ECE 577: Fundamentals of Semiconductor LEDs and Lasers

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Office Hours: by appointment
Course Credits: 3
Class Meeting Day(s): MW
Class Time: 11:00 am – 12:15 pm
Class Location / Room: CHTM 103
Term / Semester: Spring 2016

Course Website: http://www.unm.edu/~dfeezell/ECE577/
I will post the syllabus, homework assignments and solutions, lecture slides, and other course materials. The website requires you to login using your UNM NetID. A detailed course schedule is also available on the course website. This schedule includes the material to be covered, recommended sections of the book for reading, exam dates, and approximate HW assignment dates and due dates. Please note that the lecture schedule is approximate.

Course Description: Semiconductor light-emitting diodes (LEDs) and lasers are key components in a variety of applications, including solid-state lighting, displays, optical communications, high-density optical data storage, and sensing. By the end of the course, you should be able to design and analyze a variety of LED and laser structures. Topics to be covered include: carrier generation and recombination, photon generation and loss in laser cavities, LED internal quantum efficiency, LED extraction efficiency, density of optical modes and blackbody radiation, radiative and non-radiative processes, distributed Bragg reflectors, optical gain, spontaneous and stimulated emission, Fermi's golden rule, gain and current/carrier relations, characterizing real diode lasers, rate equations, small and large signal analysis, vertical-cavity surface-emitting lasers.

Required Textbook: "Diode Lasers and Photonic Integrated Circuits," L. Coldren, S. Corzine, and Milan Masanovic, John Wiley & Sons Inc., 2nd edition (2012), ISBN: 0470484128.

Reference Textbooks: "Physics of Photonic Devices," S. L. Chuang, John Wiley & Sons Inc., 2nd edition (2012), ISBN: 0470293195

"Optoelectronics and Photonics: Principles and Practices," S. O. Kasap, Prentice Hall, 1st Edition (2001), ISBN: 0201610876.

Prerequisites: ECE 572 – Semiconductor Physics and ECE 570 – Optoelectronic Semiconductor Materials and Devices

Grading: *30% homework, 20% VCSEL design project, 25% midterm, 25% final*

Homework policy: Late homework assignments will typically not be accepted as I will post the solutions to the assignments right after you turn them in. Homework is due at the *beginning* of the class period on the due date. Homework should be neatly written, with each problem labeled and the pages stapled together. Show your work in a logical fashion in order to get maximum credit and *please box your final answers*! If the problem says "plot" you should use Excel, Matlab, or some other numerical tool, if the problem says draw or sketch, you can do it by hand.

Attendance Policy: Regular and punctual attendance is required. UNM Pathfinder policies apply, which in part means instructor drops based on non-attendance are possible. This policy applies regardless of the grading option you have chosen.

Accommodation Statement: Accessibility Services (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner. If you need local assistance in contacting Accessibility Services, see the Bachelor and Graduate Programs office.

Academic Integrity: The University of New Mexico believes that academic honesty is a foundation principle for personal and academic development. All University policies regarding academic honesty apply to this course. Academic dishonesty includes, but is not limited to, cheating or copying, plagiarism (claiming credit for the words or works of another from any type of source such as print, Internet or electronic database, or failing to cite the source), fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. The University's full statement on academic honesty and the consequences for failure to comply is available in the college catalog and in the *Pathfinder*.

Cell Phones and Technology: As a matter of courtesy, please turn off cell phones, pagers, and other communication and entertainment devices prior to the beginning of class. Notify me in advance if you are monitoring an emergency, for which cell phone ringers should be switched to vibrate.

Library and Tutorial Services: UNM-Main campus provides many library services and some tutorial services for distance students. For library services, go to http://www.unm.edu/libraries/ to link to a specific library or to contact a librarian. For tutorial services, go to http://caps.unm.edu/online to explore UNM's online services.

Weather Policy: In the event of severe weather conditions UNM may close. Please call 277-SNOW to check UNM's status during questionable weather conditions.

Copyright Policy and Law: *(University Counsel's Office - Subject to Change Without Notice)*
The unauthorized distribution of copyrighted material, including through peer-to-peer file sharing, may subject a student to criminal and civil penalties. The laws that govern copyright are not specific to any one technology. Students can violate the rights of a copyright holder using many different types of technology. Both uploading and downloading of files can pose a violation of the copyright law. Students should be cautious when obtaining any copyrighted material. As a rule of thumb, before a student receives anything for free, they should research whether that source provides material licensed by the copyright owner. A group called EDUCAUSE has a list of legal file sharing alternatives at http://www.educause.edu/legalcontent.

Individuals who violate copyright law by illegally uploading and downloading copyrighted files may be subject to civil penalties of between $750 and $150,000 per song. These penalties are

established by federal law. In the past, pre-litigation settlements offered by copyright owners have been in the $3,000 to $4,000 and up range while juries in some jurisdictions have issued verdicts of hundreds of thousands and up. In addition, a court may, in its discretion, grant the copyright owner reasonable attorney fees. Although criminal prosecution of students for file sharing is extremely rare, federal law lays out criminal penalties for intentional copyright infringement which can include fines and jail time. In addition to potentially violating the law, unauthorized distribution or receipt of copyrighted material is a violation of University Business Policies and Procedures Manual 2500. That policy states that: "Users shall respect all copyrights including software copyrights…Use of University computing services in violation of applicable laws or University policy may result in sanctions, including withdrawal of use privilege; disciplinary action, up to and including, expulsion from the University or discharge from a position; and legal prosecution under applicable federal and/or state law."