

edX UBCx: Photonics101

Silicon Photonics: Design & Fabrication

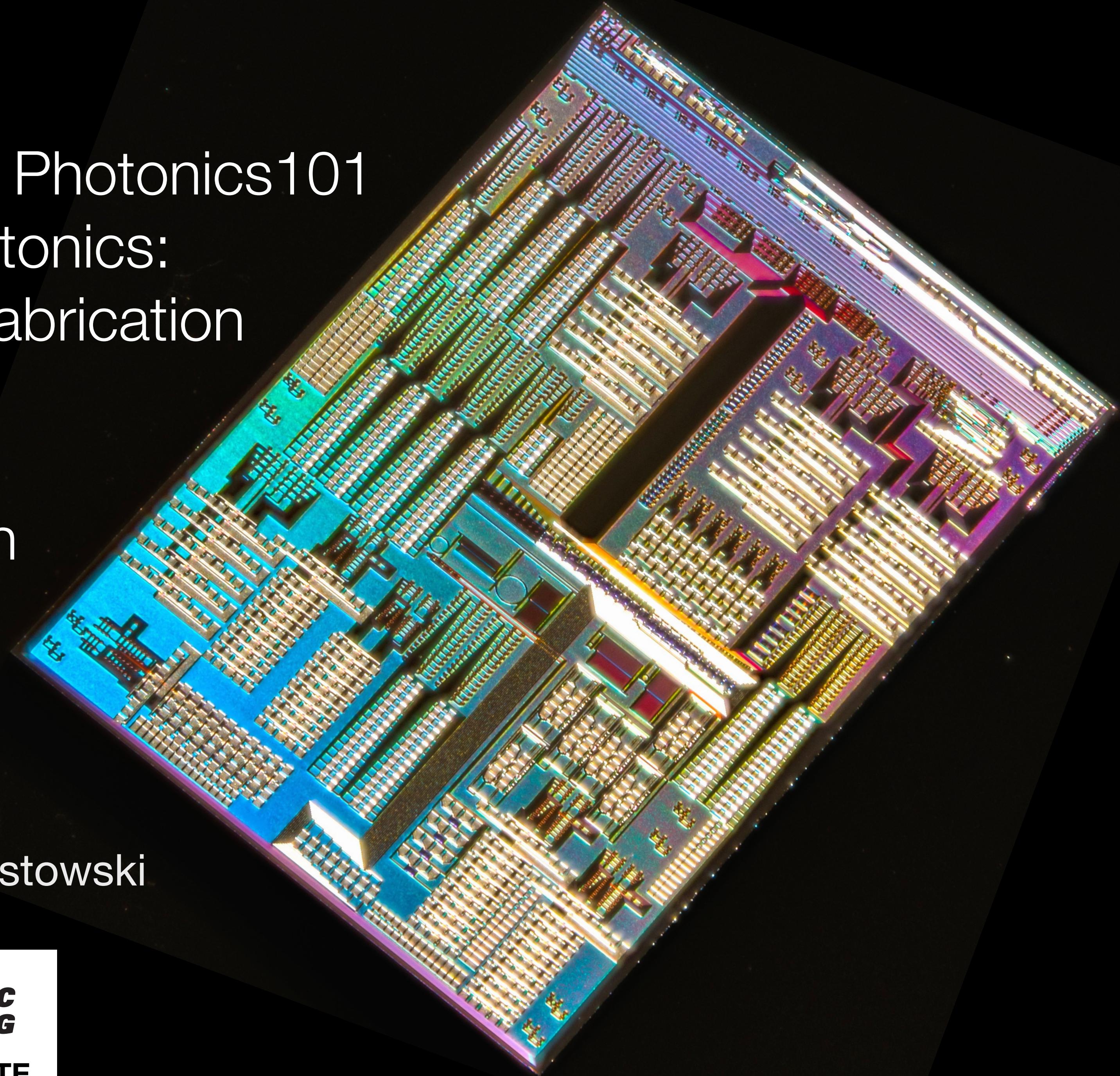
Course Introduction

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NSERC
CRSNG

Si-EPIC CREATE

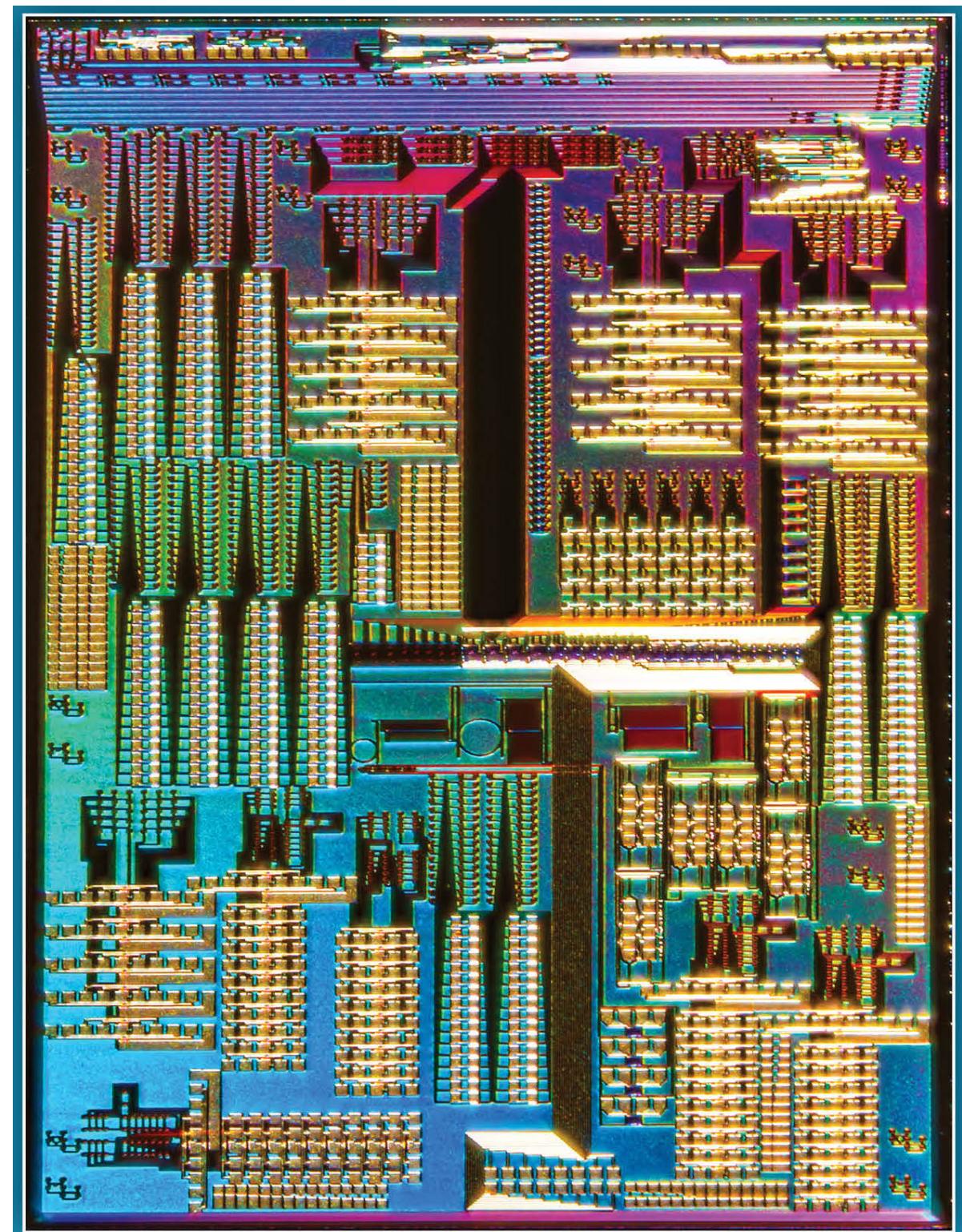


Outline

- Silicon photonics – introduction
- Course logistics:
 - Resources
 - Time commitment – flexible
 - Grading
- Design cycle – Schedule:
 - Modelling
 - Layout
 - Fabrication
 - Automated Test
 - Data Analysis

Silicon Photonics – Motivation

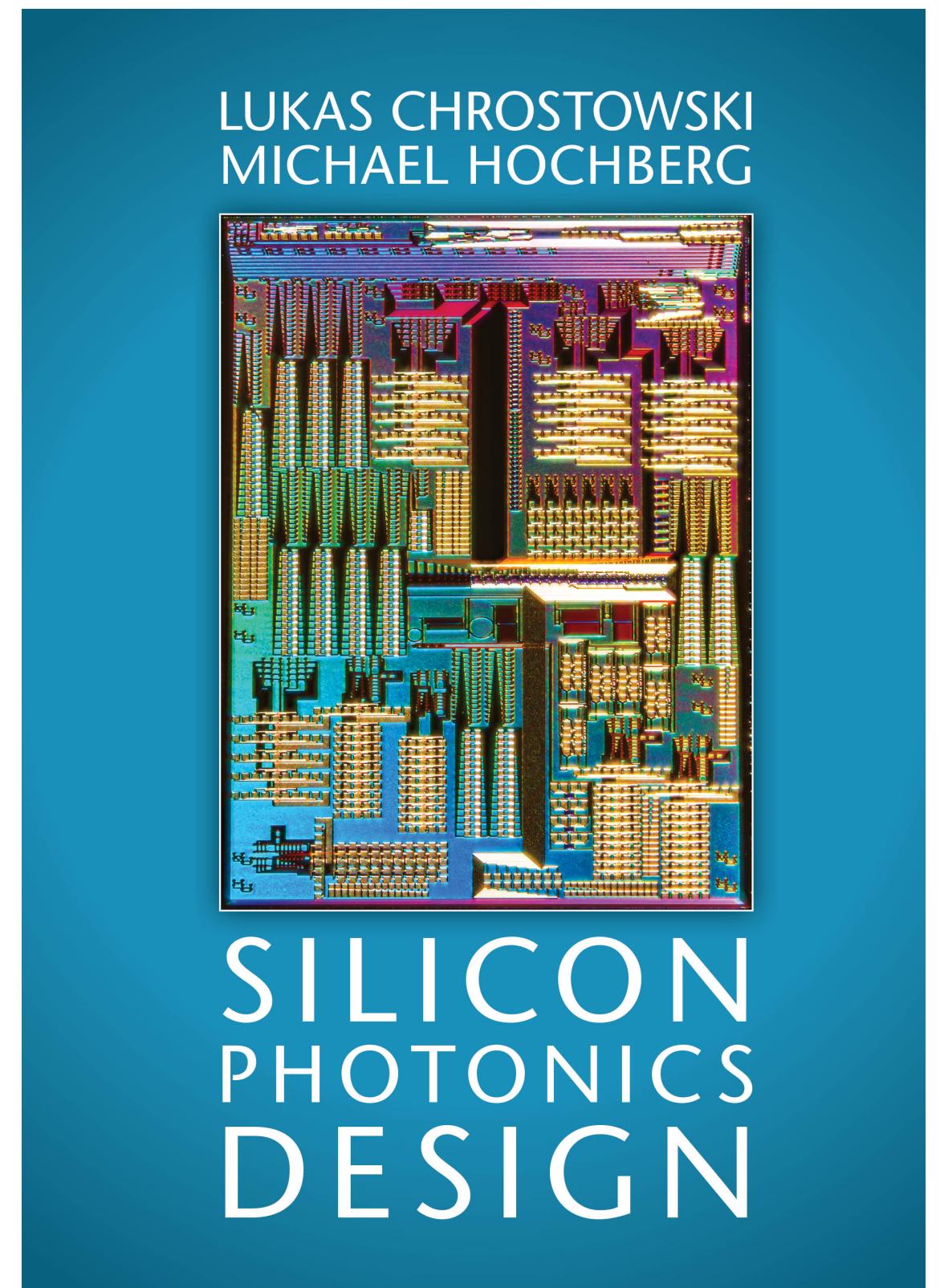
- Silicon electronics industry
 - Over \$50 Billion annual R&D investment
 - Mature **materials processing, design tools, libraries**
 - Possibility of leveraging this technology for optics/photonics
- Silicon photonics
 - “integrated optics” and “photonic integrated circuits (PICs)” on silicon
 - use silicon as an optical waveguide material and for optical processing/switching
 - Small size, CMOS compatible
- Both electronics & photonics:
 - silicon electronic and photonic integrated circuits (SiEPIC)



* \$53B in 2012. Source: IC Insight, and <http://www.electroiq.com/articles/sst/203/02/semiconductor-rand-spending-rises-7percent-despite-weak-market.html>

Resources

- Part of the textbook “Silicon Photonics Design: From Devices to Systems”
- Lecture videos
- Tutorial videos
- Documents
- Activities
- Feedback on your design
- Discussion Forum



Resources – Design tools

- Many tools available
 - Commercial tools provided by Lumerical Solutions, Mentor Graphics, Mathworks
 - Flexibility in how much time you want to spend on this course

MATLAB

Lumerical MODE

Component models

KLayout

Pyxis Layout

Layout

MATLAB

Lumerical
INTERCONNECT

Circuit models

MATLAB

Python

Measurement Data Analysis

Flexibility in your time commitment

Design Activities	Minimum	Comprehensive
Waveguide modelling – Lumerical MODE	✓	✓
Waveguide modelling – MATLAB		✓ (with scripts, temperature dependance)
Waveguide bends – Lumerical MODE	✓	✓ (with scripts)
Y-Branch – Lumerical MODE		✓
Interferometer – MATLAB	✓	✓
Interferometer – Lumerical INTERCONNECT		✓ (includes grating couplers, temperature)
Layout – PDK, Library, Testing	✓	✓
Layout – kLayout	✓	✓
Layout – Mentor Graphics Pyxis		✓
Design Review	✓	✓
Manufacturing Variability	✓	✓
Data Analysis	✓	✓
Design & Final Report	✓	✓

Grading

- This course is graded as follows:
 - 50% – Mini-homework questions embedded within the units, answered and graded in the web browser. Questions may be answered as many times as necessary to get the correct answers.
 - 10% – Design review score: peer evaluation based on the PDF report and GDS layout.
 - 20% – Analysis: comparison of experiments vs. simulation; experimental data should lie within the range of simulated results considering manufacturing variability.
 - 20% – Final Report
- Grade required to pass the course: 70%

Design Cycle – Schedule

