

Master Course in
MATHEMATICAL ENGINEERING

A. BAITURSYNOV KOSTANAY STATE UNIVERSITY

DEPARTMENT OF INFORMATION SYSTEMS

FACULTY OF INFORMATION TECHNOLOGIES

Program duration: 2 years

Class Degree:

Reference Faculty : NAME AND FAMILY NAME e-mail adress Abdykarim Baimankulov

Program held in Russian with some courses in English

ADMISSION REQUIREMENTS / Требования к поступлению

Bachelor degree or three-year university degree, or an equivalent qualification obtained abroad and recognized as valid regarding the curricular requirements and the adequacy of personal preparation. The order of preference by degree (graduates) in the admission process is : Mathematics, Physics, and Engineering. All other qualifications in the areas of Engineering and Architecture and the area of Sciences Economics and Business Administration and Management are considered eligible. The certification of English language with a IELTS test score 5.0 or higher is an eligibility requirement for access to the master program.

AIMS \ ЦЕЛИ

The aim of the degree program is to train a professional figure who can use engineering technologies and applied mathematics to define and solve complex problems that require detailed mathematical modelling, computer simulations and statistical investigation. Characterised by a strong synergy between mathematics and engineering disciplines, the MSc degree gives students the opportunity to address problems from various engineering fields relating to both artificial systems, constructed or designed by humans, and natural systems and phenomena.

The programme aims to provide graduates with the skills needed for the following activities:

- Choose the best mathematical model to use, on the basis of a trade-off between desired accuracy and accepted complexity;
- Perform qualitative and quantitative analysis of output generated by the model and evaluate the conformity with the phenomenon to be analysed;
- Perform numerical simulations of natural phenomena, industrial processes and behaviours of materials and structures;
- Perform analyses of statistical data, synthesize them, adapt them to stochastic models of interest in the applications, and employ them for forecasting purposes in reliability and decisional analyses;

The curriculum is intended to ensure all the cognitive tools necessary to practise the

profession of mathematical engineer, such as:

- Mathematical modelling, aimed at deducing the most suitable mathematical model to describe applicative problems and analyse their solutions from both a qualitative and a quantitative point of view;
- Numerical simulation, aimed at describing the most suitable methods for approximating the solution and methods for graphically representing numerical solutions;
- Probability and statistics applied to solving non-deterministic problems and managing and interpreting data stemming from experiments or from probabilistic models;
- Broad engineering skills for application in various sectors.

With the preparation and discussion of the thesis, students have an opportunity to put into practice all knowledge acquired, mixing theoretical and applicative and/or experimental skills as well as providing an original input.

CAREER OPPORTUNITIES

MSc graduates will have a good basic engineering background and sound mathematical training, enabling them to work as part of design teams to develop mathematical models and simulations, analyse data, perform risk analysis, and solve optimization problems. Likely employment opportunities for graduates are with manufacturing industries, consulting firms, banks and insurance companies, computer companies, engineering firms specialising in simulation, and research laboratories.

The program qualifies the following professional profile/s:	Roles and skills:
Mathematical engineer specialised in mathematical modelling and numerical simulation	<p>ROLE\РОЛЬ</p> <p>This is professional with both a good engineering and a solid mathematical preparation; especially suitable for work within research and design groups that need in-depth design studies, based on the use of advanced mathematical procedures, to develop mathematical models and simulations.</p> <p>SKILLS RELATED TO THE ROLE:</p> <ul style="list-style-type: none"> - Starting from the application problem, she/he identifies and deduces the mathematical model to use, based on a trade-off between desired accuracy and tolerated complexity , searching for a satisfactory consistency with the reality and optimizing costs, in terms of time and resource usage. - She/he uses the most recent numerical methods, visualization strategies to report results to colleagues in other disciplines. - Industrial goods manufacturing companies - IT Companies

	<ul style="list-style-type: none"> - Environmental agencies - Biomedical industries - Company that design and/or manage complex civil engineering structures or mechanical systems - Engineering companies specialized in simulations - Research centres and laboratories.
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LEARNING OUTCOMES:

After the study of some cross-mathematical disciplines, students will specialize their knowledge in formulation of mathematical models and their numerical simulation, random systems, data management and optimization problems .
The conclusion of the curriculum includes the writing of a thesis related to an assignment completed independently by the student, that highlights either the innovative use of mathematical methods known for the specific application or the development of innovative mathematical methods.

PROGRAMME :

The master's duration is two academic years, organized in four semesters. The programme requires passed a minimum of 120 ECTS and is made up of :

FIRST YEAR	50 CREDITS ECTS
Basic Training Module	17 compulsory ECTS
Specialisation Module	16 compulsory ECTS
Elective	9 elective ECTS
Research work of a student, including writing of Master's thesis	8 compulsory ECTS

SECOND YEAR	70 CREDITS ECTS
Basic Training Module	4 compulsory ECTS
Specialisation Module	17 compulsory ECTS
Research practice	12 compulsory ECTS
Teaching(Pedagogical) practice	3 compulsory ECTS
Master's final project	X compulsory ECTS
Thesis defense	X compulsory ECTS
Research work of a student, including writing of Master's thesis	20 compulsory ECTS
Complex examinations	4 compulsory ECTS
Writing and defending Master's thesis	10 compulsory ECTS

FIRST SEMESTER

Code	Discipline	ECTS
HPhS 5201	History and Philosophy of science	3
FL 5202	Foreign Language (professional)	3
Psy 5203	Psychology	3
Ped 5204	Pedagogy	3
ICM 5302	Introduction to Continuum Mechanics (BD)	5
PDE 5303	Partial Differential Equations (BD)	4
	Research work of a student, including writing of Master's thesis	4
	TOTAL	25

SECOND SEMESTER\ВТОРОЙ СЕМЕСТР

Code/ КОД	Discipline\Дисциплина	ECTS
TDSS 5301	Technology of designing software systems	3
	Programming Languages (BD) (Elective)	3
	General Numerical Methods (BD) (Elective)	6
NMODE 5304	Numerical Methods for ODEs (PD)	4
CP 5205	Cloud programming	5
	Research work of a student, including writing of Master's thesis	4
	TOTAL	25

THIRD SEMESTER

Code	Discipline	ECTS
NMPDE 6307	Numerical Methods for PDEs (PD)	4
SEOO 6206	SEO-optimization	4
FM 6308	Fluid Mechanics (PD)	5
6306	Simulation of moisture and heat flow in a multilayer environment	5
SP 6305	Statistics and Probability	3
	Teaching (Pedagogical) practice	3
	Research work of a student, including writing of Master's thesis	16
	TOTAL	40

FOURTH SEMSTER

Co de	Discipline	ECTS
	Research practice	12
	Research work and implementation of the master's project, defense	
	Research work of a student, including writing of Master's thesis	4
	Complex examinations	4
	Writing and defending Master's thesis	10
	TOTAL	30

Basic disciplines –BD; Discipline in the profile – PD; Elective course – EC



CURRICULUM

is developed on the basis of the Typical Curriculum, approved by the Decree №343 issued 16.08.2013 of MES RK
Start of Education / Начало обучения 2016-2017 academic year

master programme

scientific master programme

field of study: technical sciences and technologies

specialty 6M070400 - Computing equipment and software

full time study

duration 2 years

Academic degree Master of Technical Sciences in 6M070400-Computing equipment and software

1. Academic Calendar

years	September					October				November				December					January				February				
	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	27
	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	12	18	25	4
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	O	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	/R	::	::	=	=	=	/R	/R	/R	/R	/R	/R
2	O	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	R/TP	::	::	RP	RP	RP	RP	RP	RP	RP	RP	RP

years	March				April				May				June					July				August			
	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21
	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1	/R	/R	/R	/R	/R	/R	/R	/R	/R	::	::	R/S	R/S	R/S	R/S	R/S	R/S	R	=	=	=	=	=	=	=
2	RP	RP	RP	R	R	R	=	RL	FE	FE	M	M	M	M	D	D									

Abbreviations:

Organizational activities

Theoretical studies

Examinations

Holidays

Summer Semester

Teaching Practice

Research work of a student

Revision Lectures

/ types of studies, held simultaneously

FE Final Examination

D Defense of Master Thesis

RP Research Practice

M Master thesis preparation

2. Curriculum

Code of Module	Module Title	Basic/Professional Compulsory/Elective	Code of subject	Subject	KZ credits	ECTS	Assessment		Working load of a student in hours							Distribution of credits within semesters			
							Exam	Course paper	Барлығы / Всего	classroom work			Supervised work	Independent work	1 year		2 year		
										Total Classroom work	оның ішінде / в том числе				1 sem	2 sem	3 sem	4 sem	
											Lectures	Practical Classes			Laboratory	Number of weeks in semester			
15	15	15	19																
Theoretical Studies																			
General module																			
OMinv_01	General Professional disciplines	BD/C	GTF / IFN / HPhS 5201	History and Philosophy of science	2	3	1		90	30	5	25		20	40	2			
		BD/C	ShT / IYa / FL 5202	Foreign Language (professional)	2	3	1		90	30		30		20	40	2			
		BD/C	Psi / Psy 5203	Psychology	2	3	1		90	30	5	25		20	40	2			
		BD/C	Ped 5204	Pedagogy	2	3	1		90	30	5	25		20	40	2			
Total					8	12			360	120	15	105		80	160	8			
Specialty modules																			
MSinv_02	Technology of Inforamtion Systems Design	PD/C	PZhZhT / TPPS / TDSS 5301	Technology of designing software systems	2	3	2		90	30	5	25		20	40		2		
		BD/E	BB / OP / CP 5205	Cloud programming	3	5	2		135	45	5	40		25	65		3		
		BD/E	SEOO / SEOO / SEOO 6206	SEO-optimization	3	4	3		135	45	5	40		25	65			3	
Total					8	12			360	120	15	105		70	170		5	3	
Mathematical Engineering																			
MSinv_03	Mathematical Engineering	PD/E	ICM 5302	Introduction to Continuum Mechanics	3	5	1		135	45	5	40		25	65	3			
		PD/E	PDE 5303	Partial Differential Equations	3	4	1		135	45	5	40		25	65	3			
Жалпы 3 модуль бойынша / Итого по 3 модулю					6	9			270	90	10	80		50	130	6			
MSv_04		PD/E	NMODE 5304	Numerical Methods for ODEs	3	4	2		135	45	5	40		25	65		3		
		PD/E	SP 6305	Statistics and Probability	2	3	3		90	30	5	25		20	40			2	
		PD/E	6306	Simulation of moisture and heat flow in a multilayer environment	3	5	3		135	45	5	40		25	65			3	
Total					8	12			360	120	15	105		70	170		3	5	

MSv_05		PD/E	NMPDE 6307	Numerical Methods for PDEs	3	4	3		135	45	5	40		25	65			3		
		PD/E	FM 6308	Fluid Mechanics	3	5	3		135	45	5	40		25	65			3		
				Total	6	9			270	90	10	80		50	130			6		
Elective Module																				
OMv_06		BD/E		Elective	6	9	2		270	90	10	80		50	130			6		
Total on Theoretical Learning					42	63			1890	630	75	555		370	890	14	14	14		
MSInv_08	Professional Practice			Teaching (Pedagogical) practice	3	3	3											3		
				Research practice	3	12	4												3	
MSInv_09	Final Assessment			Research work of a student, including writing of Master's thesis	7	28	1,2 3,4									1	1	4	1	
				Final Complex examinations	1	4	4												1	
				Preparing and defending Master's thesis	3	10	4												3	
Total					17	57									1	1	7	8		
Total on Curriculum					59	120			1890	630	75	555		370	890	15	15	21	8	

Semester					1	2	3	4	Σ
BD/C					8				8
BD/E						9	3		12
PD/C						2			2
PD/E					6	3	11		20
Professional Practice							3	3	6
Research work, including Thesis					1	1	4	1	7
Final Assessment								4	4
Total on Curriculum					15	15	21	8	59

Agreed with:

Dean _____ N.Medetov

_____.2016

Head of Management and Monitoring of academic process _____ T.Chekhova

_____.2016

Head of Science and Postgraduate Department _____ A.Koval

_____.2016

Developed by:

Committee on Educational programs

Chairperson _____ G.Makhambetova

_____.2016