



# PHOTONIC INTEGRATED CIRCUIT

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**PRE-REQUISITES** : Introduction to Photonics

**INDUSTRIES APPLICABLE TO** : Intel, IBM, Google, Facebook, Lumentum, Lumerical, Photon Design, Comsol. Ceana, Tejas Networks, DRDO, ISRO, DAE labs.

### COURSE OUTLINE :

This is a graduate-level course for those who are interested in Lightwave/photonic circuits. The course introduces essential concepts required to understand the operation of various integrated photonic components and draws a parallel with bulk components. This course will cover theory, design, fabrication, and application aspects of photonic materials and devices. In addition to lectures, a selection of demonstration of device fabrication and characterisation will be presented.

### ABOUT INSTRUCTOR :

Prof. Shankar Kumar Selvaraja obtained B.E. Electronics and Communication Engineering from Dr. MCET, Pollachi, Bharathiar University, M.E. Optical Communication from College of Engineering, Anna University, Chennai, M. S. Microelectronics and Microsystems from University of Twente, The Netherlands and Ph.D. in Photonics Engineering from Ghent University, Belgium in 2011. His doctoral thesis was carried out at imec (inter-university microelectronics center), Leuven, Belgium on wafer-scale fabrication technology for Silicon photonic integrated circuits. He was supported by Dehouse doctoral grant and scientific leadership training award to conduct his doctoral work. Between 2011 and 2014, he worked at imec, Belgium developing next-generation microprocessor for high-speed computing using Silicon photonic integrated circuits. He has spent a decade in the area of silicon photonic developing state-of-the-art process and device technology for Silicon Complementary-Metal-Oxide-Semiconductor (CMOS) compatible photonic integrated circuit for high-speed optical interconnect. Dr. Shankar Kumar Selvaraja joined Centre for Nano Science and Engineering at Indian Institute of Science (IISc) in 2014 as an Assistant Professor, where he is heading the Photonics Research Laboratory. He is currently deputy chairman of the National Nanofabrication Center at IISc. He was awarded Early Career Research Award by Department of Science and Technology-Science and Engineering Research Board (DST-SERB), Government of Indian. In 2014, he was awarded Sir Visvesvaraya Young Faculty Research Fellowship by Ministry of Electronics and Information Technology (MeitY), Government of India. He is a senior member of IEEE (Institute of Electrical and Electronics Engineers), Member of OSA (Optical Society of America) and SPIE. His current area of research includes high-speed Si photonics, Silicon Nitride photonics circuits, microwave photonics, and on-chip mic-IR sensing technology.

### COURSE PLAN :

- Week 1:** Review of Electromagnetic Waves
- Week 2:** Photonic integrated circuits: an introduction
- Week 3:** Material technology for integrated optics
- Week 4:** Introduction to guided wave optics
- Week 5:** Integrated optical waveguide design
- Week 6:** Coupling light in a waveguide system
- Week 7:** Integrated photonic Passive devices
- Week 8:** Integrated photonic Active devices
- Week 9:** Semiconductor Light sources and Photodetectors
- Week 10:** Material engineering and fabrication
- Week 11:** A Photonic integrated circuit technology: Silicon, III-V and beyond
- Week 12:** Application of Photonic circuit in Communication and Sensing