AEEE512 - Modern Optical Communications

Course Title	Modern Optical Communications				
Course Code	AEEE512				
Course Type	Technical Elective				
Level	MSc (Level 2)				
Year / Semester	1 or 2				
Teacher's Name	Prof Christos Themistos				
ECTS	8	Lectures / week	3	Laboratories / week	
Course Purpose and Objectives	The aim of the course is to familiarize students with the concepts and the principles underlying the field of Optical Communications, to provide students with deep knowledge of the theories and methodologies related to the characteristics Fibre Optics Communications and Photonic Devices Technology and to enable students develop the skills required for the design and analyse of modern optical communication systems.				
Learning Outcomes	By the end of the course, students must be able to: 1. Review the concepts of Lightwave Technology and Optical line transmission. Identify the characteristics of guided electromagnetic waves in optical waveguides such as modes, material dispersion and attenuation. 2. Define the fundamentals of optical waveguides and fibres as key components in optical communication. Apply the Geometrical-optics and the wave propagation approach to illustrate the basic parameters of the optical waveguide such as Refractive Index, Total Internal Reflection, Losses, Bandwidth. 3. Introduce the concept of optical coupling in optical fibres and optical waveguides. Appraise the use integrated optical devices, such as, LED's, optical sensors, optical polarisers, Couplers, Connectors, Repeaters in optical communication systems 4. Familiarise with the Optical waveguide structures, TE/ TM modes, Cut-off frequency, Optical Bends. 5. Judge the several techniques applied to optical communication systems for Dispersion management. 6. Propose suitable techniques for modulation, signal routing and timing in typical optical communication systems. 7. Identify the design parameters to optimise the spectrum of novel optical sensors and filters based on Bragg gratings and microstructured fibres				
Prerequisites	None		Required		None

Course Content	• **Optical Fibre Communication Technology:** Lightwave Technology, Optical line transmission, Fibre Optics Communication Systems. • **The Optical Fibre:** Single-mode/ Multimode Fibres, Step index/ Grade Index Fibres, Refractive Index, Snell's Law, Total Internal Reflection, Modes and Materials, Dispersion, Losses, Bandwidth. • **Coupling of Optical Fibres:** Couplers, Connectors, Repeaters • **The optical waveguide:** The Optical waveguide structures, TE/ TM modes, Cut-off frequency, Optical Bends. • **Dispersion Management:** Dispersion Management Techniques, Dispersion flattened fibers. • **Optical Communication Systems:** Modulation, signal routing and timing in typical optical communication systems • **Optical Sensors and Filters:** Novel optical sensors and filters based on Bragg gratings and microstructured fibres
Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Furthermore, design projects may be assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem, implement to implement the design and report the results in written or orally.
Bibliography	**Textbook** • G.P. Agrawal, "***Fiber-Optic Communication Systems***", 4th Ed., Wiley, 2010 **References** • H. Venghaus and N. Grote, Fibre Optic Communication: Key Devices, 2nd Ed. Springer, 2017 • J.C. Palais, Fibre Optic Communication, 5th Ed., Pearson 2004
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written exam, oral exam, quizzes, design assignments, design projects and laboratory experiments. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted

	continuous assessment of the course is shown below: • Assignments 10% • Homework 10% • Mid-Term written exams 40% • Design Project 30% • Quizzes 10% Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The above criteria are weighted 30%, 40% and 30%, respectively. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	English