is going to get in the way of your studies. It's important to realize and accept that there will be times when you are just not able to work or study because life issues are demanding more attention. If this happens to you, be ready to seek out resources to help you deal with the situation.
- **Avoid common mistakes:** conversion of units, elementary algebra