INTRODUCTION TO PHOTONICS

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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, VinvishTechnologies, 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. Prof. Balaji's research interests span the development of active and passive optical components / subsystems for fiber lasers and distributed fiber optic sensors. Prof. 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