COURSE DESCRIPTION
INTEGRATED PHOTONICS

SSD: ELETTRONICA (ING-INF/01)

DEGREE PROGRAMME: INGEGNERIA ELETTRONICA (M61)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

We refer to the preparatory courses defined by the teaching regulations of the reference degree course.

PREREQUISITES

It is assumed that the student has already the basic concepts of some of the three-year degree courses in Information Engineering: Elettronica 1, Campi Elettromagnetici and Optoelettronica. These prerequisites are not mandatory.

LEARNING GOALS

The teaching aims to improve the knowledge and analytical and design skills, from the point of view of systems and applications, of the most recent Optoelectronic systems in the field of integrated photonics; with particular reference to optoelectronic devices in semiconductor and fiber optic materials. In particular, the areas of application considered are: optical communications and monitoring sensor systems.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

At the end of the course, the student will have increased his/her specific knowledge in the field of photonic devices and circuits for various application fields, starting from optical carrier information transmission systems and also optoelectronic sensor systems. He will also have honed his analytical skills in the functional functioning of such systems.

Applying knowledge and understanding

After the course, the student will have improved their electronic/optoelectronic design skills of particular passive or active optoelectronic components/systems that are used in the field of optical carrier information transmissions and optoelectronic sensor systems.

COURSE CONTENT/SYLLABUS

In the course the most common devices of integrated photonics will be analysed, starting from the operating principles, design procedures and applications aimed at both optical carrier information transmission and optoelectronic sensors will be considered. Topics covered will be:
guided optical transmission recalls;
3D optical waveguide design;
recalls of optical fibers both Multi and Single mode;
use of FO for long distance connections and for monitoring applications (the Bragg grating integrated into the FO);
design of planar guides in various semiconductor materials;
review of quantum mechanics and concepts of solid state physics;
analysis and design of passive optoelectronic devices, active optoelectronic devices, photodetectors, analysis of the working principle of semiconductor light sources;
hints of construction technologies of the systems encountered in the program.

READINGS/BIBLIOGRAPHY

Reference books and other sources:
SO Kasap, Optoelectronics and Photonics, Prentice Hall
K. Iga and Y. Kokubun, Encyclopedic Handbook of Integrated Optics, CRC Taylor and Francis Group
H. Nishihara, Optical Integrated Circuits, Mc Graw-Hill Optical and Electro-optical Engineering Series
L. Pavesi, Silicon Photonics, Springher Link
Notes written by the teacher on specific topics
Specific Scientific Articles
Copies of the slides presented in class

TEACHING METHODS OF THE COURSE (OR MODULE)

The lessons take place mainly in the classroom, providing for the active involvement of the student, especially in the 'planning' parts with specific exercises. Part of the course activities is

carried out in the Optoelectronics Laboratory, where the student sees some optoelectronic systems live and engages in experimental experiences for the characterization of specific optoelectronic systems.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [ ] Written
- [x] Oral
- [x] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

The student is assigned a topic, through the suggestion of a particular scientific paper used as a starting point, on which he will independently develop a written report (in English) which will be to argue a proposed thesis. The student also supports the report with the creation of a suitable power point presentation, which he will use at the time of the oral exam to argue the conclusions reached.
After this phase, the student is also assessed on some program topics.
The final ranking is obtained considering both the report presented and the answers to the questions, considering the correctness, rigor, completeness and effectiveness of the answers.