VILNIUS GEDIMINAS TECHNICAL UNIVERSITY STUDY MODULE CARD

Department of Environment Protection and Water Engineering

A dalis

Modulio pavadinimas
Aplinkos procesų matematinis modeliavimas

Module title
Mathematical Modelling of Environmental Processes

Modulio grupė	Studijų dalyko
Modulio blokas	Mokslo krypties doktorantūros komiteto nustatyti dalykai
Priklausomybė	Katedros

Mokslo krypties ir srities kodas		**Studijos**
T 004	**T 000**	**Doktorantūros**

Module code

Faculty	Department	B, A, M, I, D	Module No.*
A P	A V	D	24001

* modulio registracijos numeris katedroje

Credits

Total	Iš jų: KD, KS, KP
9	0

Form of evaluation

Į, E1, E2, E, BE, BD, TD, A	KD, KS, KP
E	

Studijų forma		Paskaitoms	Lab. darbams	Pratyboms	Aud. darbui	Sav. darbui	Iš viso
Nuolatinės studijos	F	64	64	0	128	112	240
Ištęstinės studijos	I						

Modulio tikslas

Suteikti žinias apie įvairius aplinkos procesus, tarpusavio ryšius bei matematinio modeliavimo taikymą jų neapibrėžtumams spręsti.

Aim of module

To provide knowledge about various environmental processes and their interrelationships, and to enhance mathematical modeling skills for addressing uncertainties.

Suteikiamos žinios ir gebėjimai

Suteikiamos matematinio modeliavimo žinios apie gamtos tvermės dėsnius, pernašos procesų lygtis atmosferoje, hidrosferoje, geosferoje, apie analitinius, skaitinius jų sprendimo būdus, bei įgūdžiai sudaryti matematinius modelius bei juos spręsti analizuojant gaunamus rezultatus.

Provided knowledge and skills

Knowledge is provided on the laws of natural phenomena, transport processes equations in the atmosphere, hydrosphere, geosphere, analytical and numerical solution methods, as well as skills to formulate mathematical models and solve them by analyzing the obtained results.

Modulio anotacija

Studijų dalyke įgyjamos žinios apie matematinio modeliavimo sąvokas, modeliavimo lygius, analizinius pernašos lygčių sprendinius, diferencialinių lygčių sprendimo būdus, pernašos procesų lygtis, bangų sklidimo modeliavimą, kompiuterinės programas bei rezultatų galutinį apibendrinimą.

Module annotation

In the course, knowledge is acquired about mathematical modeling concepts, modeling levels, analytical solutions of transport equations, methods for solving differential equations, transport process equations, wave propagation modeling, computer programs, and the final synthesis of results.

Literature (author, title of publication, publisher, year)

1. John Wainwright and Mark Mulligan. "Environmental Modelling: Finding Simplicity in Complexity" (2019)
2. Andrew Ford. "Mathematical Modelling of Environmental and Ecological Systems" (2018)
3. Isam W. Kaysi and Aziz Y. Elmahi. "Mathematical Models of Environmental Problems" (2016)
4. Keith Beven and Jim Hall. "Environmental Modelling: An Uncertain Future?" (2019)
5. Rudy Slingerland and Lee Kump. "Mathematical Modeling of Earth's Dynamical Systems: A Primer" (2019)
6. John Wainwright and Mark Mulligan. "Introduction to Environmental Modelling" (2019)
7. S.E. Jorgensen. "Mathematical Modelling in Environmental Management" (2019)
8. William E. Grant. "Environmental Modeling: A Practical Introduction" (2017)
9. Alkarkhi, A. F. M., Alqaraghuli, W. A. A. Applied statistics for environmental science with R. Elsevier. (2019)

IT resursai:

6. ArcGIS, licencijos tipas Mokama, akademinė
5. Bentley system, licencijos tipas Mokama, akademinė
4. Autocad, licencijos tipas Mokama, akademinė
3. SolidWorks, licencijos tipas Mokama, akademinė
2. Comsol Multiphysics, licencijos tipas Mokama, akademinė
1. Ansys, licencijos tipas Mokama, akademinė

Užduoties pavadinimas	Sav. darbo apimtis vienai užduočiai					Užduočių skaičius				Iš viso valandų			
	Rėžis	Priimta				NL(S)	I(S)	I(T)	NL(T)	NL(S)	I(S)	I(T)	NL(T)
		NL(S)	I(S)	I(T)	NL(T)								
Namų darbas	4-24	20				1				20			
Pasirengimas atsiskaitymui	16-40	52				1				52			

Savarankiško darbo grafikas

Užduoties tipas			užduoties pateikimo(*) ir atssikaitymo(+) savaitė																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuolatinė	Namų darbas	*	1																			
		+																		1		

Modulio sudarytojai (vardas,pavardė)
Raimondas Grubliauskas
Saulius Vasarevičius

Module examiners (name, surname):
Raimondas Grubliauskas
Saulius Vasarevičius

Katedros vedėjas (vardas, pavardė):
Aušra Zigmontienė

Doktorantūros komisijos nutarimas

1. Modulis atestuojamas
2. Modulis skirtas mokslo krypčiai: **Aplinkos inžinerija**
3. Modulio atestacija galioja: nuo 2024-05-28 iki 2029-05-28

Modulį atestavo
Mokslo krypties doktorantūros komisijos pirmininkas (vardas, pavardė)

Saulius Vasarevičius Data 2024-06-26

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY STUDY MODULE CARD

Aplinkos apsaugos ir vandens inžinerijos katedra

B dalis

Modulio pavadinimas
Aplinkos procesų matematinis modeliavimas

Module title
Mathematical Modelling of Environmental Processes

Modulio kodas						**Kreditai**		**Atsiskaitymo forma**	
Fakultetas		Katedra		B, A, M, I, D	Modulio Nr.*	Iš viso:	Iš jų: KD, KS, KP	Į, E1, E2, E, BE, BD, TD, A	KD, KS, KP
A	P	A	V	D	24001	9	0	E	

* modulio registracijos numeris katedroje

Studijų forma		Paskaitoms	Lab. darbams	Pratyboms	Aud. darbui	Sav. darbui	Iš viso
Nuolatinės studijos	F	64	64	0	128	112	240
Ištęstinės studijos	I						

List of the Course lecture topics

Lecture topics	Number of hours			
	NL(S)	I(S)	I(S)	NL(T)
1. Development and application of environmental process modeling, computer data analysis procedures and tools.	4			
2. Digital Data Statistics Tools and Analysis Methods.	4			
3. Methods, Tools, and Technologies for Big Data Analytics, Aimed at Efficiently Managing, Analyzing, and Extracting Information from Large Datasets.	4			
4. The Rotation of the Earth and Its Influence on Atmospheric Phenomena. Modeling of Advection Processes in the Atmosphere.	4			
5. Creating Molecular and Turbulent Diffusion Equations. Modeling of turbulent and laminar air flows, models of differential equations and their application.	4			
6. Peculiarities of modeling of convective processes, formation and application of equations. Creation and solution of modeling tasks of combustion processes.	4			
7. Applied models and their theoretical justification for the transfer of pollutants in natural bodies. The models used for regional and long-distance transport are described.	4			
8. Flow modeling of two different densities. Theoretical models describing the turbulent flow of liquids.	4			
9. Equations and Application of Solid Body Flux in Transverse Flow Flow. Equations of liquid border layer, peculiarities of their application.	4			
10. Mathematical justification of transfer processes in porous environment.	4			
11. Equations describing the transfer of pollutants in soil. Mathematical justification of mass and heat transfer in soil exchange. Theoretical justification of fluid transfer in soil.	4			
12. Theoretical substantiation of environmental ionization processes.	4			
13. Peculiarities of mathematical modeling in electromagnetic wave propagation environment.	4			
14. Equations of sound wave propagation in ambient air, their application for modeling. Peculiarities of application of software packages. Evaluation of the Impact of Obstacles	4			

15. Formation of equations for vibration in gaseous and liquid materials and their application for modeling.	4			
16. Obtaining a decision in recurring processes, decision management information, reasons for differences. Computer analysis, evaluation of processes and results.	4			
In total:	**64**			

List of the Course laboratory work

Lecture topics	Number of hours			
	NL(S)	I(S)	I(S)	NL(T)
1. Introduction to software database, library of tasks.	4			
2. Introduction to the application of statistical methods to environmental engineering research. Descriptive statistics and visualization of research data.	4			
3. Applications of parametric criteria and ANOVA models in environmental engineering researchs.	4			
4. Application of non-parametric criteria in environmental engineering research.	4			
5. Correlation and regression analysis in environmental studies. Simple and multiple linear regression model construction and testing.	4			
6. Application of multi-criteria decision-making methods in environmental engineering researchs.	4			
7. Modeling of transport processes.	6			
8. Variants of Modeling of Physical Properties Evaluation of Variables.	6			
9. Modeling of transfer processes in a porous environment.	6			
10. Modeling of transport processes by estimating environmental terrain.	4			
11. Moving in closed contours and modeling them.	4			
12. Peculiarities of Modeling of Joint Transfer Equations.	4			
13. Final solution management information, reasons for differences. Computer analysis, evaluation of processes and results.	6			
14. Verification of modeling models.	4			
In total:	**64**			

Compilers of the module (name,surnam	**Modulio egzaminuotojai** (vardas, pavardė):	**Katedros vedėjas** (vardas, pavardė):
Raimondas Grubliauskas	Raimondas Grubliauskas	Aušra Zigmontienė
Saulius Vasarevičius	Saulius Vasarevičius	

Doktorantūros komisijos nutarimas

1. Modulis atestuojamas				
2. Modulis skirtas mokslo krypčiai:	**Aplinkos inžinerija**			
3. Modulio atestacija galioja:	nuo	2024-05-28	iki	2029-05-28

Modulį atestavo
Mokslo krypties doktorantūros komisijos pirmininkas (vardas, pavardė)

Saulius Vasarevičius	Data	2024-06-26