# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thin layers [S2IMat1-Nanomat>CW]

## Course

Field of study
Materials Engineering

Year/Semester
1/2

Area of study (specialization)
Nanomaterials

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

dr hab. Izabela Szafraniak-Wiza prof. PP
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## Lecturers

## Prerequisites

Knowledge: Basic knowledge of solid state physics, crystallography, materials science and nanotechnology Skills: Logical thinking, use of the information obtained from library and Internet Social competencies: Understanding the need for learning and acquiring new knowledge

## Course objective

The knowledge of specific methods of thin film depositions, specific properties of thin films and their investigation methods. The knowledge of thin films applications in electronics

## Course-related learning outcomes

Knowledge:
the student has knowledge about specific properties of thin films.k_w04 k_w06 k_w08
the student has knowledge about specific investigation methods of thin film.k_w01, k_w04
the student has knowledge about thin film applications in modern electronics.k_w06, k_w04 k_w07

Skills:
the student can propose applications of different thin films in modern electronics. k_u01 k_u13

the student can propose and investigate the specific properties of thin films. k_u01 k_u08 nk_u10 k_u013
the student can relate the specific properties of thin films and their deposition methods. k_u08, k_u010 k_u016

Social competences:
the student can collaborate in order to obtain and implement the new knowledge. k_k03
the student is aware of importance of nanotechnology in modern industry and society. k_k02

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lectures:
Written test at the end of the semester
Laboratory:
The final report prepared according to lecturer’s guidelines, student activity at laboratory and final test.

## Programme content

Lectures:
1. Thin film deposition methods
2. Thin films in modern electronics
3. True single crystalline thin films
4. Conventional and unconventional lithography
5. Specific methods of thin films investigations
Laboratory:
1. XRD investigations of thin films.
2. AFM investigation of film topography – part I
3. AFM investigation of film topography – part II
4. Structural analysis of epitaxial films
5. Epitaxial stress analysis of thin films

## Course topics

none

## Teaching methods

1. Lecture: multimedia presentation.
2. Laboratory exercises: performing exercises, discussion, team work.

## Bibliography

Basic
1. Oleś, Metody doświadczalne fizyki ciała stałego, WNT 1998
2. Nanoelectronics and Information Technology, Waser R., Wiley-VCH, Berlin, 2003
3. Nanomateriały inżynierskie, K. Kurzydłowski, M. Lewandowska (red.), PWN 2010
4. Nanotechnologie, R.W. Kelsall, I.W. Hamley, M. Goeghegan (red.), PWN, 2008
Additional
Handbook of thin film devices, M. H. Francombe (red.), Acad. Press, San Diego, 2000
Kittel C.,Wstęp do fizyki ciała stałego, PWN, Warszawa, 1999
Scientific papers

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 60 | 2,00 |
| Classes requiring direct contact with the teacher | 30 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 15 | 0,00 |