



ECE 8120: Advanced Electronic Materials and Devices

Section 001

FALL 2020

MEETING TIME: Wednesday, 2 – 4.30 pm

MEETING LOCATION: Advanced Materials Research Lab (AMRL) Main Conference Room in first floor

INSTRUCTOR: Goutam Koley; Email: gkoley@clermson.edu; Office: C104 Duke Energy Building

OFFICE HOURS AND PROCEDURES: Monday; 2 – 3 pm and by appointment (online only, through zoom).

COURSE MODALITY: HYBRID/BLENDED

COURSE DESCRIPTION: Study of synthesis and characterization of wide bandgap semiconductor materials; their heterojunctions; electronic and optoelectronic devices; synthesis, characterization and device applications of 2-D materials.

COURSE PREREQUISITES: NONE

COURSE OBJECTIVES: This course develops students' understanding of wide bandgap semiconductor materials and devices as well as the emerging 2-dimensional materials and device applications. It also develops students' ability to design advanced electronic devices and circuits.

REQUIRED MATERIALS:

Required Textbook: No fixed textbook, materials mostly based on research papers and the references given below.

References:

- Gallium Nitride I and II edited by J. I. Pankove, and T. D. Moustakas, Academic Press, 1998. ISBN-13: 978-0125440554.
- Physical properties of Semiconductors by C. M. Wolfe, N. Holonyak, and G. E. Stillman. ISBN-13: 978-0136699613
- 2D Materials, Volume 95 (Semiconductors and Semimetals) 1st Edition, by Francesca Iacopi (Editor), John J. Boeckl (Editor), Chennupati Jagadish (Editor). ISBN-13: 978-0128042724
- 2D Materials for Nanoelectronics (Series in Materials Science and Engineering) 1st Edition by Michel Houssa (Editor), Athanasios Dimoulas (Editor), Alessandro Molle (Editor). ISBN-13: 978-1498704175

Additionally, students are required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone.

TOPICAL OUTLINE:

This can be organized by weeks (15 weeks for fall/spring semesters) or hours (3 hours per credit hour).

Course Outline:

- Introduction – applications of wide bandgap based devices (1.5 weeks)
- Synthesis and characterization of wide bandgap semiconductor materials (4 weeks)

- Concept of hetero-junctions (1.5 weeks)
- Electronic and optoelectronic device applications using wide bandgap semiconductors (4 weeks)
- Synthesis and characterization of 2-dimensional (2D) materials (2 weeks)
- Electronic device applications using 2-D materials (2 weeks)

CLASS CANCELLATION POLICY: Class is cancelled if the instructor is more than 15 minutes late to class.

GRADING POLICY:

Grading scale: A: [90-100] B: [80-89] C: [70-79] F: [0-69]
 Homework: 15%;
 Midterm: 25%;
 Project: 30%;
 Final exam (comprehensive coverage of course content): 30%

ATTENDANCE POLICY:

1. This class is assigned as Hybrid/Blended. This means that the university will assign students a day of the week they are to come this class; on other days, they must attend online.
2. Note that attendance is optional even on days students are to come physically. But are expected to attend the class either **online or physically**.
3. If class is cancelled for some reason on a test/exam day then it will be scheduled on the next class day unless otherwise instructed by instructor.
4. In case of physical attendance it is required to maintain physical distancing in the classroom. Individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.
5. While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.
6. Please note that the University may convert to a purely online mode at any time. University classes are initially in a purely online mode and will remain so until Sept. 21.

ADDITIONAL POLICIES:

- Inclement Weather Policy: Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather related cancellation.
- Homework Policy: All homework assignments are due in class on the day of submission.
- Late Assignments and Missed Exams: You will get zero for this corresponding part unless you get the permission from the instructor. The timestamp on your files in the email box will be examined to determine when the program was submitted. Late submission is not allowed.

- Collaboration: You are required to do the homework assignments by yourself; copying their work will not be tolerated. Anyone found copying or using another person's work will be dealt with under Clemson's policy on academic dishonesty. The consequences range from receiving a failing grade for the assignment to expulsion. However, we do strongly encourage students to discuss the materials covered in class. There is a fine line between discussion and cheating. If you feel uncertain about whether you are crossing the line, feel free to discuss these issues with the instructor before you do so.
- Cheating: For the purposes of this class, cheating is defined as:
 - Copying all or part of another student's homework
 - Allowing another student to copy all or part of your homework
 - Copying all or part of code found in a book, magazine, the internet, or other resource

ACCESSIBILITY STATEMENT: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

ANTI-HARASSMENT AND NON-DISCRIMINATION: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at <https://www.clemson.edu/campus-life/campus-services/access/title-ix/policies.html>. Alesia Smith serves as the Title IX Coordinator and the Executive Director of Equity Compliance and may be reached at alesias@clemson.edu or 864-656-3181.

EMERGENCY PROCEDURES: Emergency procedures have been posted in all buildings and on all elevators. Students should review these procedures for their own safety. Students are required to monitor their university email (see <https://www.clemson.edu/studentaffairs/student-handbook/universitypolicies/email-communications.html>) thus establishing this as a convenient method for official communication to students. Students are also encouraged to enroll in CU-Safe alerts. See <https://www.clemson.edu/cusafety> for more information.

TITLE IX STATEMENT: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

SAFE CAMPUS: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

ACADEMIC INTEGRITY: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

COPYRIGHT STATEMENT: Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and "Fair Use Guidelines" policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

MODIFICATION STATEMENT: Instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.