

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Proizvodne tehnologije
Course title:	Production Technologies

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi – prva stopnja	/	prvi	prvi
Technologies and Systems – 1st cycle	/	first	first

Vrsta predmeta / Course type obvezni/obligatory

Univerzitetna koda predmeta / University course code: TS 1 UN 2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Laboratorijske vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		15	15		93	6

Nosilec predmeta / Lecturer: prof. dr. Mirko Soković

Jeziki / Languages: slovenski/ slovenian	Predavanja / Lectures:	slovenski/Slovenian
	Vaje / Tutorial:	slovenski/Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

- vpis v prvi letnik študija,
- študent/študentka mora pred izpitom opraviti seminarsko delo ter ga javno predstaviti (pred kolegi študenti, asistentom in profesorjem).

Prerequisites:

- enrollment in the first year of study,
- before the exam, the student must complete the seminar work and present it publicly (in front of fellow students, the assistant and the professor).

Vsebina:

- **Uvod**
Splošno o tehnologiji, razdelitev tehnoloških postopkov.
Osnovni pojmi in definicije proizvodnje.
Vrste materialov v proizvodnji.
Stopnja kompleksnosti izdelkov.
Različni načini izdelave (glede na obliko in tolerance, velikostni razred izdelkov, ter zahtevano število izdelkov).

Content (Syllabus outline):

- **Introduction**
General information about technology, classification of technological processes.
Basic concepts and definitions of production.
Types of materials used in production.
Degree of product complexity.
Different production methods (depending on the shape and tolerances, product size class and desired number of products).

- **Fizikalne osnove preoblikovanja kovin**
Kristalna zgradba kovin.
Elastična in plastična deformacija.
Mehanizem plastične deformacije mono- in polikristala.
Utrditev.
Vpliv temperature pri preoblikovanju.
Procesi pri segrevanju hladno deformirane kovine.
- **Osnovni pojmi pri preoblikovanju**
Definicija preoblikovanja.
Razvrstitev preoblikovalnih postopkov.
Karakteristične veličine pri preoblikovanju.
- **Postopki preoblikovanja**
Uvod in razdelitev postopkov:
 - *masivno preoblikovanje (valjanje, kovanje, vlečenje, stiskanje in iztiskavanje surovcev),*
 - *preoblikovanje pločevine (globoki vlek, upogibanje, štančanje in drugi postopki).*
- **Obdelava z odrezavanjem**
Definicija, pomen in vloga.
Razdelitev in značilnost postopkov.
Mehanistični princip odrezavanja.
Gonilniki razvoja pri odrezavanju.
Sodobni materiali izdelkov.
Materiali za orodja.
Gibanja pri odrezavanju.
Geometrija orodja pri rezanju.
- **Postopki odrezavanja**
Postopki odrezavanja z orodjem z definirano geometrijsko obliko rezila (struženje, pehanje in skobljanje, vrtanje, freziranje in žaganje, posnemanje).
Postopki odrezavanja z orodjem z nedefinirano geometrijsko obliko rezila (brušenje, honanje, superfiniš, lepanje).
CNC stroji pri odrezavanju (osnovne značilnosti in razdelitev).
- **Nekonvencionalni postopki obdelave**
Splošno in razdelitev postopkov.
Mehanski postopki.
Kemični postopki.
Elektrokemični postopki.
Toplotni postopki. Kombinirani postopki.
- **Postopki spajanja**
Definicije in razdelitev postopkov.

- **Physical principles of metal transformation**
 Crystal structure of metals.
 Elastic and plastic deformation. Mechanism of plastic deformation of mono- and polycrystals.
 Solidification.
 Effect of temperature on transformation.
 Processes of heating cold deformed metals.
- **Basic concepts of transformation**
 Definition of transformation.
 Classification of transformation processes.
 Characteristic quantities in transformation.
- **Transformation processes**
 Introduction and classification of processes:
 - massive transformation (rolling, forging, drawing, pressing and extrusion of raw materials),
 - sheet metal transformation (deep drawing, bending, stamping and other processes).
- **Cutting processing**
 Definition, meaning and role.
 Classification and characteristics of the processes.
 Mechanistic principle of cutting.
 Development drivers in cutting.
 Modern product materials.
 Materials for tools.
 Cutting movements.
 Tool geometry in cutting.
- **Cutting processes**
 Cutting processes using a tool with a defined geometric shape of the blade (turning, honing and planing, drilling, milling and sawing, imitation).
 Cutting processes using a tool with an undefined geometric shape of the blade (grinding, honing, superfinishing, lapping).
 CNC machines in cutting (basic characteristics and classification).
- **Unconventional processing processes**
 General features and classification of the processes.
 Mechanical processes.
 Chemical processes.
 Electrochemical processes.
 Thermal processes. Combined processes.

Varjenje, spajkanje (lotanje) in lepljenje. Mehanski postopki spajanja (kovičenje, spajanje elementov s preoblikovanjem).

• **Joining processes**

Definitions and classification of processes. Welding, soldering (brazing) and gluing. Mechanical joining processes (riveting, joining elements by forming).

Temeljni literatura in viri / Readings:

Temeljna literatura/Basic literature

- [1] Balič, J.; Pahole, I. *Proizvodne tehnologije*, UM Fakulteta za strojništvo, Maribor, 2006.
- [2] Brezočnik, M. *Proizvodne tehnologije - Osnove posebnih postopkov obdelave*, UM Fakulteta za strojništvo, Maribor, 2011.
- [3] Kalpakjian, S.; Schmid, S. R. *Manufacturing Engineering and Technology*, SI-Edition, Prentice Hall, 2013.
- [4] Kuzman, K (Ed.). *Moderno proizvodno inženirstvo*, Priročnik, Grafis Trade, Grosuplje, 2010.

Priporočljiva literatura/Recommended

- [1] Gologranc, F. *Uvod v preoblikovanje*, 2. predelana in razširjena izdaja, FS Ljubljana, 1987.
- [2] Groover, M.P. *Fundamentals of Modern Manufacturing – Materials, Processes, and Systems*, 4th Edition, John Wiley & Sons, Inc., USA, 2010.
- [3] Schuler: *Metal Forming Handbook*, Springer-Verlag Berlin Heidelberg, 1998.

Cilji in kompetence:

Učna enota prispeva predvsem k razvoju naslednjih splošnih in specifičnih kompetenc:

- sposobnost evidentiranja problema in njegove analize ter predvidevanja operativnih rešitev v tehnološkem smislu,
- sposobnost obvladovanja standardnih razvojnih metod, postopkov in procesov,
- sposobnost uporabe pridobljenega teoretičnega znanja v praksi,
- sposobnost obvladovanja razvoja in napredka,
- razumevanje raznolikosti in globalnega ter socialnega vpliva tehnologij na okolje,
- sposobnost razumevanja in uporabe sodobnih teorij s področja tehniških, tehnoloških in naravoslovnih ved,
- sposobnost interdisciplinarnega povezovanja znanja,
- razvoj strokovnih veščin in spretnosti na področju tehnologij in sistemov,

Objectives and competences:

The learning unit mainly contributes to the development of the following general and specific competences:

- the ability to grasp and analyse a problem, as well as foresee operational solutions in the technological sense or in the process of organisation and management,
- the ability to master standard development methods, procedures and processes,
- the ability to use acquired theoretical knowledge in practice,
- the ability to manage development and progress,
- understanding the diversity and global and social impact of technologies on the environment,
- the ability to understand technical problems mathematically and solve them with the help of mathematics,
- the ability to connect knowledge interdisciplinary,

- sposobnost stalne uporabe informacijske in komunikacijske tehnologije na svojem strokovnem področju.

- development of professional skills and abilities in the field of technologies and systems,
 - the ability to continuously use information and communication technology in one's professional field.

Predvideni študijski rezultati:

- Znanje in razumevanje:
Študent/študentka:
- se seznani s splošnimi pojmi in pomenom tehnologije,
 - se seznani z osnovnimi pojmi povezanimi s proizvodnjo in nastajanjem izdelka,
 - spozna osnovne konvencionalne postopke obdelave,
 - se seznani z nekonvencionalnimi postopki obdelave, ki so prisotni v sodobnem industrijskem okolju,
 - spozna sodobne trende v proizvodnih tehnologijah.

Intended learning outcomes:

- Knowledge and understanding:
Student:
- becomes familiar with general concepts and the importance of technology,
 - becomes familiar with basic concepts related to the production and creation of the product,
 - becomes familiar with basic conventional processing methods,
 - becomes familiar with unconventional processing methods found in the modern industrial environment,
 - gets acquainted with the modern trends in production technology.

Metode poučevanja in učenja:

- Avditorna oblika poučevanja z uporabo sodobnih in uveljavljenih tehnik.
- Sodelovanje strokovnjakov iz proizvodnega okolja pri prenosu znanja iz prakse v izobraževalni proces.
- Računske vaje, laboratorijske vaje ter ogledi uspešnih podjetij.
- Individualne seminarske naloge vezane na različne postopke proizvodnih tehnologij.

Learning and teaching methods:

- Auditory form of teaching using modern and established techniques.
- Cooperation of experts from the production environment in the transfer of knowledge from practice to the educational process.
- Calculation exercises, laboratory tutorials and tours of successful companies.
- Individual seminar assignments related to various processes of production technologies.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt): <ul style="list-style-type: none"> • pisni izpit • ustni izpit • projektno in seminarsko delo Ocenjevalna lestvica: ECTS.	30% ocene 40% ocene 30% ocene	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> • written exam • verbal exam • project and seminar work Grading scale: ECTS.

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