

ISBN 978-601-04-1694-9		specialities omathematicso, ornechanicso, ornathematical outformaticso. It will be useful for the post-graduate study economic, mathe-matical and naturally-technical specialties.	solution algorithms of the problems, t calculus are presented in the appendix. It is intended as an educational	Some theoretical foundations of optimal control pr manual: methods of variation calculus, maximum p solving of topical problems of economic macromodels.	Aisagaliev S.A., Zhunusova Zh.Kh. A 28 Variation calculus and metho S.A. Aisagaliev, Zh.Kh. Zhunusova- ISBN 978-601-04-1694-9		Doctor of Physical and Candidate of Physical and Doctor of Physical and	of the Minisory of the on the base (I	of the Faculty of Mech of the Hun of the Hun of the Repub	LBC 22.161.8x73 A 28
© Aisagaliev S.A., Zhunussova Zh.Kh., 2016 © KuzXU al-Funabi, 2016	UDC 517.97 (075.8) LBC 22.161.8a73	specialities ornathematicso, ornechanicso, ornathematical and computer modelings and outformaticso. It will be useful for the post-graduate students and scientific workers of the economic, mathe-matical and naturally-technical specialties.	In the starts for macputation with what software of controls examples, order unovy and solution algorithms of the problems, term tasks on sections of optimal control and variation calculus are presented in the appendix. It is intended as an educational manual for students of the high schools training on	Some theoretical foundations of optimal control problem are expounded in the educational manual: methods of variation calculus, maximum principle, dynamical programming for solving of topical problems of economic macromodes.	<ul> <li>Aisegaliev S.A., Zhunussova Zh.Kh.</li> <li>Variation calculus and methods of optimization: educational manual /</li> <li>S.A. Aisegaliev, Zh.Kh. Zhunussova. – Almaty: Qazaq university, 2016. – 322 p.</li> <li>ISBN 978-601-04-1694-9</li> </ul>		Reviewers: Doctor of Physical and Mathematical Sciences, Professor M.I. Tleubergenov Candidate of Physical and Mathematical Sciences, Ass. professor A.U. Kalizhanova Doctor of Physical and Mathematical Sciences, Professor S.Ya. Scrovajjsky	of the Minkory of Education and Science of the Republic of Kacakhstan on the base of Al-Furabi Kacakh National University (Protocol 38 1, October 7, 2015)	Recommended for publication by the Academic Councel of the Faculty of Mechanics and Mathematics. Editorial-Publishing Council of the Humanitius and Mathematical Union of the Republican Educational and Methodical Council of the Republican Educational and Methodical Council	
LECIUKE 20,	LECTURE 13.	LECTURE 18.	LECTURE 16. LECTURE 17.	CHAPTER IV	LECTURE 13. CHAPTER III LECTURES 14. LECTURE 15.	LECTURES 9, 10. CHAPTER II LECTURES 11. LECTURE 12.	LECTURES 6, 7. LECTURE 8.	CHAPTER I LECTURE 3. LECTURE 4. LECTURE 5.	INTRODUCTION LECTURE 1.	FOREWORD
MINIMIZATION METHODS	THE PENALTY FUNCTION METHOD.	THE GRADIENT PROJECTION METHOD. CONDITIONAL GRADIENT METHOD. CONJUGATE GRADIENT METHOD		THE INITIAL EXTREME POINT CONSTRUCTION NUMERICAL METHODS OF MINIMIZATION IN FINITE-DIMENSIONAL SPACE	DUALITY THEORY LINEAR PROGRAMMING PROBLEM STATEMENT. SIMPLEX-METHOD DIRECTION CHOICE. NEW SIMPLEX-TABLE CONSRUCTION.	A KUHN-TUCKER'S THEOREM. NONLINEAR PROGRAMMING PROBLEM STATEMENT. NECESSARY CONDITIONS OF THE OPTIMALITY SOLUTION ALGORITHM OF NONLINEAR PROGRAMMING PROBLEM.		CONVEX PROGRAMMING. ELEMENTS OF THE CONVEX ANALYSIS	4	

CHAPTER V LECTURE 21.	VARIATION CALCULUS	
LECTURE 22.	EULER EQUATION 138 DUBOIS - RAYMOND LEMMA. BOLZ PROBLEM. WEIERSTRASS NECESSARY CONDITION	minimizatio
LECTURE 23.	LEGENDRE CONDITION AND A	In co written in
LECTURE 24.	FUNCTIONALS DEPENDING ON THE ANALYSING STREET, SUNCTIONALS DEPENDING FUNCTIONS. FUNCTIONALS DEPENDING ON HIGHER ORDER DERIVATIVES	lectures the brief theor mastering o In th
ou i DTED VI	PROBLEM. GENERAL COMMENTS	
CHAPTER VI LECTURE 25.	PROBLEM STATEMENT OF OPTIMAL CONTROL. MAXIMUM PRINCIPLE FOR OPTIMAL CONTROL PROBLEM WITH FREE RIGHT END	stochastic
LECTURE 26.	PROOF OF MAXIMUM PRINCIPLE FOR OPTIMAL CONTROL PROBLEM WITH FREE RIGHT END	different p
LECTURE 27.	MAXIMUM PRINCIPLE FOR OPTIMAL CONTROL PROBLEM. CONNECTION BETWEEN MAXIMUM PRINCIPLE AND VARIATION CALCULUS	
CHAPTER VII LECTURE 28. LECTURE 29.	OPTIMAL CONTROL. DYNAMIC PROGRAMMING 19 OPTIMALITY PRINCIPLE. BELLMAN EQUATION 19 DISCRETE SYSTEMS. OPTIMALITY PRINCIPLE.	3 theory we differentia
LECTURE 30. Appendix I.	BELLMAN EQUATION 20 SUFFICIENT OPTIMALITY CONDITIONS 22	)7 are reduc
Appendix II.	TASKS FOR INDEPENDENT WORK	minimiza
Appendix III.	FOR INDEPENDENT WORK	12 Executio
References		sections.
		complete critical r
	4	

Educational issue

# Aisagaliev Serikbay Abdigalievich Zhunussova Zhanat Khaphizovna

## VARIATION CALCULUS AND METHODS OF OPTIMIZATION

## Educational manual

Computer page makeup: K. Umirbekova Cover designer: K. Umirbekova

\_www.maths.york.ac.uk

#### IB No9155

Signed for publishing 04.02.16. Format 60x84 1/16. Off set paper. Digital printing. Volume 26,83 printer's sheet. Edition: 100. Order No43. Publishing house «Qazaq university» Al-Farabi Kazakh National University KazNU, 71 Al-Farabi, 050040, Almaty Printed in the printing office of the «Kazakh Universitety» publishing house