City University of Hong Kong

Information on a Course offered by Department of Electronic Engineering with effect from Semester B in 2014/15

Part I

Course Title:	Applications of Lasers in Optoelectronics
Course Code:	EE5432
Course Duration:	One Semester (13 weeks)
No. of credits:	3
Level:	P5
Medium of Instruction:	English
Prerequisites:	Nil
Precursors:	EE4035 Optical Communication; or EE4142 Guided Wave Optoelectronics; or equivalent
Equivalent Course:	Nil
Equivalent to the Old Course:	Nil
Exclusive Courses::	EE4105 Laser Applications

Part II

1. Course Aims:

This course aims to provide students with an understanding of laser theories, design considerations, operation dynamics, and applications of lasers in optoelectronics, which stimulates interests in learning the latest development in optoelectronic technologies.

2. Course Intended Learning Outcomes (CILOs)

Upon successful completion of this course, students should be able to:

No.	CILOs
1.	Describe optoelectronic applications of lasers and match the types of lasers to the applications
2.	Analyze the designs of different laser oscillators and examine the output performances
3.	Analyze the dynamic operations of lasers
4.	Describe research developments of novel laser devices
5.	Characterize different lasers commonly used in optoelectronics

3. Teaching and learning Activities (TLAs)

CILO	Teaching and Learning Activities
1, 2, 3, 4, 5	Lecture, tutorial, and in-class exercise (including a presentation)
5	Laboratory

The presentation is designed to encourage students to research into individual topics about lasers. The topics include specific engineering applications of lasers, specifically popular lasers, or novel lasers. The students are expected to learn through actively researching and integrating the knowledge about the latest technological development in optoelectronics.

Timetabling Information

Pattern	Hours
Lecture:	26
Tutorials:	13*
Laboratory:	
Other activities:	0

*Some tutorials will be conducted in the laboratory.

4. Assessment Tasks/Activities

	Type of assessment tasks	*Weighting (if applicable)*
Continuous Assessment	Assignments, Tests, Lab	30%
Examination	Written exam	70% 2 hours

Remarks: To pass the course, students are required to achieve at least 35% in course work and 35% in the examination. Also, 75% laboratory attendance rate must be obtained

5. Grading of Student Achievement:

Letter Grade	Grade Point	Grade definition
A+ **A** **A-**	**4.3** **4.0** **3.7**	Excellent
B+ **B** **B-**	**3.3** **3.0** **2.7**	Good
C+ **C** **C-**	**2.3** **2.0** **1.7**	Adequate
D	**1.0**	Marginal
F	**0.0**	Failure

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1, 2, 3, 4	The application of current knowledge in optoelectronics to laser technology, specialized knowledge in laser dynamics, and evaluation of anticipated trends in laser applications are central to the aim of this course.

Part III

Keyword Syllabus:

Introduction: Light-matter interaction, unique properties of laser, survey of novel laser applications

Fundamental Optoelectronics:Ray matrix, Gaussian beams, optical cavities, Schrodinger equation, harmonic oscillators, perturbation theory, density matrix, optical susceptibility

Laser Theory: Semi-classical rate equations, detailed balancing, population inversion, linewidth broadening

Laser Dynamics: Continuous-wave, modulation, Q-switching, mode-locking, injection-locking, optical chaos

Laser Applications: Optical communication, detection and ranging, biomedical applications

Novel Laser: Quantum dot lasers, quantum cascade lasers

Recommended Reading:

Textbooks:

A. Yariv, *Quantum Electronics*, 3/e, Wiley (1989)

J. M. Liu, *Photonic Devices*, Cambridge University Press (2005)

References:

R. L. Liboff, *Introductory Quantum Mechanics*, 3/e, Addison-Wesley (1997)

J. T. Verdeyen, *Laser Electronics*, 3/e, Prentice Hall (1995)

W. T. Silfvast, *Laser Fundamentals*, Cambridge University Press (1996)

Online Resources (if any)