



# INTRODUCTION TO PHOTONICS

**PROF. BALAJI SRINIVASAN**

Department of Electrical Engineering  
IIT Madras

**TYPE OF COURSE** : Rerun | Elective | UG | PG

**COURSE DURATION** : 12 weeks (26 July' 21 - 15 Oct' 21)

**EXAM DATE** : 23 Oct 2021

**PRE-REQUISITES** : Basic knowledge in Electromagnetics is preferred

**INTENDED AUDIENCE** : Third or Final year BE/BTech, First year ME/MTech/MS/PhD

**INDUSTRIES APPLICABLE TO** : Sterlite Technologies, NeST Photonics, Tejas Networks, Vinvish Technologies, BEL, CGCRI, RRCAT, DRDO – LASTEC/IRDE/CHESS

**COURSE OUTLINE :**

Introductory course in photonics leading to more advanced courses such as Lasers, Optical Communications, Optical Sensors and Photonics Integrated Circuits. The learning objectives are: (1) Learn the fundamental principles of photonics and light-matter interactions, (2) Develop the ability to formulate problems related to photonic structures/processes and analyze them, and (3) Understand processes that help to manipulate the fundamental properties of light.

**ABOUT INSTRUCTOR :**

Prof. Balaji Srinivasan obtained his Ph.D. in 2000 from the University of New Mexico, USA. He subsequently worked as a Senior Development Scientist at Corning Incorporated, USA, where he led technology development efforts related to 3D Optical Cross-connects and Channel Selectable Tunable Filters. Since 2004 he has been with the Indian Institute of Technology Madras as a faculty in the Department of Electrical Engineering, presently as Professor. Balaji's research interests span the development of active and passive optical components / subsystems for fiber lasers and distributed fiber optic sensors. Balaji has co-authored more than 130 journal and international conference publications. He also has seven patents to his credit. He has successfully executed or currently investigating 24 research projects worth over INR 17 Crores (USD 2.6M) of funding, resulting in the development of 6 technologies, 3 of which have been successfully transferred to industry for commercialization.

**COURSE PLAN :**

**Week 1:** Science of light – evolution, ray/wave/statistical/quantum optics

**Week 2:** Wave phenomena – Interference, Diffraction

**Week 3:** Statistical properties of light - Coherence

**Week 4:** What are photons? Photon properties - energy, flux, statistics

**Week 5:** Interaction of photons with atoms

**Week 6:** Light amplification

**Week 7:** Laser fundamentals

**Week 8:** Semiconductor junction characteristics

**Week 9:** Semiconductor light sources

**Week 10:** Semiconductor light detectors

**Week 11:** Interaction of light with RF and acoustic waves

**Week 12:** Nonlinear optics