אורט בראודה
המכללה האקדמית להנדסה
ORT Braude College

The Department of Physics and Optical Engineering

Course Name:	Optical Communication Systems Components
Course Number:	31715
Course Extent	Lectures 3, Exercises 1 weekly hours
Course Demerits	3.5
Pre-requisites	39135 Introduction to semiconductors and solid state

Course Goals:

The course intends to provide a basic understanding in the physics of optical fibers and in optical fiber communication technologies and provide basic tools to design and apply components in optical communication systems.

Course structure and requirements:

The course comprises frontal lectures, exercises and home assignments.

Course grade: the home assignments comprise 30% and the final exam 70% of the course grade.

Course Topics:

1. **Review of pre-requisite topics:**
   Maxwell equations; the scalar wave equation; plane waves and the ray model; Pointing vector, intensity and power, time averaging in detectors; formulae and applications of decibel units.

2. **Introduction to optical fiber communication:**
   Historical background to optical communication; other optical fiber applications; development of optical fiber communication systems; advantages and disadvantages of optical fiber communication; the main components of optical fiber communication systems and networks; channel capacity and the communication capacity "crisis".

3. **Introduction to optical fibers:**
   The underlying physical laws, classification of optical fibers, main characteristics of optical fibers, optical fiber types.

4. **Light conduction in a planar waveguide:**
   The parameters of guided light; modes in a one-dimensional planar waveguide.

5. **Light conduction in a cylindrical waveguide:**
   Cylindrical waveguide modes: mode types, number of modes, distribution of the electric and magnetic fields, mode indexes.

6. **Light conduction in a single-mode fiber, dispersion:**
   Phase and group velocity, dispersion in different optical fibers, single-mode fiber, MFD, inter- and intra-modal dispersion, pulse spreading and dispersion compensation.

7. **Light attenuation in optical fibers:**
   Absorption, scattering; bending losses; limitations imposed by attenuation; bandwidth-length limits.

8. **Nonlinear effects in optical fibers:**
   The Kerr effect; Brillouin and Raman non-linear scattering; optical gain.

9. **Optical fiber communication system components and technology:**
   Sources, detectors, welders, connectors, splitters, circulators, switches, multiplexers, polarizers, and modulators.

10. **Optical fiber amplifiers:**
    Raman amplifier: introduction, amplifier configuration and characteristics;
    EDFA: introduction, amplifier configuration and characteristics.

11. **Optical fiber manufacturing, methods and technologies:**
    Preform preparation, drawing, coating.