UČNI NAČRT PREDMETA/COURSE SYLLABUS	
Predmet:	SKLADIŠČNI SISTEMI IN SKLADIŠČNO POSLOVANJE
Course title:	WAREHOSE SYSTEMS AND WAREHOUSE OPERATION

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
LOGISTIKA SISTEMOV 1. stopnja		2.	4.
SYSTEM LOGISTICS 1st degree		2.	4.

Vrsta predmeta / Course type	OBVEZNI
Univerzitetna koda predmeta / University course code:	UN

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Laboratory work	Druge oblike študija Field work	Samost. delo Individ. work	ECTS
e-P 15 a-P 30		e-V 9 a-V 15	6		105	6

Nosilec predmeta / Lecturer:	TONE LERHER
Jeziki / Languages: Predavanja / Lectures:	SLOVENSKI / SLOVENE
Vaje / Tutorial:	SLOVENSKI / SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisits:
Ni pogojev.	None.

Vsebina:	Content (Syllabus outline):
Razvoj in pomen skladiščnih sistemov v transportno-skladiščni logistični funkciji. Materialni tok – skladišče kot sistem čakalne vrste (zalogovna in pretočna zmogljivost). Operacije skladiščenja – sprejem, naročila, komisioniranje, kontrola, pakiranje, odprema. Upravljanje skladiščnih sistemov – sprejem in odprema, zaloge, lastnosti, oskrba trga. Skladiščna in manipulativna oprema: oprema za uskladiščenje, transporterji, sortirna oprema. Vrste viličarjev – glede na principe delovanja, pogone, zmogljivosti, nosilnosti. Transportni vozički – klasični, avtonomni, zložljivi, montažni – namenski vozički, induktivno vodeni itd. Transportno skladiščne enote – palete, zaboji. Varovanje tovora, varno manipuliranje in varno upravljanje s transportnimi sredstvi. Skladiščne strategije kot podpora skladiščnim procesom (sistem za upravljanje in naročanje transporta, vpeljava ABC sistema pri uskladiščenju blaga. Komisioniranje – načini, sredstva, cone. Oblikovanje skladiščnih sistemov – regalni skladiščni sistemi, konstrukcija skladišč, optimiranje oblike. Potreba in vpeljava zunanjega logističnega servisa -	Development and importance of warehouse systems in the transport-warehouse logistics function. Material flow – warehouse as a queuing system (warehouse volume and throughput capacity). Warehouse operations – receiving, process customer orders, order-picking, checking, packing, put away. Warehouse management systems – receiving and shipping, stock locator system, features, market supply. Storage and handling equipment – storage equipment, transporters, sorting equipment etc. Types of forklifts – due to their working principles, drive motors, carrying capacity, bearing strength. Transportation handcarts – classical, autonomous, folding, assembling – special handcarts, inductive guided etc. Transport unit loads – pallets, boxes etc. Protection of goods and safety manipulating and safety managing with transport devices. Warehouse strategies as a support to the warehousing processes (the system for managing-ordering of transport, the application of ABC system with the storage of goods). Order picking – types, equipment, zones. Design of warehouse systems – storage rack systems, construction of the warehouse, shape optimisation.

"outsourcing".	Need for implementing external logistics service - "outsourcing".

Temeljni literatura in viri / Readings:

- E-gradivo predmeta.
- Lerher, T., Potrč, I. (2017) Transportni sistemi v intralogistiki. Univerza v Mariboru, Fakulteta za logistiko.
- Bartholdi, John J. & Hackman, Steven T. (2017). Warehouse and distribution science, Release 0.98. The Supply Chain & Logistics Institute, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology Atlanta, USA.
- Kay B.M. (2016) Lecture Notes for Production system design, North Carolina State University, USA.
- Gudehus, T. (2012) Logistik 1: Grundlagen, Verfahren und Strategien, Springer Verlag, Berlin.
- Arnold, D. (2002) Handbuch Logistik, Berlin, Springer Verlag, ISBN: 3-540-41996-9, COBISS.SI-ID: 24234757.

Cilji in kompetence:	Objectives and competences:
• se seznanijo s skladiščnimi poslovanjem v različno organiziranih skladiščnih sistemih, • se usposobijo izdelati načrt organizacije poslovanja skladiščnega sistema, • razviti sposobnosti študentov za samostojno in kreativno reševanje problemov dimenzioniranja skladiščnih sistemov.	• to introduce special knowledge for operation of different organized warehouses, • to get knowledge for organisation design and operating rules for the warehousing system, • to further develop student's capabilities of independent and creative solutions of dimensioning the warehouse systems.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: • povezovati uporabo različnih znanj za reševanje problemov skladiščenja in izbire opreme, • aplikacija algoritmov optimiranja skladiščnih sistemov na realne probleme skladiščenja, • poznavanje pojma tehniške logistike, • poznavanje osnovnih konceptov logistične verige, principov delovanja sistemov transporta, projektnih zahtev in sledenje tovora v logističnem sistemu, • povezovanje različnih znanj in postopkov ter pomena uporabe strokovne literature in računalniških sistemov za reševanje logističnih problemov.	Knowledge and Understanding • combined use of different fundamental skills for solution of warehousing and equipment selection, • application of algorithms for storage systems optimization applied on real practical problems, • knowledge of technical logistics conception, • knowledge of fundamental principles of logistics – supply chain, operation principles of transport systems, projects demands and tracking the freight in the logistics system, • connection of different knowledge and procedures and importance of professional literature and computer systems for efficient solutions of logistics problems.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja: pri predavanjih študent spozna teoretične vsebine predmeta. Del predavanj se izvaja na klasični način v predavalnici, del pa v obliki e-predavanj (e-predavanja se lahko izvajajo na videokonferenčni način ali s pomočjo posebej v ta namen didaktično pripravljenih e-gradiv v virtualnem elektronskem učnem okolju). Vaje: pri vajah študent utrdi teoretično znanje in spozna aplikativne možnosti. Del vaj se izvaja na klasični način v predavalnici, del pa v obliki e-vaj (e-vaje se lahko izvajajo na videokonferenčni način ali s pomočjo posebej v ta namen didaktično pripravljenih e-gradiv v virtualnem elektronskem učnem okolju).	Lectures: students understand the theoretical frameworks of the course. Part of the lecture course is in a classroom while the rest is in the form of e-learning (e-lectures may be given via video-conferencing or with the help of specially designed e-material in a virtual electronic learning environment). Tutorials: Students enhance their theoretical knowledge and are able to apply it. Part of the tutorial is in a classroom while the rest is in the form of e-tutorials (e-tutorials may be given via video-conferencing or with the help of specially designed e-material in a virtual electronic learning environment).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
▪ Opravljene obveznosti e-predavanj in e-vaj so pogoj za pristop k izpitu .		▪ Successful completion of e-lectures and e-tutorials is a prerequisite for entering the exam.
▪ Pisni izpit.	50%	▪ Written exam.
▪ Ustni izpit.	50%	▪ Oral exam.

Reference nosilca / Lecturer's references:

1. Lerher, T., Borovinšek, M., Ficko, M., Palčič, I. (2017). Parametric study of throughput performance in SBS/RS based on simulation. International journal of simulation modelling, Vol. 16, No. 1, 96-107, doi: 10.2507/IJSIMM16(1)8.372.
2. Lerher, T., Ekren, B. Y., Sari, Z., Rosi. B. (2016). Method for evaluating the throughput performance of shuttle based storage and retrieval systems. Technical Gazette, Vol. 23, No. 3, 715-723.
3. Lerher, T., Ekren, B. Y., Sari, Z., Rosi. B. (2015). Simulation Analysis of Shuttle Based Storage and Retrieval Systems. International Journal of Simulation Modelling, Vol. 14, No. 1, 48-59. doi: 10.2507/IJSIMM14(1)5.281.
4. LERHER, Tone, EDL, Milan, ROSI, Bojan. Energy efficiency model for the mini-load automated storage and retrieval systems. Int. j. adv. manuf. technol., August 2013, doi: 10.1007/s00170-013-5253-x.
5. LERHER, Tone, ŠRAML, Matjaž, POTRČ, Iztok. Simulation analysis of mini-load multi-shuttle automated storage and retrieval systems. Int. j. adv. manuf. technol., 2011, vol. 54, no. 1/4, str. 337-348, doi: 10.1007/s00170-010-2916-8.
6. LERHER, Tone, POTRČ, Iztok, ŠRAML, Matjaž, TOLLAZZI, Tomaž. Travel time models for automated warehouses with aisle transferring storage and retrieval machine. Eur. J. oper. res.. [Print ed.], Sep. 2010, vol. 205, iss. 3, str. 571-583, doi: 10.1016/j.ejor.2010.01.025.
7. LERHER, Tone, ŠRAML, Matjaž, POTRČ, Iztok, TOLLAZZI, Tomaž. Travel time models for double-deep automated storage and retrieval systems. Int. J. Prod. Res., June 2010, vol. 48, no. 11, str. 3151-3172, doi: 10.1080/00207540902796008.