AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Code:	UBPJO-106	Module name:	Surface engineering		
Academic year:	2013/2014	Semester:	Fall	ECTS credits:	5
Programme:	University Base of Courses in English				
Course homepage:	https://intcourses.agh.edu.pl	Lecture language:	English		
Responsible teacher:	prof. dr hab. inż. Kusiński Jan (kusinski@agh.edu.pl)				
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Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K001	Student understands the necessity of continuous education and upgrading his professional and personal competencies; knows the possibilities of continuous education and extending professional competencies	Test, Participation in a discussion, Activity during classes
M_K002	Student understands the impact of surface engineering on technological developments; is aware of possible side effects of technological advancement, including environmental issues, and necessity of taking responsible decisions	Participation in a discussion, Presentation, Test, Activity during classes
Skills		
M_U001	has sufficient language skills (in English) to acquire new knowledge from textbooks, scientific journals, databases and internet sources, to critically evaluate the information and apply in the engineering practice; is able to use the information on the natural resources and industrially produced materials for the needs of technological developments.	Participation in a discussion, Presentation, Examination, Activity during classes

M_U002	Have sufficient skills to optimize the surface design using surface engineering techniques for the material properties improvement	Project, Examination
M_U003	Student can choose proper surface technology to obtain a desired surface properties	Participation in a discussion, Presentation, Examination, Activity during classes
Knowledge		
M_W001	has extended knowledge on the surface engineering, processing, properties and characterization methods of materials; knows the principles of surface engineering design; has basic knowledge on materials degradation;	Participation in a discussion, Presentation, Test, Examination
M_W002	basic knowledge concerning materials engineering, especially on novel structural and functional materials for application in various systems (power plants, machinery, aeronautic, and other industry)	Project, Examination, Activity during classes

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	Fieldwork classes	Workshops	E-learning
Social competence												
M_K001	Student understands the necessity of continuous education and upgrading his professional and personal competencies; knows the possibilities of continuous education and extending professional competencies	+	-	-	+	-	-	-	-	-	-	-
M_K002	Student understands the impact of surface engineering on technological developments; is aware of possible side effects of technological advancement, including environmental issues, and necessity of taking responsible decisions	+	-	-	+	-	-	-	-	-	-	-
Skills												

M_U001	has sufficient language skills (in English) to acquire new knowledge from textbooks, scientific journals, databases and internet sources, to critically evaluate the information and apply in the engineering practice; is able to use the information on the natural resources and industrially produced materials for the needs of technological developments.	+	-	+	+	-	-	-	-	-	-	-
M_U002	Have sufficient skills to optimize the surface design using surface engineering techniques for the material properties improvement	+	-	+	+	-	-	-	-	-	-	-
M_U003	Student can choose proper surface technology to obtain a desired surface properties	+	-	+	+	-	-	-	-	-	-	-
Knowledge												
M_W001	has extended knowledge on the surface engineering, processing, properties and characterization methods of materials; knows the principles of surface engineering design; has basic knowledge on materials degradation;	+	-	+	+	-	-	-	-	-	-	-
M_W002	basic knowledge concerning materials engineering, especially on novel structural and functional materials for application in various systems (power plants, machinery, aeronautic, and other industry)	+	-	+	+	-	-	-	-	-	-	-

Module content

Lectures

SURFACE ENGINEERING

The aim of the lecture is presentation for the students the basic technologies of surface engineering technologies, which improves the lifetime of the machinery parts and tools, as well as increases their commercial values. Also the philosophy of surface engineering, its general applications and requirements will be presented for the students. The lecture is dedicated to the students of material science, mechanical engineering, bioengineering and others interested in this area of engineering knowledge. To follow the course the basic knowledge of physics, chemistry, physical chemistry and material science is necessary. The course programme includes the following subjects: directions of surface engineering techniques development; surface thermal (flame hardening, induction hardening) and thermo chemical treatments (nitriding, boriding, carbonizing, chromising, aluminizing); thermal spraying

techniques; glow-discharge techniques; PVD and CVD techniques; corrosion protection techniques; sol-gel technique; galvanotechnique methods; paints; tubes preizolation; laser and electron beam techniques; ions implantation; techniques of characterization of the coatings structure and properties.

Project classes

SURFACE ENGINEERING
On the basis of the bibliographical studies (books and journals) each student will present report concerning the solution of particular surface engineering problem related to the subjects presented during the lectures

Laboratory classes

SURFACE ENGINEERING
Wear resistant surface layers (practical experiments of carbonizing, nitriding, bronzing – analysis of microstructure, hardness and wear resistance); corrosion and heat resistant surface coatings (analysis of microstructure and properties); laser application in formation of surface layers and coatings; paintings and emails; galvanotechnique; spray techniques; plastic coatings; coatings produced by means of CVD and PVD techniques, methodology of structural and compositional analysis of surface layers and coatings (optical and scanning electron microscopy, AFM, EDS and WDS microanalysis, XPS, X-Ray spectroscopy), techniques of hardness, micro- and nanohardness, wear and erosive resistance measurements.

Method of calculating the final grade
Final score = 0.2 lecture attendance + 0.3 (laboratory + project presentation) + 0.5 exam

Prerequisites and additional requirements
Prerequisites and additional requirements not specified

Recommended literature and teaching resources
Recommended literature and teaching resources
1.D.S.Rickerby and A.Matthews: “Advanced Surface Coatings: a Handbook of Surface Engineering”, Chapman and Hall, New York, 1991.
2.Tadeusz Burakowski Tadeusz Wierzchon: “Surface Engineering of Metals: Principles, Equipment, Technologies”, CRC, 1998
3.J.R. Davis: “Surface Engineering for Corrosion and Wear Resistance”, ASM Handbook ,2001, ISBN 10: ISBN 0-87170-700-4
4.ASM Metals Handbook. Vol. 5, Surface Engineering; ISBN/PUB: 087170384X
5.N.B.Dahorte: „Lasers in Surface Engineering”: ASM International, 1998
6.P.K. Datta and J.S. Burnell-Gray: “Advances in Surface Engineering”; Royal Society of Chemistry, 1997
7.Journals: Wear, Surface and Coating Technology, Surface Science, Surface Science Reports, Corrosion Science, Catalysis Today, Thin Solid Films, Surface and Interface Analysis, Acta Materialia, Vacuum, Inżynieria Powierzchni (In Polish), Inżynieria Materiałowa (In Polish) and other related to the lecture subjects,

Scientific publications of module course instructors related to the topic of the module
Additional scientific publications not specified

Additional information
attendance to lecture, laboratory, project presentation mandatory

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	28 h
Participation in laboratory classes	10 h
Participation in project classes	4 h
Preparation for classes	35 h
Realization of independently performed tasks	20 h
Examination or Final test	15 h
Preparation of a report, presentation, written work, etc.	18 h
Summary student workload	130 h
Module ECTS credits	5 ECTS