**Name of the module: Surface Engineering**

**Number of module: 365-26531**

BGU Credits: 3

ECTS credits: 4

Academic year: 2012-2013

Semester: Spring semester

Hours of instruction: 3 hours per week

Location of instruction: will be defined

Language of instruction: Hebrew

Cycle: Second cycle

Position: an advanced course for graduate students of Materials Engineering Department

Field of Education: Materials Engineering: Surface engineering. Methods for improvement of materials performance by surface thermal treatments and coating

Responsible department: Materials Engineering

General prerequisites: none

Grading scale: the grading scale would be determined on a scale of 0 – 100 (0 would indicate failure and 100 complete success 0 to 100), passing grade is 75.

Lecturer: Prof. Nachum Frage

Contact details: room 110, building 59

Office phone: 08-6461468

Email: nfrage@bgu.ac.il

Office hours:

Monday, from 9 to 11AM

Module evaluation: at the end of the semester the students will evaluate the module, in order to draw conclusions, and for the university's internal needs.

Course Description:

The course will explore the application of various approaches for surface thermal treatment and coating for enhancing materials performance (oxidation resistance, wear resistance, chemical stability)

The first part of the course is related to the importance of surface condition on materials performance and to the possible ways for altering chemical composition and microstructure of a surface and its mechanical properties, for instance hardness. General principles of diffusion hardening, CVD, PVD coating are considered.

The second part describes conventional and modern approaches for surface treatments, namely: diffusion coating, CVD, PVD, thermal spray coating, laser assisted coating, ion implantation.

The third part is related to the testing and characterization of coatings and thin films.

.

Aims of the module:

Students will learn the general aspects of surface treatments and the effects of various coatings on materials performance.

Objectives of the module:

To familiarize students with modern approaches of surface engineering and their physical and chemical principles.

Learning outcomes of the module:

On successful completion of the course the students should be able to:

1. Identify various approaches for surface treatments.
2. Identify the physical and chemical principles of each surface treatment method.
3. Explain the effect of each surface treatment on materials performance.
4. Identify various methods for testing and characterization of coatings and thin films.

Attendance regulation: attendance and participation in class is mandatory (at least 80%).

Confirmation: the syllabus was confirmed by the faculty academic advisory committee to be valid on 2012-2013.

Last update: 02.08.2012

Teaching arrangement and method of instruction: lectures, which include the examples of analysis of chemical reactions in real systems.

Assessment:

Final Exam: 100%

Work and assignments: will be defined

Time required for individual work: in addition to attendance in class, the students are expected to do their assignment and individual work: at least 2hours per week.

Module Content\ schedule and outlines:

Introduction and motivation of the course, examples of real systems where surface treatments allow enhancing materials performance (3h)

General principle of diffusion coatings (thermodynamics and kinetics) (6h)

Analysis of carburizing and nitriding of steels, thermodynamic

and kinetics considerations (6h)

CVD and PVD methods of coating (6h)

Thermal spray coating and laser assisted coating (6h)

Residual stresses in coatings and thin films (3h)

Thermal stability of coatings (3h)

Methods for testing and characterization of coatings and thin films (6h)

Required reading:

Additional literature: Introduction to Engineering Materials, Second Edition, G. Murray, C. White and W. Weise, CRC Press, 2007

Handbook of Metallurgical Process Design, edited by G. Totten

Introduction to Engineering Materials; Behavior, properties and selection, G. Murrey,

Additional literature: Metal Handbook, Ceramic Handbook.