

科號 Course Number : 10420PHYS587000 學分 Credit : 3 人數限制 Size of Limit : 30

中文名稱 Course Title : 雷射物理與應用一

英文名稱 Course English Title : Laser Physics and Applications (I)

任課教師 Instructor : 潘犀靈 Ci-Ling Pan

上課時間 Time : WaWbWc 上課教室 Room : 物 218

課程大綱 :

#### 一、課程說明(Course Description)

"雷射物理與應用"一之課程內容以介紹雷射的物理基礎及其工作原理為主。修習之後，學生可進一步的從事先進雷射科學的研究，或應用雷射於其專業領域，包括基礎科學、工程與應用科學、生醫科學與工程。課程內容包括：雷射簡介、光學系統中光束軌跡、雷射共振腔、電磁波與雷射介質之交互作用、雷射輸出之功率及頻率、各種雷射系統與雷射的某些應用。學生應已修過大學部電磁學與基礎量子力學（近代物理）。

#### 二、指定用書(Text Books)

Bahaa E. A. Saleh and Malvin Carl Teich, *Fundamentals of Photonics*, 2<sup>nd</sup> Edition© 2007, John Wiley & Sons, Inc., 1<sup>st</sup> Edition, Copyright © 1991, available as an e-book in the library.

#### 三、參考書籍(References)

1. J. T. Verdeyen, *Laser Electronics*, Prentice-Hall, 3<sup>rd</sup> ed., 1995.
2. A. Yariv and P. Yeh, *Photonics: Optical Electronics in Modern Communication*, 6<sup>th</sup> ed., Oxford University Press, 2006.
3. A. Siegman, *Lasers*, University Science Books, 1986.
4. P. W. Milonni and J. H. Eberly, *Laser Physics*, Wiley, 2010.
5. Svelto, *Principles of Lasers*, Springer, 4<sup>th</sup> ed., 2004
6. Rüdiger Paschotta, "Field Guide to Lasers," SPIE Press, 2008.

#### 四、教學方式(Teaching Method)

課堂講授，討論與實驗室參觀

#### 五、教學進度(Syllabus)

1. Introduction
2. Gaussian Beams and Beam Propagation – Chap. 3 plus Review of Wave Optics and Ray Matrix)
3. Optical Cavities and Resonators – Chap. 10
4. Interaction of radiation with matter ( spontaneous emission, stimulated emission and absorption, line broadening mechanisms) – Chapters 13
5. Optical amplification (population inversion, gain and gain saturation, pumping requirements and techniques) – Chapter 14
6. Theory of laser oscillation - cw and transient behavior (Q-switched and mode-locked Lasers)– Chapter 15
7. Characteristics of selected laser systems
8. Selected topics on laser and applications, e.g., nonlinear optics, ultrafast and THz Photonics

#### 六、成績考核(Evaluation)

Homework: (35%)

Report: (15%)

Each student will hand in a report on a type of laser not covered in lectures or current topics of laser physics. The report should be in the format of IEEE Transactions (e.g., PTL, JQE or JLT). He or She will also make a 15-minute presentation of the report to the class.

Exams: Midterm (25%)

Final (25%)