TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY

Director of the School of Advanced Manufacturing Technologies _____ Alexey N. Yakovlev

Course Name
Modern surface hardening and coating technologies

Field of Study: Major 22.04.01 Material Science and Technologies

Programme name: Material Science

Level of Study: Master Degree Programme

Year of admission: 2019

Semester, year: 3, 2020

ECTS: 3
Total Hours: 108
Contact Hours: 48

- **Lectures:** 16
- **Labs:** 16
- **Practical experience:** 16

Assessment: exam

Division for Material Science

Head of Division _____ Vasiliy A. Klimenov

Instructor(s) _____ Boris S. Zenin

Course Name

Course Overview

Course Objectives	The main goal of the course can be structured into following objectives: to prepare students for getting new properties of technical materials with application of protective and hardening coatings; to develop students abilities for choose optimal technology for treatment the parts working in special condition.
Learning Outcomes	Professional competency includes knowing of issues on the research and development of novel materials and structures, in particular: - materials for structural and functional applications for different industries, including electronics and medicine, and technology of surface hardening and coating; - principles for design of novel materials – nanostructured, smart, gradient and composite materials with ceramic, metal and polymer matrix; - technologic facilities and devices for surface hardening and coating deposition; - manufacturing processes for advanced materials; - methods for investigation of properties and diagnostics of loaded materials and structures; - physical and chemical models of materials and manufacturing processes; - law and regulatory issues of application of new materials.
Course Outline	The course involves lectures, practical classes and laboratory works. Preparation of presentations on the themes
Prerequisites (if available)	Materials Science; Theory of materials structure; Physical and mechanical properties of materials.
Course Structure	• Service life of machine parts • Surface hardening treatment • Hardening and protecting coating • High-energy beam surface treatment
Facilities and Equipment	Optical microscopes, Hardness testers, X-ray diffractometer XRD-7000, Transmission electron microscope JEM-2100, Scanning electron microscope JSM-7500, Polymer specimen preparation line (grinders, mixers, extruders, thermopress, etc), Optical profilometer New View 6200, Nano indenter Nanotest 600 and G200 (MTS), Universal electromechanic Inston 5582 and hydraulic BiSS UTM 150 testing machines.
Grading Policy	In accordance with TPU rating system we use: - Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (performance tests, perform tasks, problem solving). Max score for current assessment is 60 points, min – 40 points. - Course final assessment (exam/ credit test) is performed at the end of the semester. Max score for course final assessment is 40 points, min – 22 points. The final rating is determined by summing the points of the current assessment during the semester and exam (credit test) scores at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 80.
Course Policy	Class attendance will be taken into consideration when evaluating students' participation in the course. Students are expected to actively engage in class discussions about the assigned readings. Attendance is strictly controlled. All classes is obligatory to presence.

Teaching Aids and Resources	***Compulsory Readings:*** 1. Damage in Composite Materials Ed. by G.Z. Voyaljis, Elsevier, New York, 1993. 2. Physical Metallurgy. 4 th Ed. rev. And enhanced Ed. By R.W. Cohn, P.Haasen Amsterdam: Elsevier, 1996.-2984 p. 3. Physical Mesomechanics of Materials Ed. by V.E Panin Cambridge Interscience Publishing, 1998. 4. Callister, William D., Jr., Materials Science and Engineering: An Introduction. – 5th edition - USA, 1999 5. V.E.Panin, A.I. Slosman, B.S. Zenin, Modern Problem of Material Science and Technology of Materials and Coatings. – Tomsk, TPU, 2006 6. A.I. Slosman, B.S. Zenin, Modern Surface Hardening and Coating Technologies. – Tomsk, TPU, 2006 ***Additional Readings:*** 1. Journal of Material Science 2. Journal of Composite Materials 3. Metallurgical and Materials Transactions 4. Composite Science and Technology. 5. Materials Science and Engineering
Instructor (-s)	Boris S. Zenin, bosezen@tpu.ru, 564114