YEDİTEPE UNIVERSITY
FACULTY OF ENGINEERING

COURSE DESCRIPTION FORM
2019/2020-1

COURSE INFORMATON				
Course Code	**MSN 560**	**Course Title**	**Optical and Photonic Materials and Coatings**	
Semester	*Credits*	*ECTS*	*C +P + L Hour*	Prerequisites
3	3	10	3+0+0	-

Language of Instruction	**Course Level**	**Course Type**
English	Undergraduate	Core/Elective

Course Coordinator	Dr. Öğr. Üyesi Ayşe Dulda
Instructors	Dr. Öğr. Üyesi Ayşe Dulda
Assistants	
Goals	The primary objective of the course is to provide an understanding of the basic optical properties of common used optical materials such as crystalline materials, ceramic materials semiconductors glasses. The student will be exposed to a quantitative interpretation of the fundamental of the interaction of light and transparent optical materials as well as general information on the applications of optical materials in optical engineering. We analyze the effect of generation and propagation of light in a matrix. We also study how fabrication methods impact the performance of optical materials. Examples in this class cover a wide range of applications including optical coating, laser gain media, nonlinear optics materials, and sol-gel technology.
Content	Introduction: Electromagnetic radiation, atomic structure, light and matter interaction (reflection, refraction, n, absorption, transmission and scattering), properties and constant of optical materials (dispersion & Fresnel equations), spectroscopy measurements and optical instruments (spectrometers, lasers, microscopes, grating)), processing of optical materials (polishing, molding, crystal growing, wet chemistry, CVD), design of optical systems. Optical materials classes: Crystalline materials, Ceramics materials, semiconducting materials (II-V, Si, Ge), glasses (silica, fluoride, chalcogenide), optical polymers (organic & inorganic) materials by sol-gel technology, dyes (organic & inorganic), nanomaterials and quantum dots, principal of material engineering of optical materials (dopants, impurities and defects). Applications: Thin films, optical fibers, waveguides, laser media, nonlinear crystals and nonlinear materials, LED, solar cells, detectors, optical adhesive materials, filters and optical components.

Contribution of the Course to the Professional Education	Ability to learn how to apply course knowledge to solve real-world problems in a variety of optical materials and engineering applications.

Course Learning Outcomes	**Detailed Program Outcomes**	**Teaching Methods**	**Assessment Methods**
describe and illustrate with examples the concept of coherence, estimate the coherence of light sources;	1a, 1b, 2a	1,2	A
estimate output characteristics of photon sources;	1a, 1b	1,2	A, G
explain the principles of operation of quantum lasers,	1a, 1b	1,2	A, G
explain properties of Gaussian beams	1a, 1b	1,2	A, G
interpret limitations of Fresnel and Frauenhofer diffraction;	1a, 1b	1,2	A, G

Teaching Methods:	1: Lecture by instructor, 2: Lecture by instructor with class discussion, 3: Problem solving by instructor, 4: Use of simulations, 5: Problem solving assignment, 6: Reading assignment, 7: Laboratory work, 8: Term research paper, 9: Presentation by guest speaker, 10: Sample Project Review, 11: Interdisciplinary group working, 12: ...
Assessment Methods:	A: Written exam, B: Multiple-choice exam C: Take-home quiz, D: Experiment report, E: Homework, F: Project, G: Presentation by student, H: ...

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Ray Optics, EM Optics and Guided Wave Optics	Lecture Notes and Textbook
2	Photonic Crystals	Lecture Notes and Textbook
3	Electrons in Semiconductors	Lecture Notes and Textbook
4	Photons in Semiconductors and Dielectrics	Lecture Notes and Textbook

5	LEDs	Lecture Notes and Textbook
6	Optical Amplifiers and Lasers	Lecture Notes and Textbook
7	Crystal Growth	Lecture Notes and Textbook
8	Midterm	
9	Nonlinear Optics	Lecture Notes and Textbook
10	Detectors	Lecture Notes and Textbook
11	Micro and Nanophotonics	Lecture Notes and Textbook
12	Student Presentations	Lecture Notes and Textbook
13	Student Presentations	Lecture Notes and Textbook
14	Student Presentations	Lecture Notes and Textbook
15	Final	

RECOMMENDED SOURCES	
Textbook	Saleh, B. E. A., and M. C. Teich. *Fundamentals of Photonics*. New York, NY: Wiley, 1991. ISBN: 9780471839651
Additional Resources	MIT open course lecture notes https://ocw.mit.edu/courses/materials-science-and-engineering/3-46-photonic-materials-and-devices-spring-2006/download-course-materials/

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Midterm	1	30
Presentation	1	30
Total		
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		
Total		**100**

COURSE CATEGORY	Field Course

COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES		
No	Program Learning Outcomes	check √
1a	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline,	√
1b	Ability to use theoretical and applied knowledge in these areas in complex engineering problems.	√
2a	Ability to identify, formulate, and solve complex engineering problems,	√
2b	Ability to select and apply proper analysis and modeling methods for this purpose.	
3a	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result,	
3b	Ability to apply modern design methods for this purpose.	
4a	Ability to devise, select and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice.	
4b	Ability to employ information technologies effectively.	
5a	Ability to design experiments for investigating complex engineering problems or discipline specific research questions,	
5b	Ability to conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	
6a	Ability to work efficiently in intra-disciplinary teams,	
6b	Ability to work efficiently in multi-disciplinary teams,	
6c	Ability to work individually.	

7a	Ability to communicate effectively in Turkish, both orally and in writing,	
7b	Knowledge of a minimum of one foreign language,	
7c	Ability to write effective reports and comprehend written reports, prepare design and production reports,	
7d	Ability to make effective presentations,	√
7e	Ability to give and receive clear and intelligible instructions.	
8a	Recognition of the need for lifelong learning, ability to access information, ability to follow developments in science and technology,	
8b	Ability to continue to educate him/herself.	
9a	Consciousness to behave according to ethical principles and professional and ethical responsibility.	
9b	Knowledge on standards used in engineering practice.	
10a	Knowledge about business life practices such as project management, risk management, change management.	
10b	Awareness in entrepreneurship and innovation.	
10c	Knowledge about sustainable development.	
11a	Knowledge about the global and social effects of engineering practices on health, environment, and safety,	
11b	Knowledge about contemporary issues of the century reflected into the field of engineering.	
11c	Awareness of the legal consequences of engineering solutions.	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Presentation	1	3	3
Off-the-classroom study for presentation	1	60	60
Off-the-classroom study for the final exam	1	60	60
Total Work Load			249
Total Work Load / 25 (h)			9,96

ECTS Credit of the Course			10

Prepared by: Dr. Öğr. Üyesi Ayşe Dulda	Preparation date: 15.12.2020