Actuarial Mathematics

Course Outline
Academic Semester: 2025/26

1. General

School	**School of Finance and Statistics**		
Academic Unit	**Department of Banking and Financial Management**		
Level of Studies	**Undergraduate**		
Course Code	**XPANM01**		
Semester	**5th or 7th**		
Course Title	**Actuarial Mathematics**		
Idependent Teaching Activities		Weekly Teaching Hours	Credits
	Lectures	**4**	**7,5**
Course Type	**Special background**		
Prerequite Courses			
Language of Instruction and Examinations	**Greek**		
Is the course offered to Erasmus Students?	**Yes**		
Url (Eclass)	**https://eclass.unipi.gr/modules/auth/opencourses.php?fc=64**		

2. Learning Outcomes

Learning Outcomes

The aim of the course is to understand mainly which collective and individual risk models are used to describe the total claims or losses or even compensations in portfolios of risks of short time periods without taking into account the time value of the property. Thus, special emphasis is given through various probability theoretical methods to the study of the distribution of total losses of these models, how premiums are calculated and how total compensations are calculated in reinsurance problems.

General Competences

- Independent work
- Teamwork
- Working in an interdisciplinary environment
- Searching, analyzing and synthesizing data and information using the necessary technologies

3. Syllabus

Decision making under uncertainty. Principles of premium calculation. Properties of premium calculation principles. Theory of utility. Principle of utility in insurance. Utility functions. Principle of utility in insurance. Risk aversion and risk aversion. Jensen’s inequality. Cases of partial risk coverage. Insurance schemes. Proportional schemes (fixed ratio, excess capital) and non-proportional schemes (excess loss, loss stoppage). Calculation of the moments of coverages and the corresponding own retentions. Covariance of coverage and own retention. The optimum of excess loss. Individual risk model. Convolutions. Direct and recursive way of calculating the probability function of total claims. Calculation of moments of the distribution of total claims and the method of moment generators. Margin of safety and approximations of the distribution of total claims. Applications to general insurance and short-term life insurance. One-period collective risk models. Complex distribution models as models of total claims. The

distribution of total claims. Analytical results of calculating the distribution of total claims. The complex Poisson distribution and its properties. The complex binomial and the complex negative binomial distribution. Recursive calculation of the distribution of total claims. The Panjer, Jewell and Sundt families. Calculations for continuous distributions of individual loss amounts. Mixed distributions for the number of losses. Mixed and complex mixed Poisson distributions and their properties. The Sichel distribution, the Poisson distribution – inverse Gaussian distribution and the generalized Poisson–Pascal distribution. Complex distributions for the number of losses. Infinitely divisible distributions, modified distributions. The complex Poisson as an approximation of the individual standard. Approximations of the distributions of total claims. Excess loss insurance and stop-loss insurance. Distribution of reinsurer claims. Limited mathematical hope, upper bounds for moments and calculation of the stop-loss premium. Positive experience clauses. Asymptotic results of the behavior of the right tail of some complex distributions and the stop-loss premium. Subexponential distributions.

4. Teaching and Learning Methods - Evaluation

Delivery	**Face-to-face**	
Use of Information and Communications Technology	**E-Class**	
Teaching Methods	**Activity**	**Semester Workload**
	Lectures	52
	Independent Study	123,5
	Tutorials	12
	Course Total	**187,5**
Student Performance Evaluation	Written Exam (100%)	

5. Attached Bibliography

Suggested Bibliography

- Κουτσόπουλος Κ.Ι. (1999) Αναλογιστικά Μαθηματικά, Μέρος Ι, Θεωρία των κινδύνων. Εκδ. Συμμετρία
- Teacher’s Notes

Related Academic Journals