Department of Physics
Indian Institute of Technology Kanpur

PHY664 Photonic Devices
2024-2025, Semester – I

Instructor: *Prof. R.Vijaya* ***Office:*** *SL 217, Tel: 7552* ***e-mail:*** *rvijaya@iitk.ac.in*

Schedule of lectures: *as per DOAA site* ***Class room:*** *as per DOAA site*
(Any meetings for discussion are to be requested by e-mail)

Pre-requisites: Basic electromagnetic theory and basic optics/photonics.

Target group: Masters and doctoral students of PHY, CELP and EE.

Overview: The course aims at providing the knowledge base of modern photonic devices through an in-depth analysis of the underlying physical concepts and the necessary discussions on technological challenges. The course is targeted at students who are inclined towards practical aspects of photonics along with the basics.

Course highlights:
* Strong emphasis on the theoretical concepts of Photonics
* Introduction to modern photonic technologies
* Sufficient importance to active and passive photonic devices
* Discussion on practical aspects and challenges in characterizing photonic devices

Detailed course contents:

S. No.	Broad theme	Contents	Lectures (of 50 min. duration)
1	Light-matter interaction – a review	Dispersion in dielectrics, consequences of interference and diffraction	5
2	Periodic structures as optical devices	Optical multi-layers, diffraction gratings, photonic crystals	5
3	Fiber optic devices	Modal theory, devices for wavelength-, direction- and polarization-selectivity	6
4	Integrated-optic devices	Coupled-mode theory, waveguides and couplers in silicon platform	6
5	Light source	Significance of using LED and laser sources	4
6	Electro-optic and optoelectronic devices	Modulators, photodetectors and solar cells	4
7	Novel devices	Plasmonic sensors, slow light devices	5
8	Device characterization	Measurement techniques in time- and spectral-domain	5
		Total number of lectures:	40

Reference texts:
A single text-book will not address all the topics of the course. Please refer to these books and any other resources (such as tutorial papers) for getting the proper perspective:

1. Thomas P.Pearsall, Photonics essentials, 2nd Ed., Mc-Graw Hill (2010)

II. Jia-Ming Liu, Photonic Devices, Cambridge University Press (2005)
III. Grote and Venghaus, Fiber optic communication devices, Springer (2001)
IV. Zeev Zalevsky and Ibrahim Abdulhalim, Integrated nanophotonic devices, 2nd Ed., Elsevier (2014)
V. Larry A. Coldren, Scott W. Corzine and Milan L. Masanovic, Diode lasers and photonic integrated circuits, 2nd Ed., John-Wiley and Sons (2012)
VI. Mark A. Mentzer, Applied optics fundamentals and device applications, CRC Press (2011)
VII. A. Dmitriev (Ed.), Nanoplasmonic sensors, Springer (2012)
VIII. Jacob Khurgin and Rodney Tucker, Slow light, CRC Press (2008).

Evaluation (tentative):
Quizzes: 20%
Mid-semester examination: 30%
End-semester examination: 50%
Pass grade requires a minimum of 30% at the end of the course.

Attendance: Compulsory. Attendance will be monitored on a regular basis. Prolonged absence without a justified reason may lead to de-registration.
