ECE 414 – Spring 2016
"Elements of Electro- and Fiber Optics" – Professor Bermel

Course Policies

Section 1 (TR 10:30-11:45 am, EE 226)

Welcome to ECE 414, "Elements of Electro- and Fiber Optics." In this document, we outline the course policies and procedures, particularly regarding prerequisites, communication, grading, quizzes, homework, projects, academic honesty, and resources available to you.

Course Prerequisites and Co-requisites:
This class is designed for advanced undergraduate students. Official prerequisites are ECE 301 (Signals & Systems) and ECE 311 (Electromagnetism). Ideally, you should be comfortable with these topics: differential equations, matrix algebra, electric circuits, semiconductor devices, electromagnetism (Maxwell's equations), and the propagation, reflection, and refraction of plane waves.

Textbook:
The primary textbook for the course is "Fundamentals of Photonics," by Bahaa E.A. Saleh and Marvin Carl Teich, 2nd edition, published by Wiley-Interscience, ISBN 978-0-471-35832-9. It is available as a hard copy through commercial booksellers, and through the Purdue Engineering library reserve desk, Dewey Decimal classification number 621.36 Sa32f 2007.

The supplementary textbooks are "Fiber-Optic Communication Systems," by Govind P. Agarwal, published by John Wiley & Sons, ISBN 0-471-21571-6, and "Photonic Crystals," by John D. Joannopoulos *et al.*, published by Princeton University Press, ISBN 978-0-691-12456-8. Both are available in hard copy through commercial booksellers and the Purdue libraries. The latter is also available as a soft copy through the author's website, via the following link:
http://jdj.mit.edu/book/

Communication:
Most pertinent information (videos, quizzes, course handouts, homework assignments, homework solutions, and final project assignments) will be posted online through the course website:
http://web.ics.purdue.edu/~pbermel/ece414/
Grades will be available via Purdue's Blackboard Learn system:
http://mycourses.purdue.edu/
Communication outside of class is highly encouraged.

Grading:
Each student's course grade will be based upon the total numerical score he or she earns, with the following point allocation for the exams, class participation, homework, and final report.

Exam 1	100 points
Exam 2	100 points
Class Participation	100 points
Homework	100 points
Final Report	100 points
Final Exam	200 points
Total	700 points

The grading scheme outlined above takes into account seven Course Outcomes, as defined in our ABET accreditation standards, for which each student must demonstrate a minimum level of competency. These course outcomes are outlined in the next section.

Course Outcomes:
A student who successfully fulfills the course requirements will demonstrate the following abilities:

i. to analyze simple optical systems including dielectric slabs, thin lenses, reflectors, and optical resonators;
ii. to analyze optical waveguides, examine fiber modes and waveguide properties;
iii. to explain the operating principles of gas lasers, semiconductor lasers, and light emitting diodes;
iv. to discuss the operational principles of optical detectors, including various optical detection schemes;
v. to list the fundamentals and key components of optical fiber communication systems;
vi. to articulate the fundamentals of ultrafast optics; and
vii. to demonstrate a basic understanding of novel concepts in photonics, including photonic crystals, optical interconnects, metal optics, and metamaterials.

You will have multiple opportunities to satisfy these ABET outcomes. The primary means will be through the regular homework, exams, class participation, and final report. The instructor will write questions based on these Course Outcomes. You will satisfy each Course Outcome when your score for the corresponding assignments equals or exceeds a value we specify as representing a minimal competency. If you fail to meet this level of minimal competency on a specific Course Outcome, you will have more opportunities, typically on later assignments that cover overlapping materials. Typically, students otherwise doing well in the course will readily satisfy all Course Outcomes.

Homework:
Homework assignments will be due approximately once per week starting Thursday, January 14, except for weeks without classes. The detailed schedule is listed on the syllabus, below.

Homework should be submitted in class on the listed due dates.

Doing the homework is the only way to truly learn the subject matter. Students who do not work the homework themselves typically do not perform well in the course.

You *may* work together as you solve your homework problems, as this can be an effective means of learning the material. If you do work in a group, please **be sure that the solution you turn in is your own work**. You will receive reduced or zero credit for homework submissions that appear to be copies of each other. For written assignments, please write your solutions legibly and in an organized manner so that the grader can follow your work easily and, where possible, place your final answer in a box.

Solutions to the homework assignments are posted online shortly after they are due.

Final Report:

Your final report will consist of choosing a single original technical research article written in the last decade related to the course topics, and then writing a short critical review of it. The format of the review will be 3-4 pages, typewritten, 1.5 line spacing, in 12 point Times New Roman with 1" margins. The intention will be to choose an article from one of the following peer-reviewed optics journals: JOSA B, Optics Letters, Optics Express, Optics Communications, Journal of Modern Optics, IEEE Journal of Quantum Electronics, Physical Review Letters, Physical Review A-E, IEEE Journal of Selected Topics in Quantum Electronics, IEEE Journal of Lightwave Technology, or IEEE Journal of Photovoltaics. To choose your article, you can search for references in a book chapter you find particularly interesting, or choose a professor working on a topic of interest and then check their publications list on their webpage. You can also search for the selected journals in Google to browse a list of recent articles, or use Google

Scholar to find a paper on a topic of interest and check if it was published in one of the listed journals. You should also make sure to submit a copy of the entire article (including any supplementary material) and a full citation.

In writing the report, you should provide a brief summary of the content of the article, then employ the concepts that we have discussed in this and other classes and research experiences to evaluate whether the article is scientifically correct, novel, and significant. You can also comment on the presentation style: whether the article is clear, well-organized, and engaging – but this cannot be the *entirety* of your critique. Positive and negative critiques are both fine, as long as they are supported by fact and logic.

The entire final report assignment will be due on Tuesday, April 19, 2016.

A request to regrade exams or the final project must be filed with Prof. Bermel ***within one week*** of grades being posted. Due to Purdue policies, no such requests can be honored after the deadline.

Academic Honesty Policy:
We expect every member of the Purdue community to practice honorable and ethical behavior both inside and outside the classroom. Any actions that might unfairly improve one's score on exams, homework, or final project will be considered cheating, and will not be tolerated. Examples of cheating:

1. Submitting or presenting work that is not your own (particularly without citation).
2. Asking other students for quiz answers before submitting your own.
3. Altering a quiz or homework, and then requesting a regrade.

Cheating on homework or projects can result in a zero score for the assignment, or a failing grade for the course, at the discretion of Prof. Bermel. If necessary, we will also refer such a case to the Office of the Dean of Students.

Class Attendance:
Your attendance in class is extremely important. If you must miss a class, you are responsible for any material, information, handouts, announcements, etc. that you missed. Since participation is a key part of your grade, repeated absences will detract from your overall grade. Late arrivals and early departures from class can be disruptive, so please keep these to a minimum.

Campus Emergency:
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through email.

Students with documented disabilities:
Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University. Students with disabilities must be registered with Adaptive Programs in the Office of the Dean of Students before classroom accommodations can be provided. If you are eligible for academic accommodations because you have a documented disability that will impact your work in this class, please schedule an appointment with Prof. Bermel as soon as possible to discuss your needs, either within the first three weeks of classes, or within one week of receiving your accommodation letter,. If you do not communicate your accommodation needs in a timely manner, testing accommodations cannot be guaranteed.

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Schedule

Section 1, TR 10:30-11:45 am, EE 226

DATE	LECTURE NO.	TOPICS	Reading Assign. SECTIONS	HOMEWORK SET DUE
1/12-T	1	Introduction and Overview of Our Class	ST Preface*	--
1/14-R	2	Fundamentals of Ray Optics	ST 1.1	1
1/19-T	-	-	-	--
1/21-R	3	Ray Optics: Reflection, Refraction and Lenses	ST1.2-1.3	2
1/26-T	4	Ray Optical Matrices: Basics	ST 1.4	--
1/28-R	5	Ray Optical Matrices: Combining Elements	ST 1.4	3
2/2-T (5:30 pm, EE 224)	6	Fundamentals of Wave Optics	ST 2.1-2.3	--
2/4-R	7	Fundamentals of Electromagnetic Optics	ST 2.4-2.6	4
2/9-T	8	Waveguide Modes	ST 1.3	--
2/9-T (5:30 pm, EE 224)	9	Modal Confinement	ST 8.1,8.2	5 (on R)
2/16-T	-	**EXAM 1**	--	--
2/18-R	10	Photonic Crystals	ST 8.4, JJ 1-6	6
2/23-T	11	Fiber Optics: Guided Rays	ST 9.1, GA2.1[§]	--
2/25-R	12	Fiber Optics: Guided Waves	ST 9.2, GA 2.2[§]	7
3/1-T	13	Photonic Crystal (Holey) Fibers	ST 9.4, JJ 9[†]	--
3/3-R	14	Lasers: Energy Levels	ST 13.1-13.4	8
3/10-R (5:30 pm, EE 224)	15	Lasers: Transitions, Rates	ST 14.1-14.2	--
3/10-R	16	Lasers: Rate Equations	ST 15.1	9
3/15-T	-	**NO CLASS – SPRING VACATION**	--	--
3/17-R	-	**NO CLASS – SPRING VACATION**	--	--
3/22-T	17	Common Laser Amplifiers	ST 14.3	--
3/24-R	18	Common CW Lasers	ST 15.3	10
3/29-T		**NO CLASS**		--
3/31-R		**NO CLASS**		--
4/5-T	19	Common Pulsed Lasers	ST 15.4	--
4/5-T (5:30 pm, EE 224)	20	Semiconductor Optical Sources	ST 16.1-16.2, 17.1	--
4/7-R	-	**EXAM 2**	--	--
4/12-T	21	Semiconductor Sources: Injection Lasers	ST 17.2	--
4/12-T (5:30 pm, EE 224)	--	Preparation for Final Report	-	--
4/14-R	22	Semiconductor Sources: Materials	ST 17.1C	11
4/19-T	23	Photon Detectors: Types and Characterization **FINAL REPORT DUE**	ST 18.1-18.5	--
4/21-R	24	Photon Detectors: Noise	ST 18.6	12
4/26-T	25	Fiber Communications	ST 24, GA	--
4/28-R	26	Current Research in Photonics	JJ 10	13
TBA		**FINAL EXAM**		

*ST=Saleh & Teich
[§]GA=G. Agarwal
[†]JJ=J.Joannopoulos

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Instructors and Staff

Class	Professor	Secretary
Section 1 TR 10:30 – 11:45 am EE 226	Peter Bermel, EE 332, BRK2270 Tel: 765-496-7879 Email: pbermel@purdue.edu Office Hours: TR 11:45 am – 12:45 pm, or by appointment	Mary Ann Satterfield, EE 326B Tel: 765-494-6389 Email: msaterfi@purdue.edu Office Hours: M-F 8 am–noon; 1-5 pm