KARTA PRZEDMIOTU

Nazwa przedmiotu: ***Lasers and their applications (WTCNOCSI-LaTA)***
Nazwa w języku polskim:
Nazwa w jęz. angielskim: ***Lasers and their applications***

Dane dotyczące przedmiotu:

Jednostka oferująca przedmiot: Wydział Nowych Technologii i Chemii
Przedmiot dla jednostki: Wydział Nowych Technologii i Chemii

Domyślny typ protokołu dla przedmiotu:

Zaliczenie na ocenę

Język wykładowy:

angielski

Skrócony opis:

In this course Student will learn the fundamental physics of laser. and the working principle of a laser and its applications. Furthermore, Substantial emphasis during the lectures will be placed to different applications of the laser technologies, such as super-resolution microscopes and optical tweezers which allow the manipulation of microscopic objects in biology and medicine. Frequency combs and optical atomic clocks set new standards in precision measurements. Students will be able to apply directly their previous knowledge in basic physics, electromagnetic waves and quantum mechanics and see how this knowledge eventually leads to the laser engineering solutions used in multiple fields in the modern world.

Opis:

Wykład /metoda słowna z wykorzystaniem prezentacji multimedialnych.
1. The basic principles of laser (Requirements for a laser)/ 2 godz.
2. Laser properties related to applications / 2 godz
3. The spectrum of atomic hydrogen: Quantum electrodynamics / 2 godz.
4. Interaction of the laser radiation with the materials / 2 godz. /
5. Laser tweezers in cell biology / 2 godz..
6. Silicon Photonic: Computing at the speed of light / 2 godz.
7. Optical surface interferometry / 2 godz.
8. choose of laser for holography application / 2 godz
9. Examples of Lasers Used in Our Lives / 2 godz.
Seminaria /rozwiązywanie i analizowanie problemów zgodnie z tematyką wykładów.
Laboratoria /pomiar wybranych właściwości ciał stałych i detektorów podczerwieni. Obejmują budowę stanowiska pomiarowego, wykonanie pomiarów oraz opracowanie wyników i wyciągnięcie wniosków.
Tematy ćwiczeń:
1. Collimation of a Laser beam and Power and Irradiance of a HeNe Laser Beam measurements / 3 godz.
2. Electrooptical modulation of laser / 3 godz.
3. Young interferometer experiment for light phase modulation measurements / 3 godz.
4. Spectra measurements of laser sources / 3 godz.

Literatura:

podstawowa:
1. O'Shea, Callen & Rhodes, Introduction to Lasers and Their Applications, Addison Wesley, 1978. ISBN 9780201055092
2. Travis S, Introduction to Laser Science and Engineering, CRC Press an imprint of Taylor & Francis Ltd (2019)
3. Pradip Narayan Ghosh, Laser Physics and Spectroscopy, CRC Press an imprint of Taylor & Francis Ltd (2018)
uzupełniająca:
1. Karl F. Renk, Basics of Laser Physics for Students of Science and Engineering, Springer International Publishing AG (2017)
2. Springer Handbook of Electronic and Photonic Materials, pod redakcją S. Kasap I P. Capper, Springer, Heidelberg, 2006.

Efekty uczenia się:

Symbol / Efekty uczenia się / Odniesienie do efektów kierunku
W1 /The students gain important fundamental knowledge concerning lasers and properties of laser beams. / K_W02,
W2 / The gained knowledge will lead to the ability to appropriately choose or optimize laser materials processes for an application. / K_W02, K_W03
W3 / Design simple experiments to measure the fundamental properties of a laser (especially its divergence angle, coherence length, and beam profile). / K_W12
W4 / be familiar with how a variety of laser types work and be familiar with their wavelengths, power capabilities, and beam properties / K_W14
U1 / An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematic / K_U03, K_U05
U2 / Analyze different laser systems and its applications in various fields. / K_U09
U3 / An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions / K_U07
U4 / Student will have the ability to self-learning / K_U06
K1 / Can work and interact in a group / K_K03
K2 / understand the technologies and operating modes of important materials processes / K_K02, K_K05

Metody i kryteria oceniania:

The course ends with a pass written and oral. Laboratory - an exercise requires the positive ratings from test before starting the exercise, exercise execution and devotion written report of the exercises. Completion of the course requires positive assessments of laboratory exercises and to pass a written test containing open-ended questions.
Achieving effects W1, W2, W3, W4, U1, U2 and K1 is verified during the final test, and the results W3, U3 and U4 and K2 are checked during the execution of laboratory exercises.
score 2 – less than 50% of correct answers.
score 3 – 50 ÷ 60% of correct answers.
score 3,5 – 61 ÷ 70% of correct answers.

score 4 – 71 ÷ 80% of correct answers.
score 4,5 – 81 ÷ 90% of correct answers.
score 5 – more than 91% of correct answers.
Student receives 5 if possess the knowledge, skills and competences foreseen learning outcomes, and also shows interest in the subject, in a creative approach to assigned tasks and show independence in acquiring knowledge, is persistent in overcoming difficulties and systematic work.
Student receives 4 if possess the knowledge and skills curriculum provided a good level. Able to solve the tasks and problems of medium difficulty.
Student receives 3 if possess the knowledge and skills provided the curriculum sufficiently. Isolated solves problems and problems with a low degree of difficulty. His knowledge and skills are noticeable gaps that can complement but under the guidance of a teacher.
Student receives 2 if does not possess the knowledge, skills and competences necessary requirements. The final evaluation consists of the evaluation obtained on exam and laboratories and the commitment and approach to student learning.

Forma studiów

stacjonarne

Rodzaj studiów

I stopnia

Rodzaj przedmiotu

wybieralny

Przedmioty wprowadzające

Fizyka - Nature and Properties of Light, Basic Geometrical Optics. In addition, student should be able o account for spectroscopic methods in different energy intervals.
Matematyka - Knowledge of mathematical analysis of functions of several variables and differential and integral calculus for this type of functions
Podstawy inżynierii fotonicznej - fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics
Programy

Programy

kierunek: inżynieria materiałowa, specjalność: inżynieria fotoniczna

Forma zajęć liczba godzin/rygor

W 18/+; L 12/+

Autor

dr hab. Noureddine BENNIS

Bilans ECTS

Lp. Aktywność Obciążenie w godz.
1. Udział w wykładach 18
2. Udział w laboratoriach 12
3. Udział w ćwiczeniach
4. Udział w seminariach
5. Samodzielne studiowanie tematyki wykładów 24
6. Samodzielne przygotowanie do laboratoriów 12
7. Samodzielne przygotowanie do ćwiczeń
8. Samodzielne przygotowanie do seminarium
9. Realizacja projektu
10. Udział w konsultacjach 16
11. Przygotowanie do egzaminu
12. Przygotowanie do zaliczenia 10
13. Udział w egzaminie
godz.; ECTS
Sumaryczne obciążenie pracą studenta: 92; 3,0
Zajęcia z udziałem nauczycieli: 1+2+3+4+9+10+13: 46; 2,0
Zajęcia powiązane z działalnością naukową: 58; 2,0

Punkty przedmiotu w cyklach:

<bez przypisanego programu>

Typ punktów	Liczba	Cykl pocz.	Cykl kon.
Europejski System Transferu i Akumulacji Punktów (ECTS)	3	2024/25L	