Electromagnetic Waves in Optoelectronics, IPT 522000

Time: T5T6F2 *(1:10-3:00 PM, Tuesday; 09:00 AM, Friday), at Room* **105**, *EECS bldg.*

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- **Course Description:**
  - Fundamental concepts for Electromagnetic Waves in Optoelectronics, including the mathematical methods, physical concepts, device ideas, and simulation techniques.
  - Extensions and applications of these basic concepts to update research fields will also be addressed.
  - Although this course is given primarily for the first year graduate students, those who are undergraduates or senior graduates are encouraged to take this course.
  - Background: Electromagnetism I, II.
- **Text Books and References:**

  [T1]: Hermann A. Haus, *"Waves and Fields in Optoelectronics,"* Prentice-Hall (1984).

  [T2]: Ammon Yariv, *"Optical Electronics,"* 4th Edition, John Wiley & Sons (1991).

  [R1]: S. Ramo, J. Whinnery and T. Van Duzer, *"Field and Waves in Communication Electronics,"* John Wiley & Sons (1994).

  [R2]: Ammon Yariv and Pochi Yeh, *"Optical waves in crystals,"* Wiley-Interscience (2003).

  [R3]: John D. Jackson, *"Classical Electrodynamics,"* 3rd edition, John Wiley & Sons (1984).

  [R4]: Ammon Yariv, *"Quantum electronics,"* 3rd edition, John Wiley & Sons (1989).
- **Teaching Method:**
  in-class lectures with some studies on journal papers
- **Syllabus:**
  1. (13/09-16/09) Introduction
  2. (20/09-23/09) Electrostatics abd Magnetostatics, base on C1-2 [R1], C1-5 [R3].
  3. (27/09-30/09) Maxwell's equations, base on Chap. 1 [T1, T2], C3 [R1], and C6-7 [R3].
  4. (04/10-07/10) Plane waves propagation and reflection, base on C2 [T1] and C6 [R1].
  5. (11/10-14/10) Mirrors and interferometers, base on C3 [T1]
  6. (18/10-21/10) Fresnel diffraction and paraxial wave equation, base on C4 [T1].
  7. (25/10-28/10) Hermite-Gaussian beams, base on C4 [T1] and C2 [T2].
  8. (01/11-04/11) Midterm exam
  9. (08/11-11/11) Optical waveguides and fibers, base on C6 [T1], C3 [T2], and C8 [R1].
  10. (15/11-18/11) Coupled-mode theory for resonators and couplers, base on C7 [T1], C4 [T2], and C10 [R1].
  11. (22/11-25/11) Distributed feedback structures, base on C8 [T1].
  12. (29/11-02/12) Anisotropic media, base on C11 [T1].
  13. (06/12-09/12) Acoustic-, Electro-, and Magnetic-optic modulators, base on C9, 12 [T1], and C7-10 [R2].
  14. (13/12-16/12) Nonlinear systems, base on C10, 13 [T1].
  15. (20/12-23/12) Phase-conjugate optics, base on C17 [T2] and C19 [R4].
  16. (27/12-30/12) Optical detection, base on C14 [T1], and C10, 11 [T2].
  17. (03/12-06/01) Final Exam
- **Evaluation:**
  1. Four Homework, 40%;
  2. Two Exams: one midterm exam, 30%, and one final exam, 30%;
  3. Bonus: One paper study report with detailed model explanation and formula derivations, 20%.
- **Office hours:** 10:30-12:00, Friday at Room 523, EECS bldg.

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