**Name of the module**: Introduction to wave propagation and light rays

**Number of module**:\_ \_377.2.5580 \_\_\_\_\_\_\_\_\_\_\_\_

**BGU Credits**: 3

**ECTS Credits:** 5

**Academic year:** 2013-2014

**Semester**: Fall

**Hours of instruction**: 3

**Day and time**: Wednesday 14:00-17:00

**Location of instruction**:

BGU main Campus, Beer Sheva

**Language of instruction**: Hebrew

**Cycle:** Second Cycle. Third Cycle

**Position:** Basic training in optics, to be taken by students from disciplines where optics was not taught at a sufficient level

**Field of Education:** Electrooptics,

**Responsible department:**

Electro Optic Engineering

**General prerequisites**:

None

**Grading scale:**

0-100

**Course description**:

Preparatory course for students with insufficient background in optics aimed at bringing them to the level of optics studied in disciplines such as Physics or Electrical Engineering. It includes a review of basic concepts and phenomena of electromagnetic wave propagation.

**Aims of the module**:

To bring the students to the knowledge level in optics of graduates of Physics and Electrical engineering disciplines.

**Objectives of the module:**

1. Teach the students the basic properties of electromagnetic propagation such as plane wave, beam vs. pulse propagation, scalar vs. vectorial nature, polarization, interference etc..
2. Teach the students the optical properties of materials such as anisotropy, absorption and dispersion effects.
3. Teach the students the basic optical phenomena such as refraction, reflection and diffraction effects.
4. Teach the students the basic theoretical approaches in electromagnetism such as ray optics, paraxial wave equations and Fourier optics.

**Learning outcomes of the module:**

On successful completion of the course the students should be able to:

1. model the electric properties of a given medium.
2. calculate the field distribution in some simple geometries, including some basic optical devices.
3. choose the right theoretical approach for future.

**Assessment:**

Mid-term exam – 25 %

Final exam – 75 % (must pass above 65)

**Work and assignments:**

Homework exercises – 5-7 worksheets; submission non-mandatory

**Time required for individual work:**

1. 3 hours lecture weekly
2. 3 hours individual work weekly on the average.

**Module Content\schedule and outlines:**

1. review of Maxwell equations and wave equations, polarization – 3h
2. wave propagation in free space – from vector to scalar wave equations – 3h
3. wave propagation in media – 3h
4. electromagnetic response of materials – Lorentz and Drude models, absorption and dispersion – 6h
5. Fresnel problem – reflection and refraction of plane waves, Brewster angle, total internal reflection – 6h
6. ray optics – Eikonal equation, Fermat principle, rays equation and its solution in different nonhomogeneous media, propagation of rays. Basic optical elements (the eye, lenses, mirrors, telescope, microscope,…) – 9h
7. diffraction – Paraxial wave (Schroedinger) equation – 3h
8. interference – interference between two waves, thin layer optics (Fabry-Perot etalon), Young’s experiment, diffraction grating – 6h

**Required reading**:

Presentations provided by the lecturer.

**Additional literature:**

1. P. Yeh, “Optical waves in Layered Media”, Wiley Interscience.

2. E. Hecht, “Optics”, 4th edition, Adison-Wesley.

3. B.E.A. Saleh & M.C. Teich, “Fundamentals of Photonics”, Wiley Interscience.

**Lecturer:** Dr. Yonatan Sivan

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Wednesday 13:00-14:00

**Module evaluation**: At the end of the semester the students evaluate the module, in order to draw conclusions, and for the university internal needs.

**Confirmation**: The syllabus was confirmed by the faculty academic advisory committee

**Last update:** 11/9/14