UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Ime predmeta:	TRANSPORT IN SKLADIŠČENJE
Course title:	TRANSPORTATION AND WAREHOUSING

Študijski program in stopnja Study programme and cycle	Študijska smer Study option	Letnik Year of study	Semester Semester
LOGISTIKA SISTEMOV 2. stopnja		2.	3.
SYSTEM LOGISTICS 2nd degree		2.	3.

Vrsta predmeta (obvezni ali izbirni) / Course type (compulsory or elective)	IZBIRNI ELECTIVE
Univerzitetna koda predmeta / University course code:	MAG

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Clinical training	Druge oblike študija Other forms of study	Samost. delo Individual work	ECTS
6 e-P 15 a-P		9 e-V 15 a-V			135	6

Nosilec predmeta / Course coordinator:	**TONE LERHER IN DARJA TOPOLŠEK**
Jeziki /Languages: **Predavanja / Lectures:**	SLOVENSKI/SLOVENE
Vaje / Tutorial:	SLOVENSKI/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites for enrolling in the course or for performing study obligations:**
Ni pogojev.	None.

Vsebina (kratek pregled učnega načrta):	**Content (syllabus outline):**
Stroški skladišča.	Warehouse costs.
Zdravstveni in varnostni program.	Health and safety programme.
Skladiščni sistemi.	Storage systems.
Skladiščna tehnologija.	Technology in warehousing.
Skladiščne operacije.	Warehouse operations.
Komisioniranje.	Order Picking.
Upravljanje s tveganji v skladišču.	Risk management in warehouse.
Sistem upravljanja skladišča (WMS).	Warehouse management system (WMS).
Način transporta.	Transport mode.
Odločitve izbire modalite.	Choices of modalities.
Sporazumi o dobavitelju transporta.	Transport supplier agreements.
Načrtovanje transporta.	Transport scheduling.
Distribucijsko omrežje.	Distribution network.
Sistemi upravljanja transporta (TMS).	Transport management systems (TMS).
Organizacija transporta in poti.	Organization of transport and routes.
Transportno logistični terminali.	Transport logistics terminals.

Pametna mobilnost/Trajnostni transport. V okviru vaj študent: Izboljšuje vhodni tok blaga. Izbere primerne sisteme za skladiščenja blaga. Izvaja program 5S v okolju skladišča. Določa ključne kazalnike uspešnosti (KPI) in izvaja aktivnosti za izboljšanje operacij skladiščenja. Razume in izvaja ustrezne tehnologije na področju skladiščenja. Izvaja sistem upravljanja skladišča (WMS). Optimira izbiro načina transporta. Ocenjuje tovorni trg in izbere ustrezne prevoznike. Optimira razpored transporta. Izbere ponudnike logističnih storitev. Oblikuje distribucijsko omrežje. Določa kazalnike uspešnosti (KPI) in izvaja aktivnosti za izboljšanje transporta. Izbira in uporablja različne sisteme za upravljanje transporta (TMS).	Smart mobility/green transport logistics. At tutorials: Improves receipt of goods from suppliers. Selects appropriate storage systems. Implements a 5S programme in warehouse environment. Defines and implements Key Performance Indicators (KPIs) to improve warehouse operations. Understands and implements appropriate technology in warehousing. Selects and implements a warehouse management system (WMS). Optimizes transport mode selection. Evaluates freight market and selects appropriate carriers. Optimises transport scheduling. Selects logistics service providers. Designs a distribution network. Defines and implements Key Performance Indicators (KPIs) to improve transportation. Selects and Implements a transport management systems (TMS).

Temeljni literatura in viri / Reading materials:

E-gradivo predmeta./E-learning materials.

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, Michael G. (2016). Production system design. Department of Industrial and Systems Engineering, North Carolina State University, USA.

Lerher, T. & Šraml, M. (2012) Designing unit load automated storage and retrieval systems. V: MANZINI, Riccardo (editor). Warehousing in the global supply chain : advanced models, tools and applications for storage systems. London [etc.]: Springer. 2012, pp. 211-231.

Lerher, T. (2016). Throughput and Energy Related Performance Calculations for Shuttle Based Storage and Retrieval Systems. Nova Science Publishers, USA.

Lerher, T., Potrč, I. (2017) Transportni sistemi v intralogistiki. Univerza v Mariboru, Fakulteta za logistiko.

Topolšek, Cvahte Ojsteršek (2016). Transportna logistika [Elektronski vir] : e-gradivo. Celje : Fakulteta za logistiko, 2016, COBISS.SI-ID: 512938045.

Stroh, M.B. (2006). A Practical Guide to Transportation and Logistics, Logistics Network. Dumont.

Committee for the Surface Transportation Environmental Cooperative Research Program Advisory Board, Transportation Research Board, National Research Council (2002). Surface transportation environmental research: a long-term strategy. Washington, D.C. : Transportation Research Board.

Journal of transportation. Atlanta, GA : NewsRX, 2008.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Predstavitev metod in tehnik upravljanja skladišč. • Izboljšanje znanja na področju optimizacije transporta.	Learning objectives: • Presenting methods and techniques in warehouse management. • Improving skills in transport optimizing.

- Predstavitev informacijskih sistemov na področju skladiščenja in transporta.
- Izboljšanje znanja in spretnosti na področju poslovnih prevozov in gospodarskih vplivov.
- Izboljšanje znanja in spretnosti na področju fizičnih, tehnoloških, procesnih in varnostnih vidikov skladiščnega/distribucijskega poslovanja.

Kompetence:
- Študent je sposoben izboljšati logistične procese na področju transporta in skladiščenja.
- Študent je sposoben pridobiti informacije, ki vplivajo na procese transporta in skladiščenja.
- Študent ima ustrezen odnos do dela in sodelavcev.
- Študent je sposoben vključevati inovacije v transportne operacije.

- Presenting IT systems in warehousing and transportation.
- Improving skills and knowledge in the field of business transportation and its economic impacts.
- Improving skills and knowledge in the fields of physical, technological, process and safety considerations of warehouse/distribution operations.

Competences:
- Student is able to improve logistics processes in area of transportation and warehousing.
- Student can select important information which has an influence on transport and warehouse processes.
- Student has an impeccable attitude to work and coworkers.
- Student can include innovations in transportation operations.

Predvideni študijski rezultati:

Znanje in razumevanje:
- Študent ima znanje o metodah in tehnikah, ki se uporabljajo pri upravljanju skladišč in transporta.
- Študent pozna cilje upravljanja skladišč in transporta.
- Študent pozna strukture odločanja, ki se uporabljajo pri upravljanju skladišč in transporta.
- Študent razume vlogo zasebnih voznih parkov, špediterjev in posrednikov.
- Študent razume vlogo IT v transportnih operacijah.
- Študent razume temeljne vidike mednarodnega transporta.
- Študent razume izbirne in transportne postopke ter opremo za ravnanje z materiali.

Prenesljive/ključne spretnosti in drugi atributi:
- Študent zna izboljšati transportne in skladiščne procese z uporabo informacijskih sistemov.
- Študent zna oceniti učinkovitost različnih odločitev na področju transporta in skladiščenja.
- Študent zna uporabiti standarde za reševanje logističnih izzivov na področju transporta in skladiščenja.

Intended learning outcomes:

Knowledge and Understanding:
- Student has a knowledge about methods and techniques used in warehouse and transport management.
- Student knows the main aims of warehouse and transport management.
- Student knows a decision structures used in warehouse and transport management.
- Student understands the role of private fleets, freight forwarders and brokers.
- Student understands the role of IT in the transportation operations.
- Student understands the basics of international transportation considerations.
- Student understands picking and shipping processes and material handling equipment.

Transferable/Key Skills and other attributes:
- Student is able to improve transport and warehousing processes with using IT systems.
- Student is able to assess effectiveness of different decisions variants in area of transportation and warehousing.
- Student can use standards to solve logistics problems in area of transportation and warehousing.

• Študent je sposoben prepoznati edinstvene značilnosti, prednosti in slabosti različnih načinov transporta. • Študent je sposoben opisati stroške in narediti cenovno obravnavo različnih možnosti transporta. • Študent razume kazalnike za merjenje kakovosti in učinkovitosti transportnih storitev. • Študent zna razložiti reprezentativne tehnike skladiščenja in tehnik manipuliranja, meritve uspešnosti in vlogo distribucijskih operacij. • Študent zna identificirati ključne operacije znotraj skladišča in njihove odnose. • Študent zna identificirati in razložiti različne modele obratovanja/lastništva skladišč.	• Student is able to identify the unique features, advantages and disadvantages of the various modes of transport. • Student is able to describe the cost and pricing consideration of various transportation options. • Student demonstrates metrics to measure transportation service quality and efficiency. • Student explains the facility configuration consideration, representative storage and handing techniques, performance metrics, and the role of distribution operations. • Student is able to identify key operations within a warehouse and their relations. • Student is able to identify and explain the different warehouse operating/ownership models.

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 seminar is in a classroom while the rest is in the form of e-learning (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 %) / Share (in %)	**Assessment methods:**
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.
• Opravljen seminar.	30%	• Coursework.
• Pisni izpit.	40%	• Written examination.
• Ustni izpit.	30%	• Oral examination.

Reference nosilca / Course coordinator's references:

1. Lerher, T. (2018). Aisle changing shuttle carriers in autonomous vehicle storage and retrieval systems. International Journal of Production Research, Vol. 56, Iss. 11, 3859-3879, doi: 10.1080/00207543.2018.1467060.
2. 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.

3. 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, https://doi.org/10.17559/TV-20141022121007.
4. Topolšek, D., Čižiuniene, K., Cvahte Ojsteršek, T. (2018). Defining transport logistics : a literature review and practitioner opinion based approach. Transport, Vol. 33, Iss. 5, 1196-1203, doi: doi.org/10.3846/transport.2018.6965.
5. Topolšek, D., Dragan, D. (2018). Relationships between the motorcyclists' behavioural perception and their actual behaviour. Transport, no. 1, Vol. 33, 151-164. doi: 10.3846/16484142.2016.1141371.