

**Spring 2018**

**EE765: Fourier Optics and Optical Signal Processing**

**INSTRUCTOR: Dr. Mahsa Ranji**

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Lecture Hours: One 160 minutes session per week

Office Hours: Th 4-5:30pm

**Lectures:** Tuesdays, 4:30 p.m. to 7:10 p.m., EMS E371.

**Prerequisite:** EE 310, and EE 361.

**Textbook:**

Required, *Introduction to Fourier Optics*, Joseph W. Goodman, Roberts & Company, 3rd ed., 2005.

Recommended, *Optics*, Ajoy Ghatak, McGraw Hill, 2010.

**Topics:**

2D Fourier Transforms in Spatial Domain, Polarization, Dispersion, Interference, Fraunhofer and Fresnel diffraction, Scattering, Muller matrix, Coherent and incoherent imaging, Aberrations, Ray Matrices, Lens systems, Wave optics, Optical imaging and spectroscopy, Optical information processing and more.

**Course Objective:**

Upon the completion of this course the student will be able to:

1. Discuss the fundamental principles of Fourier Optics.
2. Explain how these properties are used in imaging and microscopy techniques.

**Requirements:**

1. Attendance is not mandatory but is recommended for all meetings.
2. Completion of all assignments prior to class.

**Grading Policy:**

Homework: 15%

First Exam: 35%

Second Exam: 35%

Presentation: 15%

For your presentation choose a topic related to Fourier optics and image understanding to present for 15-20 minutes in teams of two people. Read some papers on your assigned topic to

present to class and turn in your presentation (power point) as part of your final grade. The topic should be relevant to recent research topics in the Fourier Optics field.

**Homework:** Due date will be mentioned on top of the HW sheet each time. Late homework is not accepted unless there is a justifiable reason for late submission.

**Exams:**

The tentative first exam date is on March 14th. Please mark your calendars since the exam date is fixed. The first exam covers the first half of the course and the second exam will cover the second half (i.e., it is not cumulative). You will be allowed to bring two two-sided A4 sheets from lecture notes for both exams.

**Workload:**

This course meets weekly for a total of 35 contact hours. There is a total of 8-9 required homework assignments, each of which will take 10-12 hours.

**Course Schedule:**

Week	Topic
1	Introduction to linear systems
2	Two-Dimensional Fourier Transform (FT)
3	Scalar Diffraction theory
4	Fresnel and Fraunhofer diffraction
5	Vector diffraction: plane wave, polarization, stokes
6	Scattering, Muller matrix
7	Linear lens systems
8	<b>Exam 1</b>
9	<b>Spring break</b>
10	Linear lens systems
11	Ray optics
12	Optical Coherence and Incoherent Imaging
13	Microscopy- systems
14	Microscopy- aberrations
15	Presentations
16	<b>Exam 2</b>

**Academic Misconduct Policy:**

The university has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic misconduct. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. University policy prohibits and punishes misconduct, which is any act by which a student seeks to claim credit for the work of or efforts of another without authorization or citation (plagiarism), forges or falsifies documents, falsely represents his or her academic performance (cheating) engages in unauthorized collaboration with other student papers or projects, or assists other student in any of these acts. Students who engage in academic misconduct are subject to a range of sanctions including, but not limited to: a failing grade on an assignment or test, failing grade in the course, and expulsion from the university as set forth in the UWS Chapter 14 and UWM Faculty Document 1686.

**Special Needs:**

Students having needs that require special accommodations must contact the instructor during the first week of the semester.

**Wireless and Electronic devices:**

Please read the attached statement for general policies. These guidelines can also be found at <http://www.4.uwm.edu/chs/students/index.html>. In addition, the following apply to this course: (1) The use of laptops for the purposes of taking notes during class is permitted. Please refrain from any extracurricular activities, such as surfing the internet, checking or composing email, or completing assignments for this or any other course. The first instance of inappropriate usage will result in a verbal warning and the powering down of the device. Any subsequent inappropriate usage will forfeit the right to use the device in class; (2) All devices must be set to vibrate or mute during class. Accepting or placing voice, email, or text messages during class is prohibited. If an emergency situation exists and you expect you will need to accept a message, please let the instructor know prior to the beginning of class. The first instance of inappropriate usage will result in a verbal warning and the powering down of the device. Any subsequent inappropriate usage will result in confiscation of the device until the end of class; (3) No devices are permitted during exams. All devices must be set to mute or turned off and properly stowed prior to the start of the exam. If an emergency situation exists and you expect you will need to accept a message, please let the instructor know prior to the beginning of class. Except for pre-approved situations, any use of wireless or electronic devices during exams will not be tolerated. The device will be confiscated, the exam will be turned into the instructor immediately, and the student will be asked to leave the room. Appropriate policies governing academic misconduct will be pursued.

**A further note on plagiarism:** Plagiarism is defined as attempting to pass someone else's work as your own by failing to properly cite sources (Merriam-Webster online dictionary, [www.m-w.com](http://www.m-w.com)) this includes others students' work, that published in traditional print forms, and that obtained via internet sources. Plagiarism in any form will not be tolerated. If I am able to "Google" text from any student work, and the results demonstrate that is taken directly from a source without proper citation, regardless of the number of instances observed in the assignment the assignment will receive a grade of "F", with all ramifications that may have for the final grade in the course. No accommodations will be made to allow the student to make up the assignment. Remember to cite any and all sources used in this course, including websites. All students are expected to observe the CHS Honor Code in this class. The Honor code can be found at <http://www4.uwm.edu/chs/students/honorcode/honorcode.html>

## University Policies:

The Secretary of the University website lists policies that apply to all University of Wisconsin-Milwaukee classes. This link may be used to access that site: <http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf>

1. **Students with disabilities.** Notice to these students should appear prominently in the syllabus so that special accommodations are provided in a timely manner.

<http://www.uwm.edu/dept/DSAD/SAC/SACtr.pdf>

2. **Religious observances.** Accommodations for absences due to religious observance should be noted. [http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/s1.5htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/s1.5htm)

3. **Students called to active military duty.** Accommodations for absences due to call-up of reserves to active military duty should be noted.

Students: [http://www4.uwm.edu/current\\_students/military\\_call\\_up.cfm](http://www4.uwm.edu/current_students/military_call_up.cfm)

Employees: [http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S40.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S40.htm)

4. **Incompletes.** A notation of "incomplete" may be given in lieu of a final grade to a student who has carried a subject successfully until the end of a semester but who, because of illness or other unusual and substantiated cause beyond the student's control, has been unable to take or complete the final examination or to complete some limited amount of term work.

[http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S31.pdf](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S31.pdf)

5. **Discriminatory conduct (such as sexual harassment).** Discriminatory conduct will not be tolerated by the University. It poisons the work and learning environment of the University and threatens the careers, educational experience, and well-being of students, faculty, and staff.

[http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S47.pdf](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S47.pdf)

6. **Academic misconduct.** Cheating on exams or plagiarism are violations of the academic honor code and carry severe sanctions, including failing a course or even suspension or dismissal from the University. <http://www.uwm.edu/Dept/OSL/DOS/conduct.html>

7. **Complaint procedures.** Students may direct complaints to the head of the academic unit or department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy.

[http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S49.7.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S49.7.htm)

8. **Grade appeal procedures.** A student may appeal a grade on the grounds that it is based on a capricious or arbitrary decision of the course instructor. Such an appeal shall follow the established procedures adopted by the department, college, or school in which the course resides or in the case of graduate students, the Graduate School. These procedures are available in writing from the respective department chairperson or the Academic Dean of the College/School.

[http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S28.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S28.htm)

9. **Other.** The final exam requirement, the final exam date requirement, etc.

[http://www.uwm.edu/Dept/SecU/acad%2Badmin\\_policies/S22.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm)