SYLLABUS
Fall semester 2024-2025 academic year
Educational program "8D06104-Mathematical and Computer Modeling"

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
MMT 7201,7301 - Mathematical modeling of non-stationary physical processes	5	1,7	1,7	1,6	5	5

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control
Offline	Theoretical	Semi-formal, lecture-discussion	Task solution	Writing
Lecturer - (s)	Abdibekov Ualikhan Seidildaevich			Scheduled
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ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to:	Indicators of LO achievement (ID)
to form the ability of doctoral students to independently solve the problem of researching the problem of turbulence of processes by mathematical methods in the following sequence.	LO 1. Description of turbulent processes by mathematical equations;	AI 1.1 To know basic concepts, ideas and methods AI 1.2 To understand the principles of turbulent processes by mathematical equations;
	LO 2. Construction of a mathematical model of the process;	AI 2.1 Construction of a mathematical model of the process; AI 2.2 To be able to build Construction of a mathematical model of the process;
	LO 3. Selection of closure methods; Constructing semiempirical closure methods	AI 3.1 To be able to Selection of closure methods; AI 3.2 To be able Constructing semiempirical closure methods
	LO 4. Construction of a mathematical model of turbulent flow for large Reynolds numbers	AI 4.1 To be able to Construction of a mathematical model of turbulent flow for large Reynolds numbers AI 4.2 To be able to Construction of a mathematical model and 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	
Postrequisites		
Learning Resources	Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 1, - 676 с. Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 2 - 686 с. Хинце И.О. Турбулентность. М.:Физматгиз, 1963. - 680 с. Турбулентность. Принципы и применения. - М.: Мир, 1980. - 535 с. Методы расчета турбулентных течений. - М.: Мир, 1984. -464 с. Davidson P.A. Turbulense. An Introduction for Scientists and Engineers, OXFORD University Press 2004. – 678 p. P.Sagaut,S.Deck,M.Terracol_Multiscale_and_Multiresolution_Approaches_in_Turbulence_Imperial College Press 2006. – 356 p.	

	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 course policy	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. - Plagiarism, forgery, cheating at all stages of control are unacceptable. - Students with disabilities can receive counseling at e-mail uali@kaznu.kz **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.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements

Grade	Digital equivalent points	points, % content	Assessment according to the traditional system
A	4.0 _	95-100	Great
A-	3.67	90-94	
B+	3.33	85-89	Fine
B	3.0	80-84	
B-	2.67	75-79	
C+	2.33	70-74	
C	2.0	65-69	Satisfactorily
C-	1.67	60-64	
D+	1.33	55-59	Unsatisfactory
D	1.0	50-54	

Assessment Methods

Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.

Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.

Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.

Formative and summative assessment The teacher introduces his own types of assessment or uses the proposed option	**Points % content** The teacher enters his score into points in accordance with the calendar (schedule). The exam does not change and the final score in the course.
Activity at lectures	5
Work in practical classes	20
Independent work	25
Design and creative activity	10
Final control (exam)	40
TOTAL	100

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.			
A week	**Topic name**	**Number of hours**	**Max. ball**
	Module 1. RANS		
1	**Lecture 1.** The nature of turbulent flows	**1**	
	Lab. Performance of laboratory work №1. Related exercises	2	6
2	**Lecture 2.** Averaging procedure for Navier-Stokes equation	1	
	Lab. Performance of laboratory work №2. Related exercises	2	6
3	**Lecture 3.** Local similarity principle in turbulent transport theory	1	
	Lab. Performance of laboratory work №3. Related exercises	2	6
	Independent work of student with teacher: IWST 1.		24
4	**Lecture 4.** Equations for Reynolds Stress Velocity	1	
	Lab. Performance of laboratory work №4. Related exercises	2	6
5	**Lecture 5.** Semi-empirical relations and hypotheses closures for the equation of second moments	1	
	Lab. Performance of laboratory work №5. Related exercises	2	6
	Independent work of student with teacher: IWST 2.		30
	Module 2. Turbulent viscosity models		
6	**Lecture 6.** Pulsation structure of turbulent flows in a homogeneous medium	1	
	Lab. Performance of laboratory work №6. Related exercises	2	8
7	**Lecture 7.** Pulsation structure of turbulent flows in a stratified environment	1	
	Lab. Performance of laboratory work №7. Related exercises	2	8
Midterm control 1			**100**
8	**Lecture 8.** Influence of temperature and concentration on the structure of turbulent flow	1	
	Lab. Performance of laboratory work №8. Related exercises	2	6
	Independent work of student with teacher: IWST 3.		**10**
9	**Lecture 9.** Pulsation structure of turbulent transverse flows of the conducting liquid magnetic field	1	
	Lab. Performance of laboratory work №9. Related exercises	2	6
10	**Lecture 10.** Pulsation structure of turbulent flows in a curved domain	1	
	Lab. Performance of laboratory work №10. Related exercises	2	6
	Independent work of student with teacher: IWST 4.		**10**
	Module 3. Reynolds stress and related models		
11	**Lecture 11.** Influence of rotating and magnetic field on the structure of turbulent flow.	1	
	Lab. Performance of laboratory work №11. Related exercises	2	6
12	**Lecture 12.** Turbulence structure under a transverse oblique magnetic field	1	
	Lab. Performance of laboratory work №12. Related exercises	2	6
13	**Lecture 13.** Pulsation structure of turbulent admixture transfer in curved domain	1	
	Lab. Performance of laboratory work №13. Related exercises	2	6
14	**Lecture 14.** The influence of rotation, stratification, and magnetic fields on turbulence	1	
	Lab. Performance of laboratory work №14. Related exercises	2	6
15	**Lecture 15.** Turbulence total energy balance	1	
	Lab. Performance of laboratory work №15. Related exercises	2	8
	Independent work of student with teacher: IWST 5.		**30**
Midterm control 2			**100**
Final control (exam)			**100**
TOTAL for course			**100**

Dean _____ **Doszhan N.S.**

Chair of the Academic Committee
on the Quality of Teaching and Learning _____ **Akhmetova B.I.**

Acting Head of Department _____ **Mausumbekova S.D.**

Lecturer _____ **Abdibekov U.S.**

RUBRICATOR OF THE SUMMATIVE ASSESSMENT

CRITERIA EVALUATION OF LEARNING OUTCOMES

Issued at the request of the teacher for each planned summative assessment (IWST)

TEMPLATE

Task name (points, % content from 100% MC, copy from the calendar (graphics) implementation of the content of the training course, methods of teaching and learning

Criterion	**"Excellent" Max. weight in %**	**"Good" Max. weight in %**	**"Satisfactory" Max. weight in %**	**"Unsatisfactory" Max. weight in %**

Example 1. Written assignment "My professional history" (25% of 100% MC)

Criterion	**"Excellent"** 20-25%	**"Good"** 15-20%	**"Satisfactory"** 10-15%	**"Unsatisfactory"** 0-10%
Understanding Theories and concepts of professional identity and professionalism of a teacher	Deep understanding of theories, concepts of professional identity and teacher professionalism. Relevant and relevant links (citations) to key sources are provided.	Understanding theories, concepts of professional identity and teacher professionalism. Links (citations) to key sources are provided.	Limited understanding of theories, concepts of professional identity and teacher professionalism. Limited references (citations) to key sources are provided.	Superficial understanding / lack of understanding of theories, concepts of professional identity and professionalism of the teacher. Relevant references (citations) to key sources are not provided.
Awareness of key issues of professional identity and professionalism of teachers in Kazakhstan	Links well the key concepts of professional identity and teacher professionalism with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	Links the concepts of professional identity and teacher professionalism with the context of Kazakhstan. Supports arguments with evidence from empirical research.	Limited connection of the concepts of professional identity and professionalism of teachers with the context of Kazakhstan. Limited use of evidence from empirical research.	There is little or no connection between the concepts of a teacher's professional identity and the context of Kazakhstan. Little or no use of empirical research.
Policy proposal or practical recommendations/suggestions	Offers sound policy and/or practical recommendations, proposals for improving the professional identity and professionalism of teachers in Kazakhstan.	Offers some policy and/or practical recommendations, proposals for enhancing the professional identity and professionalism of teachers in Kazakhstan	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.

Letter, APA style	The writing demonstrates clarity, conciseness and correctness. Strictly follows the APA style.	The letter demonstrates clarity, conciseness and correctness. Basically follows the APA style.	The letter has some key errors and clarity needs to be improved. There are mistakes in following the APA style.	The writing is unclear, it is difficult to follow the content. Lots of mistakes in following the APA style.

Example 2. Group presentation "Teaching profession in Kazakhstan" (30% of 100% RK)

Criterion	"Excellent" 25-30%	"Good" 20-20%	"Satisfactory" 15-20%	"Unsatisfactory" 0 – 15%
Understanding theories and concepts of the professional identity of the teacher and the teaching profession	Deep understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Understanding theories, concepts of the professional identity of the teacher and the teaching profession.	Limited understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Superficial understanding / lack of understanding of theories, concepts of the professional identity of the teacher and the teaching profession.
Awareness of key issues of the professional identity of the teacher and the teaching profession in Kazakhstan	Competent correlation of the key concepts of the professional identity of the teacher and the teaching profession with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	There is a connection between the concepts of professional identity of a teacher and the teaching profession with the context of Kazakhstan. The arguments are backed by evidence from empirical research.	Limited correlation of the professional identity of the teacher and the concepts of the teaching profession with the context of Kazakhstan. Limited use of evidence from empirical research	Insignificant connection / lack of connection between the concepts of the teacher's professional identity and the context of Kazakhstan. Little or no empirical research is used.
Pilot Study	Excellent use of the results of pilot studies (interviews or surveys) in the presentation	Good use of the results of pilot studies (interviews or surveys) in the presentation.	Satisfactory use of the results of pilot studies (interviews or surveys) in the presentation.	Poor use of the results of pilot studies (interviews or surveys) in the presentation.
Suggestion of policy or practical recommendations/suggestions	Offers very good policy and/or practical advice or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Offers some policy and/or practical recommendations or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.
Presentation, teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality visuals, slides or other materials, good teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low engagement, low quality content, poor teamwork.