

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: A **PHY600 level elective** number requested. *phy ~~600~~ 664*
2. Course Title: **Photonic Devices**
3. No. of Lectures per week: 3 of 50 minutes duration or 2 of 75 minutes duration

Credits (3-0-0-9): 09

Duration of Course: Full Semester

4. Proposing Department/IDP : PHY.

Other Departments/IDPs which may be interested in the proposed course: CELP, EE.

5. Proposing Instructor: R. Vijaya (PHY)

6. Course Description:

A) 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.

- B) 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

- C) Contents:

| S. No. | Broad theme | Contents | Lectures (of 50 min. duration) |
|----------------------------------|--|--|--------------------------------|
| 1 | Light-matter interaction – a review | Dispersion in dielectrics, consequence 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, Bragg gratings | 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 |


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

E) Short summary for including in the Courses of Study Booklet: Light-matter interaction – a review, periodic structures such as Bragg reflectors, gratings and photonic crystals, fiber-optic devices, integrated-optic devices, active devices, sensors, measurement and characterization techniques.

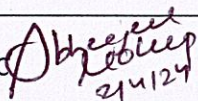
7. Target group: Masters and doctoral students of PHY, CELP and EE.
8. Recommended books:
- I. Thomas P. Pearsall, Photonics essentials, 2nd Ed., Mc-Graw Hill (2010)
 - II. Jia-Ming Liu, Photonic Devices, Cambridge University Press (2005)
 - III. Grote and Venghaus, Fiber optic communication devices, 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).
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Dated: 2 March, 2024. Proposer: R. Vijaya. RVijaya

Forwarded:

Dated: 8/3/24 DPGC Convener (PHY): 

The course is approved / not approved

Chairman, SPGC 
21/1/24

Dated: _____