Academic Course Description

King Saud University
College of Engineering - Electrical Engineering Department

EE411: Optoelectronic Devices and Systems

Compulsory/Elective course: Compulsory

Course (catalog) description: Theory, design and engineering aspects of contemporary optical and optoelectronic devices and technologies: light sources, photodetectors, polarization and modulation of light. Key design and engineering principles of the optical fiber communications links and networks.

Pre-requisites: *None* **Co-requisites:** *None*

Textbook: S.O. Kasap, "**Optoelectronics and Photonics Principles and Practices**", Prentice Hall, 2001.

References: 1) Gerd Keiser, "**Optical Fiber Communications**", 3rd ed., McGraw-Hill, Boston, 2000.
2) Chin-Lin Chen, "**Building Electro-Optical Systems Making It All Work**", John Wiley & Sons Inc., New York, 2000.

Course Learning Outcomes:

1- Understand the light wave theory and its application in the design and engineering of elementary optical and optoelectronic components and devices.
2- Study the principle, engineering and design aspects of light sources, photodetectors, polarization and modulation of light, filters, resonator, beam splitter, fiber, optical waveguide, etc.
3- Design key functions of contemporary optical fiber communications links and systems.
4- Acquire the knowledge and skills enabling the application of optoelectronics in solving real life problems and contemporary issues.
5- Understand photovoltaic devices and their application for contemporary issues such us environment, green and renewable energy, and sustainable development.

Topics Covered: Wave Nature of light, Dielectric waveguides and optical fibers, Optical communications link, Semiconductors and light emitting diodes, Stimulated emission and Lasers, Photodetectors, Photovoltaic devices, polarization and modulation of light, wavelength division multiplexing components and systems.

Class/Tutorial Schedule: Four lectures are assigned per week with 50 minute for each.

Contribution to the Professional Component:

a) College level mathematics and basic sciences 0.0 Credit hours.
b) Engineering Topics (science and/or design) 4.0 Credit hours
c) General education 0.0 Credit hours

Design experiences:

(1) Design Fabry-Perot pass band filter; (2) Design Multilayer band stop filter; (3) Design Free Space Fiber Optic Link; (4) Design optical Fiber Communication Link; (5) Design wavelength division multiplexer/de-multiplexer.

Relationship to ABET Learning Outcomes (a - k):

Outcome A: *Apply math, science and engineering*: The student is taught how he writes by himself the key equations describing light wave behaviors in a waveguide, defines and describes the design and engineering constraints and then determine the parameters and characteristics of a component, and illustrates a transfer function of a system or a module, etc.

Outcome E: *identify, formulate and solve engineering problems:* Most of the examples and problems call to specific real applications, that call the student to face a real engineering challenge, including identifying and formulating the key problems and issues and search for solution.

Outcome i: *recognition of the need for and an ability to engage in life-long learning:* This course is nurtured with a wide range of real life applications including fiber and free-space communications, optical transoceanic, national, metropolitan, and local area networks, healthcare and medical applications, military and security applications, industry sensing, solar energy, etc. The broad range of applications enables the student to recognize the need of the material in real life; in addition to provide him the tools for autonomous future discovery and long-life learning.

Outcome j: *knowledge of contemporary issues:* A large part of the applications are selected to deal with contemporary issues including the environment, pollution, green and renewable energy, safety, healthcare, communications etc.

Evaluation: There are two 2-hours mid-term exams and a three hour final exam. The grade distribution is as follows: First Mid-Term Exam (15%), Second Mid-Term Exam (15%), Homework and Quizzes (10%), Mini project (report and presentation: 20%), and Final Exam (40%). The total grades are 100%.

Challenges and actions taken to improve the course outcomes: Important effort is underway in order to acquire laboratory equipments and add experiments that support more the outcomes E and J.

Weekly Teaching Plan

Week #	Deliverables	Learning outcomes
1&2	Wave Nature of Light and Applications	A and I
3&4	Dielectric waveguides and optical fiber	E and J
5&6	Semiconductors and light emitting diodes,	A and E
7&8	Stimulated emission and Lasers,	E and J
9&10	Photodetectors,	A and I
11&12	Photovoltaic devices,	E and J
13&14	Polarization and modulation of light	A and E
15	Applications and General Review	I and J

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