SYLLABUS

Fall semester 202 -202 academic years

on the educational program "8D06104 - Mathematical and Computer Modeling**"**

Discipline's code	Discipline's title	Independent work of students (IWS)	No. of hours per week: Lectures (L)	Practical training (PT)	Laboratory (Lab)	Number of credits	Independent work of student with teacher (IWST)
MMNFP 7201	Mathematical modeling of nonstationary physical processes	98	15	15	15	5	5

Academic course information

Form of education	Type of course	Types of lectures	Types of practical training	Number of IWS	Form of final control
online	theoretical	analitical	Task solution	6	writing
Lecturer	Abdibekov Ualikhan Seidildaevich			Scheduled	
e-mail	uali@kaznu.kz				
Telephone number	2211589				

Academic presentation of the course

Aim of course	Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to:	Indicators of LO achievement (ID)
	LO 1. Description of turbulent processes by mathematical equations	ID.1 numerical method construction
	LO 2. Construction of a mathematical model of the process	ID. 2 constructing an algorithm
	LO 3. Selection of closure methods	ID. 3constructing an algorithm

	LO 4. Construction of a mathematical model of turbulent flow for large Reynolds numbers	ID. 4compiling program code
	As a result of studying the discipline, the doctoral candidate will be able to independently understand scientific articles and independently build models for turbulent flow	
Prerequisites	Mathematical and computer modeling of physical procces, continuum mechanics, mechanic of fluid, computational fluid dynamic	
Post requisites		
Information resources	**literature**: 1. Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 1, - 676 с. 2. Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 2 - 686 с. 3. Хинце И.О. Турбулентность. М.:Физматгиз, 1963. - 680 с. 4. Турбулентность. Принципы и применения. - М.: Мир, 1980. - 535 с. 5. Методы расчета турбулентных течений. - М.: Мир, 1984. -464 с. 6. Davidson P.A. Turbulense. An Introduction for Scientists and Engineers, OXFORD University Press 2004. – 678 p. 7. P.Sagaut,S.Deck,M.Terracol_Multiscale_and_Multiresolution_Approaches_in_Turbulence_Imperial College Press 2006. – 356 p. 8. Жумагулов Б.Т., Абдибеков У.С., Исахов А.А. Основы математического и компьютерного моделирования естественно-физических процессов. Алматы, Қазақ университеті, 2014, -206 стр. **Internet-resources:** Additional educational material, lecture and practical classes, CDS assignments are uploaded to the teaching materials section of the univer.kaznu.kz website.	
Academic policy of the course in the context of university	**Academic Behavior Rules:** All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule. ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC. **Academic values:** - Practical trainings/laboratories, IWS should be independent, creative.	

moral and ethical values	- Plagiarism, forgery, cheating at all stages of control are unacceptable. - Students with disabilities can receive counseling at e-mail uali@kaznu.kz
Evaluation and attestation policy	**Criteria-based evaluation:** assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams). **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task.

Calendar (schedule) the implementation of the course content:

Week / date	Topic title (lectures, practical classes, Independent work of students, IWS)	LO	ID	Number of hours	Maximum score	Form of Knowledge Assessment	The Form of the lesson / platform
Module 1. Modeling the problems of the atmosphere and ocean.							
1	Lecture 1. The mathematical modeling physical prosesses. Introduction.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 1. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		
2	Lecture 2. Mathematical modeling of atmospheric processes	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 2. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
3	Lecture 3. Mathematical modeling of pollution of oceans and seas.	LO.1-	ID.1-ID.4	1			Video lecture

		LO.4					in MS Teams
	Practical class 3. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.				20 20		
4	Lecture 4. Mathematical modeling of short-term weather forecast.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 4. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
5	Lecture 5. Mathematical modeling of tropical cyclones (tornadoes).	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 5. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.				30		
	MT 1				**100**		
Module 2. Modeling complex physical processes							
6	Lecture 6. Mathematical modeling of near space.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 6. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
7	Lecture 7. Mathematical modeling of the hydrodynamics of aluminum electrolyzers	LO.1-LO.4	ID.1-ID.4	1			Video lecture

							in MS Teams
	Practical class 7. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
8	Lecture 8. Modeling the dynamics of ionospheric plasma	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 8. Related exercises.	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.				20 20		
9	Lecture 9. Mathematical modeling of internal flows.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 9. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
10	Lecture 10. Mathematical modeling of chemical processes in a confined space	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 10. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.				30		
	MT (Midterm Exam)				**100**		
Module 3. CFD nonstationare processes							
11	Lecture 11. Fractional-Step Methods for three-dimensional parabolic equation.	LO.1-LO.4	ID.1-ID.4	1			Video lecture

							in MS Teams
	Practical class 11. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
12	Lecture 12. Fourier method for the three-dimensional pressure equation.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 12. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.				20		
13	Lecture 13. RANS for nonstationare physical processes	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 13. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
14	Lecture 14. A Reynolds stress model for velocity and scalar fields.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 14. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS Teams
	Independent work of student with teacher: IWST.	LO.1-LO.4	ID.1-ID.4		25		
15	Lecture 15. LES for physical processes.	LO.1-LO.4	ID.1-ID.4	1			Video lecture in MS Teams
	Practical class 15. Related exercises	LO.1-LO.4	ID.1-ID.4	2	6		Webinar in MS

							Teams
	Independent work of student with teacher: IWST.				25		Webinar in MS Teams
	MT 2				**100**		
	Exam				**100**		

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.
Comments:
- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)
- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.
- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).
- Tasks for the next week open after each deadline.
- CW assignments are given by the teacher at the beginning of the webinar.]

Dean

Chairman of the Faculty Methodical Bureau

Head of the Department

Lecturer