**COURSE SYLLABUS**

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| **Subject: Optoelectronics and Nanophotonics** | **Academic field: Physics** |
| **Lecturer: NGUYEN Thi Thanh Ngan** |  |
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| **Academic year: 2017-2018** |  |

**COURSE DESCRIPTION**

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| **Credit points** |  | |
| **Level** | Undergraduate | |
| **Teaching time**  **Location** | University of Science and Technology of Hanoi | |
| **Time Commitment** | Lecture | 25 hrs |
| Exercises | 05 hrs |
| Practicals | 0 hrs |
| Total | 30 hrs |
| **Prerequisites** | Solid state physics, Optics | |
| **Recommended background knowledge** | None | |
| **Subject description:** | This course will cover the fundamentals of optoelectronics and nanophotonics together with current applications of these fields. A laboratory visit during the course will provide students with some hand-on experience in advanced research in photonics and nanoparticles. | |
| **Objectives & Out-come** | *(Knowledge &/ Skills gained via the course)*  *The students will be able to:*  *- Understand and describe the basics of optoelectronics and nanophotonics*  *- Understand the applications of optoelectronics and nanophotonics*  *- Solve relevant problems* | |
| **Assessment/ Evaluation** | Attendance/Attitude | 10 % |
| Exercise(s) | 10 % |
| Practicals | 0 % |
| Mid-term test | 30 % |
| Final exam | 50 % |
| **Prescribed Textbook(s)** | [1] Fundamentals of Photonics, B.E.A Saleh & M.C. Teich, 2nd edition  [2] Laser Electronics, J.T. Verdeyen, 3rd edition  [3] Nanophotonics, P.N. Prasad, 2004, published by John Wiley & Sons | |

**COURSE CONTENTS & SCHEDULE**

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| **Class** | **Contents** | **Hours** | | | **Ref./Resources** | **Assignment(s)** |
| **Lect.** | **Exr.** | **Prc.** |  |  |
| 1 | Topic: *Nature of light & propagation*  Maxwell equations and EM waves  Ligh propagation: absorption and dispersion,  reflection and refraction, diffraction. | 02 |  |  |  |  |
| 2 | Topic: *Photons in semiconductors*  Interactions of photons with electrons | 02 |  |  |  |  |
| 3 | Topic: *Light Emitting Diodes* (LED) *and Photodetectors*  p-n junction  LED principle, structures and efficiency  Emission spectrum | 03 |  |  |  |  |
| 4 | Topic: *Physics of lasers*  Optical resonators  Interaction of photons with atoms  Laser oscillation  Characteristics of laser radiation | 03 | 02 |  |  |  |
| 5 | Topic: *Types of lasers*  Gas lasers, solid state lasers  Applications of lasers | 03 |  |  |  |  |
| 6 | Midterm Exam | 02 |  |  |  |  |
| 7 | Topic: *Electrons and EM waves in nanostructures – Semiconductor nanocrystals*  Electrons in potential wells and periodic structures  Wave optics and correspondence with quantum mechanics of electrons  Propagation of electrons over wells and barriers  Confinement effect on electrons and holes  Absorption and luminescence properties  Applications of quantum dots | 03 |  |  |  |  |
| 8 | Topic: *Metal nanoparticles, Plasmonics*  Size dependent absorption and scattering  Surface plasmons in metal nanoparticles  Local field enhancement near metal nanoparticles  Applications: plasmonic sensors | 02 |  |  |  |  |
| 9 | Topic: *Photonic crystal*  Block waves in periodic structure  Band gap and band structure | 03 | 03 |  |  |  |
| 10 | Topic: *Photonic crystal*  Applications of photonic crystals  Fabrication methods  Nonlinear optics of photonic crystals | 02 |  |  |  |  |

*Notes:*

* *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*
* *Exercises may include assignment, reports, student’s presentation, homework, class exercises ...for each class sessions*
* *Practical mostly refer to Lab- work or outside practice such as field trip.*

**Reference Literature:**

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| [1]. |
| [2]. |
| [3]. |
| [4]. |