**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 wavesLigh 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 efficiencyEmission spectrum  | 03 |  |  |  |  |
| 4 | Topic: *Physics of lasers* Optical resonators Interaction of photons with atomsLaser oscillation Characteristics of laser radiation | 03 | 02 |  |  |  |
| 5 | Topic: *Types of lasers*Gas lasers, solid state lasersApplications of lasers | 03 |  |  |  |  |
| 6 | Midterm Exam | 02 |  |  |  |  |
| 7 | Topic: *Electrons and EM waves in nanostructures – Semiconductor nanocrystals*Electrons in potential wells and periodic structuresWave optics and correspondence with quantum mechanics of electronsPropagation of electrons over wells and barriers Confinement effect on electrons and holesAbsorption and luminescence propertiesApplications of quantum dots | 03 |  |  |  |  |
| 8 | Topic: *Metal nanoparticles, Plasmonics*Size dependent absorption and scatteringSurface plasmons in metal nanoparticlesLocal field enhancement near metal nanoparticlesApplications: plasmonic sensors | 02 |  |  |  |  |
| 9 | Topic: *Photonic crystal*Block waves in periodic structureBand gap and band structure | 03 | 03 |  |  |  |
| 10 | Topic: *Photonic crystal*Applications of photonic crystalsFabrication 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]. |