Syllabus
of the elective component

Traffic Flows Modeling

Discipline	**Traffic Flows Modeling**
Higher education level	**second (master's degree)**
Moodle course web-page	*https://dl.khadi.kharkov.ua/course/view.php?id=2814*
Educational component volume	**4 credits (120 hours)**
Final control form	**test**
Consultations	**according to the schedule**
Department	**Transport Systems and Logistics Department**
Language of teaching	**English**
Course leader	**Kolii Oleksandr, PhD, Associate Professor**
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Educational Component Summary
The purpose is to train specialists to independently solve problems related to the simulation of transport systems functioning in the field of traffic flows management with different levels of detailing.
The subject is the academic discipline study as an adapted system of concepts regarding methods and approaches to the micro- and macro-simulation of transport systems, a system of indicators to evaluate the results of transport systems functioning and the background to conduct their further experimental researches.
The main tasks of studying the academic discipline are mastering the main approaches, models and software products in the field of the micro- and macro-simulation of transport systems and being able to evaluate the consequences of their operation.

Prerequisites for studying the educational component:
Higher mathematics, Probability theory and mathematical statistics, Research of operations in transport systems, Fundamentals of systems theory and management, Modelling of transport systems.

Competencies acquired by the applicants:

General competencies:
Skills to use information and communication technologies.
Ability to conduct research at an appropriate level.
Ability to generate new ideas (creativity).
Desire to save the environment.
Ability to work independently and in a team.
Ability to abstract thinking, analysis and synthesis.
Ability to communicate in the national language both orally and in writing.
Ability to communicate in a foreign language.
Knowledge and understanding of the subject area and professional activity

Special (professional) competencies:
Ability to analyze and forecast the parameters and indicators of the functioning of transport systems and technologies taking into account the influence of the external environment.
Ability to implement traffic flows operational management.

Ability to evaluate operational, technical and economic, technological, legal, social and environmental components of transportation organizations.

Ability to use modern information technologies, automated control systems and geo-information systems when organizing the transportation process.

Ability to consider the human factor in transport technologies.

Training results:

Search for the necessary information in scientific and technical literature, databases, other sources, analyze and objectively evaluate information in the field of transport systems and technologies and related interdisciplinary problems.

Develop new and improve existing transport systems and technologies, determine development goals, existing limitations, performance criteria and areas of use.

Develop and analyze graphic, mathematical and computer models of transport systems and technologies.

Use special software to analyze, develop and improve transport systems and technologies.

Тематичний план

Theme №	Theme (L, PW, SEW)	Hours	
		full-time training	part-time training
1	L. Existing approaches and levels of traffic flow analysis.	2	
	PW. Processing of live video surveillance of traffic flows.	2	2
	SEW. Methods, means and legal bases of traffic organization.	20	25
2	L. Micro modeling of traffic flows.	4	2
	PW. Determination of traffic light cycle time	2	2
	SEW. Technical means of traffic regulation. General characteristics of technical means of traffic management.	20	25
3	L. Measures of the road traffic management and safety	2	2
	PW. Simulation of transport traffic at a controlled intersection.	4	
	SEW. Dislocation, characteristics and methods of installation of road signs.	18	20
4	L. Probability distributions in the traffic flows modeling.	4	2
	PW. Analysis of the efficiency of the intersection before and after the implementation of the developed traffic light cycles	4	
	SEW. Assessment of the ease of movement in the traffic flow.	15	20
5	L. Application of the theory of queuing systems in traffic flows simulation.	4	
	PW Simulation of the public pool transportation.	4	
	SEW. Dislocation, characteristics and methods of applying road markings.	15	20
Total		**120**	**120**

Individual educational and research task: not provided

Teaching methods:

1) verbal:

1.1 traditional: lectures, explanations, stories, etc.;

1.2 interactive: discussions;
2) visual: illustration method, demonstration method;
3) practical (traditional): practical classes.

Evaluation system and requirements:

Ongoing achievements
1 The applicants' ongoing achievement in the performance of the both educational activities and self-education work while training is evaluated using a four-point scale with the further conversion into the 100-point scale. While evaluating all kinds of works provided by the educational program are taken into account.
1.1 Lectures are evaluated by determining the quality of specific tasks performance.
1.2 Practical classes are evaluated by the quality of performance of the tests or individual tasks, execution and design of the report on practical works.
2 The final evaluation of the discipline is determined as a sum of points on:
- passed standard tests, verbal questioning, attendance and communication activity level;
- in-class practical tasks execution and theoretical preparation.

Applicants' evaluation score scale according to the ongoing control is given in table1.

Table 1 – Points distribution under the themes defining a final test score according to the discipline ongoing assessment

Ongoing assessment					Discipline total score
Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	100
20	20	20	20	20	

Final estimation
1 The final test score is got by the applicant at the last double-lesson according to the discipline ongoing assessment. The condition to pass the test is not less than 60 points score.
2 Higher education applicants who have an ongoing assessment score less than 60 points can increase it at the last class by taking a combination of written and oral tests that comprise both answering 2 professionally-oriented question and a problem solution with further commenting the work done or standard tests. The applicants who made the tasks previewed by the practical classes are allowed to pass the final test.
3 Extra-points are awarded to the applicants for participation in scientific events.
3.1 Extra-points are added to the achieved sum of points by the higher education applicant for the current educational activity.
3.2 The number of extra-points awarded for different types of individual tasks depends on their volume and importance:
– discipline prize-winning places on the at the international / all-ukrainian competition of scientific students' works – 20 points;
– discipline prize-winning places at all-Ukrainian olympiads – 20 points;
– participation in the international / all-Ukrainian competition of scientific students' works – 15 points
– participation in international / all-Ukrainian scientific conferences of students and young scientists – 12 points;
– participation in all-Ukrainian discipline competitions – 10 points
– participation in KhNAHU discipline competitions and scientific conferences – 5 points;
– implementation of individual scientific and research (educational and research) tasks of increased complexity – 5 points.
3.3 The number of extra points might not exceed 20 points.

4 The result of the study is evaluated on a two-point scale (passed/failed) according to table 2. The total score comprising the extra-points might not exceed 100 points.

Table 2 – Conversion of the score into national evaluation system

According to 100-point scale	According to the national scale
between 60 scores and 100 scores	Passed
Less than 60 scores	Failed

Recognition of non-formal and informal training results

The procedure for the recognition of training results obtained in non-formal and informal education is regulated by СТВНЗ-83.1-01:2021 «Визнання результатів неформальної та інформальної освіти».

To recognise these results, an applicant should submit an application to the dean of the faculty and attach certificates and other documents confirming the competencies obtained. Based on the results of the application consideration, a subject-specific commission is established to review the submitted documents, interview the applicant and decide on the re-crediting of training results or the appointment of certification in the form of a final control (10 working days are given for preparation). Based on the results of the control, the commission assigns a final grade. If the applicant receives less than 60 points, the results of non-formal or informal education are not credited. When re-crediting training results in a discipline, the applicant is exempt from studying it.

Course policy:

– the course involves working in the team, the environment in the audience is friendly, creative, open to constructive criticism;

–the discipline requires mandatory attendance of lectures and practical classes, as well as self-education work;

– self-education work involves studying certain discipline themes, which are submitted in accordance with the program for self-education work, or have been considered briefly;

– all the tasks provided by the program must be completed within the prescribed time-frame;

– if the higher education applicant is absent for valid reasons, he/she passes the completed tasks during the self-education work and consultations provided by the teacher;

– while studying the course, higher education applicants should follow the rules of academic integrity set out in such documents: «Rules of academic integrity of participants of the KhNAHU Education process» (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), «Academic integrity. The text check of academic, scientific and qualification works for the plagiarism» (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), «Moral and ethical code of participants of the KhNAHU educational process» (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).

– in case of detecting the plagiarism, the applicant receives 0 points for the task and must retake the tasks provided in the syllabus;

– cheating during control works and examinations is prohibited (including mobile devices). Mobile devices are only allowed to be used during online testing.

Recommended literature:

1. Antoniou C. Demand for Emerging Transportation Systems: Modeling Adoption, Satisfaction, and Mobility Patterns / C. Antoniou, D. Efthymiou, E. Chaniotakis. Elsevier, 2020. — 287 p.

2. Cantarella G. Dynamics and Stochasticity in Transportation Systems: Tools for Transportation Network Modelling / Elsevier, 2020. — 345 p.

3. Раціональне розташування зупиночних пунктів автобусних та тролейбусних маршрутів відносно регульованих перехресть : монографія / П.Ф. Горбачев, О.В. Макарічев, О.С. Колій. – Харків: Видавництво ХНАДУ, 2018. – 131 с.
4. Chow J. Informed Urban Transport Systems: Classic and Emerging Applied Sciences in a Smart Cities Era / Elsevier, 2018. — 473 p.
5. VISUM 21.0 User Manual [Електронний ресурс]. – 80 min / 700 MB. – 2021. – 1 електрон. опт. диск (CD-ROM) ; 12 см. – Систем. вимоги: Pentium; 32 Mb RAM; CD-ROM Windows 98/2000/NT/XP. – Назва з контейнера.

Additional sources:

1. Ortuzar J. de D. Modelling transport. Third edition / J. de D. Ortuzar, L. G. Willumsen. – John Wiley & Sons Ltd. 2006. – 499 p.
2. Council of Supply Chain Management Professionals [Електрон-ний ресурс] / Official web-site. – Режим доступу : \WWW/ URL: http://cscmp.org/.
3. Верховна Рада України [Електронний ресурс] / Офіційний веб-портал. – Режим доступу : http://rada.gov.ua/.
4. Papageorgiou, M., & Kotsialos, A. Traffic Flow Modeling: Introduction. Springer Science & Business Media, 2013. - 368 p.
5. Daganzo, C. F. Traffic Flow Theory and Applications. Springer International Publishing, 2018. – 403 p.
6. Treiber, M., Kesting, A., & Helbing, D. Traffic Flow Dynamics: Data, Models and Simulation. Springer Berlin Heidelberg, 2013. - 490 p.
7. Knoop, V. L. Macroscopic Traffic Flow Modelling and Control: Fundamentals and Simulation. Springer International Publishing, 2018. – 275 p.
8. Elefteriadou, L., & Zhou, H. Handbook of Advanced Traffic Flow Modeling. Springer International Publishing, 2019. – 728 p.
9. Zeng, Q., & Zhou, J. Traffic Flow Modeling for Sustainable Transportation Systems. Springer International Publishing, 2018. – 287 p.
10. Wu, Y., Wu, Y., & Xu, Y. Traffic Flow Modeling for Smart Cities: State of the Art and Future Research Directions. Springer International Publishing, 2019. - 333 p.

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