STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Systems safety and reliability		**1010615231010620356**
Field of study: **Transport**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **2 / 3**
Elective path/specialty: **Road Transport**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **part-time**	
No. of hours: Lecture: **10** Classes: **6** Laboratory: **-** Project/seminars: **-**		No. of credits: **4**
Status of the course in the study program (Basic, major, other): **(brak)**	(university-wide, from another field): **(brak)**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **4 100%** **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student understands the notion of a system. Student has basic knowledge in probability calculus and mathematical statistics. Student has basic knowledge relating to reliability of technical facilities.
2	**Skills**	Student can use basic models relating to probability calculus and mathematical statistics. Student can apply elementary reliability models of technical facilities. Student has fluent skills in computer office software.
3	**Social competencies**	Student understands and accepts that it is necessary to introduce appropriate social, industrial and transport system limitations that improve functioning of the systems. Student can manage his/her own time dedicated to performance of indicated tasks.

Assumptions and objectives of the course:

Learning about elementary and advanced methods, processes, procedures and models relating to problems of reliability and safety of systems and learning the skills to apply them.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows definitions of key terms connected with reliability of technical facilities and systems - [K2A_W16]
2. Student knows elementary and some advanced reliability and reliability-cost models of technical facilities and systems in transport - [K2A_W16, K2A_W11]
3. Student knows how to create some reliability simulation and optimization models of transport systems - [K2A_W16, K2A_W11]
4. Student knows definition of terms connected with safety of systems and hazard risk management - [K2A_W16]
5. Student knows and understands ideas and conditions of processes of system safety management and hazard risk management generated in the same. - [K2A_W16]
6. Student knows and understands hazard identification process procedures, knows the most frequently used risk assessment methods and knows how to use the methods in order to estimate and value the risk of hazards and knows hazard risk response procedures. - [K2A_W16]

Skills:

1. Student uses correct terms relating to system reliability and safety - [K2A_U01, K2A_U02]

2. Student can apply and present elementary and some advanced reliability and reliability- cost models of facilities and technical systems in transport - [K2A_U05, K2A_U07, K2A_U10, K2A_U18]

3. Student can use examples of reliability simulation and optimization models of transport systems. - [K2A_U07, K2A_U10, K2A_U18]

4. Student can identify hazards in areas of analyses connected with technical systems in transport and can estimate and value the risk of identified hazards, Student can use appropriate means for the purposes of response to the risk of identified hazards. - [K2A_U08, K2A_U11]

5. Student can edit reports with results of management procedures of the risk of identified hazards in selected areas of analyses - [K2A_U08, K2A_U11, K2A_U17]

Social competencies:

1. Student is aware of the need to build a compromise between reliability and safety of systems and costs of functioning of the same. - [K2A_K06, K2A_K08]

2. Student is aware that a way to improve safety of technical facility systems goes through the application of safety management systems and implementation of appropriate safety policies - [K2A_K02, K2A_K08]

3. Student improves systemic thinking skills - [K2A_K07]

Assessment methods of study outcomes

Lecture: a written examination.

Practical classes: credit based on written tests.

Course description

Technical facilities and their systems as objects of reliability assessments. A repertory of elementary reliability models of facilities and systems. Prognostic models of damage and replacements of non-renewable transport facilities. Advanced elements of structural reliability. A general formula of reliability and its application for determination of reliability of systems with simple and complex reliability structures. Reliability models of renewed facilities with zero time of renewal. Estimating a demand for spare parts for transport systems. A policy of renewal of resources of spare parts in transport systems. Reliability of transport means dedicated to realization of random quantities of transport tasks according to the cost and reliability-cost criteria. Optimization of the quantity of transport means in systems dedicated to realization of transport tasks. Simulation modeling in reliability assessments of transport means systems. Practice in the application of methods, processes, procedures and models connected with reliability of systems.

Safety management systems in transport systems. Risk management as a tool of safety policy in safety management systems in transport ? the TRANS-RISK method. The integrated method of hazard risk management in transport. Identification of hazards in transport. Estimating and valuation of the risk of hazards. Conduct under a risk of hazards ? safety systems. Implementations of elements of the TRANS-RISK method for risk management in the transport sector. Problems of risk management in corporations. The notion, legal conditions, risk assessments and responses to a workstation risk of hazards. The Machine Directive problems ? purpose and basic principles. Summary of system safety problems. Practice in application of methods, processes, procedures and models connected with system safety.

Basic bibliography:

1. Bobrowski D., Modele i metody matematyczne teorii niezawodności w przykładach i zadaniach, WNT, Warszawa, 1985.

2. Chrószcz B., Hansel J., Analiza i ocena ryzyka zawodowego. Wydawnictwa AGH, Rozprawy doktorskie, Monografie, Kraków, 2011.

3. Dyrektywa 2006/42/WE Parlamentu Europejskiego i Rady z dnia 17 maja 2006 r. w sprawie maszyn. Dziennik Urzędowy Unii Europejskiej, 9.6.2006.

4. Inżynieria niezawodności, Por. pod red. J. Migdalskiego, Wyd. ATR Bydgoszcz i Ośr. Badań Jakości Wyr. "ZETOM", Warszawa, 1992.

5. Jaźwiński J., Ważyńska-Fiok K., Niezawodność systemów technicznych. Wyd. Naukowe PWN, Warszawa, 1990.

6. Kadziński A., Niezawodność i bezpieczeństwo systemów. E-skrypt Politechniki Poznańskiej, 2012, niepublikowane.

7. Karpiński J., Korczak E., Metody oceny niezawodności dwustanowych systemów technicznych. Wyd. Omnitech Press, Instytut Badań Systemowych, Warszawa, 1990.

8. Migdalski J., Podstawy strukturalnej teorii niezawodności. Skrypt Politechniki Świętokrzyskiej, Kielce, 1978.

9. Niziński S., Eksploatacja obiektów technicznych. Wydawnictwo Naukowe Instytutu Technologii Eksploatacji - PIB, Warszawa - Sulejówek - Olsztyn - Radom, 2002.

10. Szopa T., Niezawodność i bezpieczeństwo. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2009.

11. Szymanek A., Bezpieczeństwo i ryzyko w technice. Wyd. Politechniki Radomskiej, Radom, 2006.

12. Zintegrowany System Bezpieczeństwa Transportu. I, II i III tom. Prace zbiorowe - red. R. Krystek, Politechnika Gdańska, WKŁ, I i II tom - Warszawa 2009, III tom - Warszawa 2010.

Additional bibliography:

1. Bryła R., Bezpieczeństwo i higiena pracy. Wyd. ELAMED, Katowice, 2011.
2. Gucma L., Wytyczne do zarządzania ryzykiem morskim. Wyd. Naukowe Akademii Morskiej, Szczecin, 2009.
3. Jamroz K., Metoda zarządzania ryzykiem w inżynierii drogowej. Wyd. Politechniki Gdańskiej, Gdańsk, 2011.
4. Kaczmarek T.T., Ryzyko i zarządzanie ryzykiem. Ujęcie interdyscyplinarne. Wyd. Difin, Warszawa, 2006.
5. Klich E., Bezpieczeństwo lotów. Wydawnictwo Naukowe Instytutu Technologii Eksploatacji ? PIB, Radom, 2011.
6. Markowski A.S. (red.), Zapobieganie stratom w przemyśle, część 3, Zarządzanie bezpieczeństwem procesowym, Wyd. Politechniki Łódzkiej, Łódź, 2000.
7. Pihowicz W., Inżynieria bezpieczeństwa technicznego, Wydawnictwa Naukowo - Techniczne, Warszawa, 2008.
8. PN-N-18002:2011, Systemy zarządzania bezpieczeństwem i higieną pracy. Ogólne wytyczne do oceny ryzyka zawodowego.
9. Zarządzanie ryzykiem korporacyjnym - zintegrowana struktura ramowa. Tom I. COSO II - The Committee of Sponsoring Organizations of the Treadway Commission. Wyd. polskie Polski Instytut Kontroli Wewnętrznej, Warszawa, 2004.
10. Zintegrowany System Bezpieczeństwem Transportu. Synteza. Praca zbiorowa - red. R. Krystek, Politechnika Gdańska, WKŁ, Warszawa, 2010.
11. Żółtowski J., Wybrane zagadnienia z podstaw konstrukcji i niezawodności maszyn. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2004.

Result of average student's workload

Activity	Time (working hours)
1. Preparation to the lecture	6
2. Participation in the lecture	30
3. Consolidation of the lecture content	6
4. Consultation about the lecture	2
5. Preparation to the exam	20
6. Participation in the exam	2
7. Preparation to the classes	6
8. Participation in the classes	30
9. Consolidation of the classes content	6
10. Consultation about the classes	1

Student’s workload

Source of workload	hours	ECTS
Total workload	109	4
Contact hours	65	3
Practical activities	0	0