Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

Podiplomski magistrski študijski program

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Integrirani obdelovalni sistemi
Subject Title:	Integrated manufacturing systems

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Tehnika – področje izobraževanja		2	Letni
		ali	
		3	zimski
Education in Engineering		2	Summer
		or	
		3	winter

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Avdit. vaje Tutorial	Lab. vaje Lab work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
10	5				75	**3**

Nosilec predmeta / Lecturer: | Prof. Jože Balič

Jeziki / Languages:	Predavanja / Lecture: Vaje / Tutorial:	Slovenščina / Slovene

Pogoji za opravljanje študijskih obveznosti:	Prerequisites:
- Osnovno znanje o tehnoloških postopkih, obdelovalnih in proizvodnih sistemih	- basic knowledge about technology and manufacturing systems

Vsebina:	Content (Syllabus outline):
Osnovni principi in razvoj avtomatizacije obdelovalnih strojev in sistemov v integrirane obdelovalne sisteme. Integracijske metode in standardi za industrijsko avtomatizacijo, stopnje integracije in stopnje produkcije. CNC tehnologija, DNC - direktno numerično programiranje NC strojev in naprav. Lokalne CAD/CAM povezave. Uvajanje integriranih CAD/CAM sistemov in CNC obdelovalnih strojev in naprav. . Računalniško integrirani obdelovalni sistemi (podsistemi in njihove funkcije, pogoji za uspešno izgradnjo in delovanje sistema, potencialne prednosti integracije, integracija na nivoju podjetja). Baze podatkov v integrirani proizvodnji Računalniško zajemanje, spremljanje in analiziranje podatkov o stanju in aktivnostih na posameznih obdelovalnih strojih in napravah, ki so integrirane v	Basic principles and automation development of machine tools and manufacturing systems towards integrated systems. Integration methods and standards for industry automation, levels of integration and levels of production CNC technology, DNC – direct numerical control/programming of NC machine tools and equipments. Local CAD/CAM integration. Introduction of integrated CAD/CAM systems, CNC machine tools and equipments. Computer integrated manufacturing systems (sub-systems and their functions, conditions for successful construction and exploitation of manufacturing systems, potential impacts of integration, integration on manufacturing tool shop level). Data bases in integrated manufacturing Computer aided shop floor data collection (SFDC)

sistem. Integracija koordinatne merilne tehnike (KMM), industrijskih robotov in pomožnih naprav v celovit sistem. Inteligentni obdelovalni sistemi <u>Seminar:</u> Vaje in seminar aplikativno dopolnjujejo vsebino z zahtevnimi praktičnimi primeri izdelave z integriranim CAD/CAM sistemom, direktno povezanim z obdelovalnim sistemom (DNC).	and activity and state analysis of machine tools and equipments, integrated into a system. Integration of coordinate measuring techniques, industrial robots and equipments into a complete integrated system. Intelligent manufacturing systems. <u>Seminar:</u> Tutorials and seminar (project) work supplement lectures with advanced practical solutions of integrated CAD/CAM systems, direct connected to machining system.

Temeljni študijski viri / Textbooks:

- Jože Balič: Manufacturing systems-flexible, integrated and intelligent, DAAAM International, Vienna, 2013
- Jože Balič et all: Moderno proizvodni inženirstvo, priročnik, Grafis Trade, 2010
- Jože Balič, Niko Majdandžič (Ed.), Digital factory, DAAAM International, Vienna, 2008

Balič, Jože. *Računalniška integracija proizvodnje*. Maribor: Fakulteta za strojništvo, 2001
- Balič, Jože. *Contribution to integrated manufacturing*, (DAAAM publishing series, Manufacturing technology). Vienna: DAAAM International, 1999.
- Balič Jože. *Prilagodljivi obdelovalni sistemi*. Maribor: Fakulteta za strojništvo, 2000.

Cilji:	Objectives:
- pridobiti poglobljena znanja s področja napredne računalniške. - posebna znanja s področja računalniške podpore integraciji vseh podsistemov. - vsebina, izgradnja in uporaba integriranih baz podatkov. - razviti sposobnosti študentov za samostojno in kreativno reševanje zahtevnejših problemov CAD/CAM povezav in direktnega prenosa krmilnih podatkov na obdelovalne stroje.	- advanced knowledge about computer integrated manufacturing. - special knowledge on computer aided integration of all sub-systems. - contents, creation and use of integrated data bases - to further develop student's capabilities of independent thinking and creative solutions of advanced CAD/CAM integration and direct connection to machine tools.

Predvideni študijski rezultati:	Intended learning outcomes:
<u>Znanje in razumevanje:</u> **- poglobljeno razumevanje integracije sestavnih elementov v sistem** - razumevanje medsebojnega delovanja posameznih podsistemov - zmožnost samostojnega analiziranja problemov ob uporabi strokovne literature	<u>Knowledge and understanding:</u> - understanding of integration principles of elements into a system - understanding of interaction and relationships between different sub-systems - understanding of skills and procedures and importance of professional literature and computer systems.
<u>Prenesljive/ključne spretnosti in drugi atributi:</u> - znanje snovanja in delovanja integriranih obdelovalnih sistemov - kombinirana uporaba znanj s področja proizvodnih tehnologij in integracijskih metod - praktične izkušnje z delom na integriranem CAD/CAM sistemu in DNC obdelovalnem sistemu.	<u>Transferable/Key skills and other attributes:</u> - knowledge for design and operation of integrated manufacturing system - combined use of knowledge from production technology and integration methods - practical experience with integrated CAD(CAM system and DNC machining center.

Metode poučevanja in učenja:	Teaching and learning methods:
− predavanja − dialog − seminarsko delo v skupini − reševanje domačih nalog − predstavitve študentov	− lectures − dialogue − team seminar work − coursework, − student's presentations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment methods:
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):

– seminarska naloga,	**30 %**	-	seminar (project) work,
– pisni izpit,	**40 %**	-	written examination,
– ustni izpit.	**30 %**	-	oral examination.

Reference nosilca / Lecturer's references:

- Jože Balič: Manufacturing systems-flexible, integrated and intelligent, DAAAM International, Vienna, 2013

- Jože Balič et all: Moderno proizvodni inženirstvo, priročnik, Grafis Trade, 2010

- Jože Balič, Niko Majdandžič (Ed.), Digital factory, DAAAM International, Vienna, 2008

- Balič Jože: Inteligentni obdelovalni sistemi. Maribor: Fakulteta za strojništvo, 2004

  - BALIČ, Jože. *CNC control unit with learning ability for machining centers : United States Patent 7,117,056,2006 : P-200200088.*