



Name of discipline and code : *B.2.4.1. Financial mathematics*

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<b>Amount of credits:</b>	2
<b>Date:</b>	6-semester 2017-2018 academic year
<b>Purpose and objectives of the course</b>	<p>Studying the discipline "Financial Mathematics" is an important part of the professional training of students. Any financial, credit or commercial operation involves a set of conditions agreed upon by its participants. These conditions include: the amount of the loan, loan or investment, the price of the goods, terms, ways of calculating interest and repaying the debt, etc.</p> <p>The combined effect on the financial operation of many factors makes its final result unobvious. To assess it, a special quantitative analysis is necessary. The totality of calculation methods is the subject of the course. The goal of the course is to help students master the basics of modern financial computing for applying the knowledge gained while solving specific problems in the field of economics.</p>
<b>Course Description</b>	<p>The discipline "Financial Mathematics" contains a systematic exposition of the basic concepts and methods of financial calculations and the quantitative analysis of financial transactions. The content of the classical course covers the basic sections of financial mathematics: calculations for simple and complex interest rates; financial rents; financial analysis of investments; financial settlements on securities. The program of the discipline "Financial Mathematics" is built on the basis of modern requirements of GOST to the level of training of economists.</p>
<b>Prerequisites disciplines</b>	<p>The course deals with the basic concepts that operate in financial computing: interest, interest rate, discount rate, current (current) cost of payment, methods for increasing and discounting payments, the principles underlying financial calculations, the current practice of calculations, the scope of their application.</p>
<b>Post-requisition discipline</b>	<p>Basic concepts and definitions of values used in financial calculations</p> <ul style="list-style-type: none"><li>• Types of interest rates</li><li>• Simple and compound interest formulas</li><li>• Scope of simple and compound interest formulas</li><li>• Interest calculation methods used in the world practice</li><li>• Formulas for calculating the final result when calculating interest on a variable rate over time</li><li>• The essence of the discount operation. Two methods of discounting: mathematical discounting and accounting operation</li><li>• Interest accrual at a simple and complex discount rate</li><li>• The essence of inflation. Measurers of inflation. Effects of inflation. Increment of amounts at a simple and complex rate in the conditions of inflation.</li></ul>

	<p>Gross rate. Real bet. Methods of compensation for losses from inflation.</p> <ul style="list-style-type: none"> <li>• Formulas for calculating the average profitability of financial transactions for a fixed period</li> <li>• The formula for accumulation at a constant rate of interest</li> <li>• Scope of continuous interest</li> </ul>
<b>Competencies</b>	<p><b>Know:</b> simple and compound interest as the basis of transactions associated with the expansion or discounting of payments; the principle of rate equivalence as the basis of many methods of quantitative analysis; methods for calculating the general characteristics of payment flows in relation to various types of financial rents;</p> <p><b>To be able:</b> to make accretion on simple and difficult percent; to carry out discounting and accounting for simple and complex interest rates; assess the consequences of replacing one financial obligation with others and draw reasoned conclusions; plan and evaluate the effectiveness of financial and credit operations; plan long-term debt repayment; to make financial settlements on securities; plan and analyze investment projects; calculate the figures for leasing, factoring and forfeiting operations; to make actuarial calculations on life insurance.</p> <p><b>Use:</b>  Skills of financial control in organizations  Financial methodologies for solving set financial problems  Methodology of collection, processing, analysis and systematization of financial information with the provision of information security requirements.  Methodology of analysis of calculation results.</p>
<b>Course Policy</b>	<p>Do not be late for classes  Do not skip classes, in case of illness, provide a certificate  If the tasks are not fulfilled, the assessment is reduced  Actively participate in the educational process  Timely and diligently to do homework  Be tolerant, open and friendly to fellow students and teachers  Constructively support feedback in all classes  Be punctual and compulsory</p>
<b>Teaching methods:</b>	Active method, passive method, interactive method
<b>Form of knowledge control</b>	<p>Assessment of knowledge will be conducted on the basis of the European ECTS system. The ECTS system initially divides students between the theses "credits", "not credits", and then assesses the work of these two groups separately.</p> <p>Students who score more than 50 points receive a "pass" rating.  "Excellent" (from 85 to 100 points), "good" (from 70 to 84 points), "satisfactory" (from 50 to 69 points).</p> <p>The points of the final evaluation are distributed as follows:  Current control work (max) -40 points  Border control work (max) -40 points  Final control (written examination max) -20 points</p> <p>At deducing of a total estimation activity of students in the decision of the problems offered on employment will be considered.</p>





	<p>Knowing that the probability of economic growth is 0,65, the probability of recession is 0,35, determine a portfolio with minimal risk.</p> <p>9). Determine whether the return on assets A and B in CAPM model is estimated correctly, if the risk-free asset's return is <math>r_f = 8\%</math>.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;"><math>\beta</math></td> <td style="text-align: center;"><math>r</math></td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">1,15</td> <td style="text-align: center;">16,9%</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">1,4</td> <td style="text-align: center;">18,9%</td> </tr> </table> <p>At which value of <math>r_f</math> we can say that the assets are estimated correctly?</p> <p>10) a) Determine the inflation rate, knowing that the real rate of return is 8%, and the nominal rate of return is 45%.</p> <p>b). Inflation rate, in each quarter, is 5%. What is the annual inflation?</p>		$\beta$	$r$	A	1,15	16,9%	B	1,4	18,9%
	$\beta$	$r$								
A	1,15	16,9%								
B	1,4	18,9%								
<b>Note</b>	Homework should be presented in the exact time set by the teacher. In the case of delivery of work after a fixed period, 50% of the points received by the student for work are removed.									

### Calendar-thematic plan of distribution of hours with the indication of the week, topics

№	Date	Subject	Number of hours	Literature	Preliminary questions on modules
1	26.01.2018	Simple interest. Simple discount	2	<p><b>Literature:</b></p> <p><b>Basic</b></p> <p>1. Chetyrkin E.M. Methods of financial and commercial calculations. M.: BUSINESS LTD., 2001.</p> <p>2. Kutukov V.B. Fundamentals of financial and insurance mathematics. M: BUSINESS. 2003.</p> <p>3. Melkumov Y.S. Theoretical and practical guide to financial computing. M.: INFRA-M. 1996.</p> <p>4. Chetyrkin E.M. Financial analysis of production investments. M: BUSINESS. 1998.</p>	<p>1. What does the multiplying factor in the composition of a simple percentage increase?</p> <p>2. How is the accretion of simple percentages and arithmetical pro-ressia related to each other?</p> <p>3. What is the difference between the exact and the approximate percentage?</p> <p>4. What does the multiplier of discounting in the formula for increasing simple prices?</p> <p>5. If the simple interest rate is doubled, how is the accrued amount?</p>
2	2.02.2018	Compound Interest. Effective Interest Rate	2	<p>4. Chetyrkin E.M. Financial analysis of production investments. M: BUSINESS. 1998.</p>	<p>1. In what cases does the bank discounting operation apply?</p> <p>2. Is it true that for a simple discount rate a bill can be considered for any time to maturity?</p> <p>3. What is the difference between an antipathic and</p>

				5. Kochovich E. Financial Mathematics. M.: "Finances and statistics". 2010.	a decursive way of calculating interest?
3	09.02.2018	Geometric progression. Future value of annuity The Present Value of an Annuity	2	6. Kapitonenko V.V. Financial mathematics and its applications: Учеб.- практ. manual for universities. - M.: "PRIOR Publishing House", 1998. - 144s.  7. S.K. Kydyraliev, A.B. Urdaletova, A.E. Kasymov, K.S. Kydyraliev «Intro to corporate finance & investments », Bishkek 2012  <b>Additional</b> 1. Shirshov EV, Petrik NI, Tutygin AG, Serova G.V. "Financial Mathematics" 3rd ed., Pererab. and add-M.: KNORUS, 2006-144p.	1) What is the multiplication factor for accruing interest on a complex loan rate? 2) How do the accumulated amounts relate to each other when calculating simple and compound loan interest? 3) Is it true that charging compound interest at a rate of 12% per annum is equivalent to charging compound interest at a rate of 1% per month? 4) How to use the financial tables in calculating the accrued and adjusted value?
4	16.02.2018	Infinitely Decreasing Geometric Progression. Stock Valuation	2	2. Chuyko A.S., Shernev V.G. "Financial Mathematics": Proc. Benefits.-M: INFRAM, 2017-160c.  3. Kapitonenko V.V. "Financial mathematics and its applications" Учеб.-практ. manuals for universities.-M: PRIOR Publishing House, 1999.-p.144.	1. What is the discounting factor multiplied by discounting at a complex discount rate? 2. Can accounting at a complex discount rate lead to negative values? 3. What happens to the amount of recorded capital, if the number of operations of discounting at a complex discount rate is growing?
5	19.02.2018	Investment coefficients	2	"Financial mathematics and its applications" Учеб.-практ. manuals for universities.-M: PRIOR Publishing House, 1999.-p.144.	1. What is the effective rate? On what parameters does it depend? 2. How does the effective rate change with the increase in the number of compound interest charges in the year? 3. In which case does the effective loan rate coincide with the nominal rate? 4. What are the rates called equivalent?

6	2.03.2018	Problems for review	2		<ol style="list-style-type: none"> <li>1. What does the consolidation of payments mean?</li> <li>2. Is the statement true: when comparing payments, their reduction to one moment of time can be carried out both by expansion and by discounting?</li> <li>3. When changing the terms of payments in which case will the new payment be greater than the old payment, and what is the lesser case?</li> <li>4. Which contracts are equivalent?</li> <li>5. What tasks can arise when consolidating payments?</li> </ol>
7	09.03.2018	Examination №1	2		
8	16.03.2018	Introduction to Linear Difference Equations	2		<ol style="list-style-type: none"> <li>1. How to determine and what characterizes the rate of inflation?</li> <li>2. Why in the conditions of inflation it is necessary to distinguish between nominal and real interest rates?</li> <li>3. Can the real interest rate be negative?</li> <li>4. What determines Fisher's formula?</li> </ol>
9	23.03.2018	Mortgage and Linear Difference Equations	2		<ol style="list-style-type: none"> <li>1. How does the interest tax on accruing with simple interest affect the interest rate?</li> <li>2. How does the interest tax on accruing compound interest affect the interest rate?</li> <li>3. Is the next statement true: when the compound interest increases, the amount of the interest tax does not depend on the time of tax payment-</li> </ol>

					annually or at the end of the financial transaction?
10	30.03.2018	Difference equations in evaluation of investment projects	2		<ol style="list-style-type: none"> <li>1. What cash flow is called the flow of prenumerando? Give an example.</li> <li>2. What cash flow is called a post-numerando stream? Give an example.</li> <li>3. How are financial tables used to estimate permanent annuities?</li> <li>4. What is the annuity buildup ratio?</li> <li>5. What is the discount rate of the annuity?</li> <li>6. What relationship exists between the future and present value of the annuity?</li> </ol>
11	06.04.2018	Inflation	2		<ol style="list-style-type: none"> <li>1. How does the annuity growth rate change when the annuity period is changed and the interest rate is changed?</li> <li>2. How does the discount rate of the annuity change with the change in the validity period of the annuity and the change in the interest rate?</li> <li>3. What is the relationship between the estimates of the annuity of prenumerando and postnumerando?</li> </ol>
12	13.04.2018	Risk and Return of stocks and portfolios	2		<ol style="list-style-type: none"> <li>1. What is ransom of rent? What are the methods of solving this problem?</li> <li>2. What is the essence of consolidation of rent?</li> <li>3. How to replace immediate rent with deferred rent?</li> </ol>
13	20.04.2018	Model CAPM	2		<ol style="list-style-type: none"> <li>1. What credit is called consumer credit? Give examples of consumer loans</li> </ol>



					2. List the main ways to repay the loan 3. Which way of repaying the loan is most beneficial to the bank (the creditor)?
14	23.04.2018	Depreciation Methods: Mathematical Approach	2		1. Which way of repaying the loan is most beneficial to the borrower? 2. Why are banks interested in that the debtor repays the amount of debt in installments during the entire term of the loan?
15	27.04.2018	Examination №2	2		
		TOTAL	<b>30</b> hours		

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### Schedule of independent work of students

№	Weeks Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Amount of points
		March								April								
1	Current control	20								20								40 points
2	Deadline IWS*.	05.03.2018-10.03.2018								23.04.2018-28.04.2018								