COURSE DATA

DATA SUBJECT

Code: 43790
Name: Pension schemes and systems
Cycle: Master's Degree
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2171 - Master's Degree in Actuarial and Financial Sciences	Facultat d'Economia	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2171 - Master's Degree in Actuarial and Financial Sciences	Life insurance, health insurance and pensions	COMPULSORY

COORDINATION

VIDAL MELIA CARLOS

SUMMARY

The course "Pension Plans and Systems" is scheduled for the first semester of the second year and is taken after students have had an initial introduction to the insurance field in the introductory course on Risk, Insurance Techniques, and Actuarial Practice, as well as having already studied one of its areas, Non-Life Insurance.

In this way, once students have acquired the necessary mathematical and statistical foundations and are familiar with the general context, they are prepared to tackle one of the specific areas of the Master's program: Pension Plans and Systems.

Although students already have some knowledge of insurance from the first year of the Master's, the area related to life insurance is still largely unfamiliar to them.

The course "Pension Plans and Systems" is naturally complemented by two other courses: "Life Insurance" and "Benefits and Health and Long-Term Care Insurance," as there are numerous links between them.

Through the study of the Master's program, students should be able to manage risk as a continuous and

constantly evolving process, carried out in an integrated manner and aligned with the strategic objectives of the company and/or pension institutions, so as to maximize the sustainable long-term value of each of their activities and balance the interests of all stakeholders.

To achieve this general objective, the course "Pension Plans and Systems" focuses its activities on: analysis of the basic financing systems for benefits; methods for measuring the sustainability of pay-as-you-go systems; instruments to improve the pay-as-you-go system; analysis of Pension Plans and Funds; analysis of group life insurance, Corporate Social Welfare Plans, and Mutual Benefit Societies; methods for distributing the actuarial cost of a pension plan; and types of pensions in funded systems.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

To successfully learn the contents of this module, students should be familiar with the basics of Financial Economics and Introduction to Risk, as well as have basic skills in using Excel spreadsheets.

COMPETENCES / LEARNING OUTCOMES

2171 - Master's Degree in Actuarial and Financial Sciences

Comprender y ser capaces de desarrollar las técnicas matemáticas y estadísticas que resultan relevantes para el trabajo actuarial: modelos de supervivencia, siniestralidad, tarificación, previsión y solvencia.

Conocer el código de conducta del Actuario así como las normas más relevantes de la práctica profesional.

Conocer y ser capaces de valorar los distintos instrumentos públicos y privados utilizados en el entorno de la previsión social.

Poseer las habilidades suficientes para participar en una conversación de negocios y estar capacitado para leer literatura actuarial al menos en dos de los idiomas oficiales de la Unión Europea.

Saber realizar una gestión integral del riesgo y alcanzar los conocimientos suficientes para dar respuesta a los riesgos actuales y a los que puedan surgir resultado del cambiante entorno económico, financiero y social, con vistas a dirigir y gestionar todo tipo de entidades financieras y aseguradoras.

Saber tomar decisiones relacionadas con los riesgos evaluables económicamente.

Ser capaces de aplicar los criterios y principios de planificación y control actuarial, necesarios para el correcto funcionamiento de las operaciones que, en cada momento, ofrezcan las entidades de seguros, financieras o cualesquiera otras que impliquen transferencia y cobertura de riesgos.

Ser capaces de construir modelos adecuados al entorno económico empresarial a partir de las posibilidades que ofrecen las modernas tecnologías de la información y de la computación.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

DESCRIPTION OF CONTENTS

TOPIC 1: BASIC CONCEPTS

1. Introduction
2. Public provision. Social Security systems
   2.1. Protective action
3. Private provision. Pension plans and other complementary systems
   3.1. Externalization: The basic framework of social welfare in Spain
4. The role of the actuary in pension plans
   4.1. Codes of conduct
   4.2. Pension plan review
   4.3. Professional activity of actuaries in relation to pension plans

TOPIC 2: BASIC FUNDING SYSTEMS

1. Introduction
2. The simple pay-as-you-go system
   2.1. The annual simple pay-as-you-go system
   2.1.1. Particular case
   2.1.2. General case
   2.2. The attenuated or average stepped contribution pay-as-you-go system
3. The pay-as-you-go system with coverage capital
   3.1. The annual pay-as-you-go system with coverage capital
   3.2. The attenuated pay-as-you-go system with coverage capital
4. The actuarial capitalization system
   4.1. The individual actuarial capitalization system
   4.2. The collective actuarial capitalization system

TOPIC 3: THE NOTIONAL ACCOUNTS MODEL

1. Introduction
2. Actuarial basis
3. Survivorship dividend
4. Advantages and disadvantages
5. The case of Sweden
6. The case of Italy
   References
   Appendix 1: The proposal submitted to the World Bank to introduce the notional accounts system in Spain

TOPIC 4: RELATIONSHIP BETWEEN THE DIFFERENT FORMULAS FOR CALCULATING THE RETIREMENT PENSION

1. Defined benefit: well designed?
2. Notional accounts
3. The points system
4. Equivalence in benefits
5. The effect of the survivorship dividend
6. The effect of the pensioners¿ mortality table
7. Basic principles of well-designed formulas
8. The formula for calculating the retirement/disability pension in the USA
9. Actuarial analysis of the formulas for calculating retirement benefits in the United States, Spain, and Sweden
   References

TOPIC 5: DEFINED CONTRIBUTION NOTIONAL ACCOUNTS (NDC): SOLVENCY AND RISK, APPLICATION TO THE SPANISH CASE

1. Introduction
2. Model, data, and assumptions
3. Results
4. Conclusions
   References

TOPIC 6: THE ACTUARIAL BALANCE (U.S. MODEL)

1. Introduction
2. Methodology, data, and assumptions
3. Main results
4. Expected internal rate of return for various hypothetical workers
5. Expected benefit-to-contribution ratio per monetary unit for various hypothetical workers
6. The actuarial balance of the CPP (Canada)
   References

TOPIC 7: THE ACTUARIAL BALANCE (SWEDISH MODEL)

1. Introduction
2. Structure and principles (and results)
3. The income statement
4. The solvency indicator
5. The balance sheet and the automatic solvency mechanism
   References

TOPIC 8: FROM THE "TABLE 29" TO THE ACTUARIAL BALANCE

1. Introduction
2. The supplementary pension table (Table 29)
3. The accounting model: the actuarial balance and the income statement
4. The proposal
5. Case study of a country: Spain
   References

TOPIC 9: LONGEVITY BY PENSION AMOUNT IN SPAIN

1. Overview
2. Introduction
3. Data and methodology
4. Results
5. Discussion
6. Illustrative example
   References
   Appendix 1: Differences in life expectancy between self-employed and salaried workers at retirement: Evidence from Spanish Social Security records

TOPIC 10: PENSION PLANS, FUNDS, AND OTHER SOCIAL WELFARE INSTRUMENTS (INDIVIDUAL AND GROUP)

1. Pension plans and funds
2. Group life insurance

3. Corporate social welfare plans
4. Insured social welfare plans
5. Mutual benefit societies
6. Group long-term care insurance
7. Other individual instruments: PIAS, SIALP, CIALP, life annuities based on real estate, reverse mortgage
   References

TOPIC 11: METHODS FOR DISTRIBUTING THE ACTUARIAL COST OF A PENSION PLAN

1. Concepts and definitions
2. Total actuarial cost
3. Methods for distributing the actuarial cost of a pension plan
   3.1. Accrued benefit method
   3.2. Projected benefit method
4. Amortization of the supplementary cost
   4.1. Methods for amortizing the supplementary cost
   4.2. Methods for allocating to the participant
5. Rebalancing plans

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Classroom practices	30,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	30,00
Independent study and work	60,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

During the course, the program content will be covered by alternating theoretical material with exercises and practical case studies. Various assignments will be proposed, which students must submit in the manner and by the deadlines specified throughout the course. To this end, all available resources (whiteboard, transparencies, projector, computer, etc.) will be used as needed and as deemed most

appropriate to achieve the course objectives.

In general, theoretical classes will be delivered using the lecture method, where the instructor will highlight the key aspects of each topic and guide students¿ study through the relevant bibliography, which must be consulted to complete and deepen understanding of the subject.

Practical classes will involve presenting questions and exercises applied to the economic, financial, and actuarial fields, which students must solve, including, where appropriate, the necessary modeling and discussion of the solution.

Some practical classes will be supported by computer tools, so that students can gain up-to-date experience with software packages and techniques that are increasingly used in all the aforementioned areas.

In practical classes, questions and problems previously introduced in the theoretical sessions will be solved, except in certain cases where, due to the practical nature of the topic, the material will be taught only in the practical session.

Group work will be carried out whenever possible.

Teaching materials will be available through the virtual classroom at https://aulavirtual.uv.es.

EVALUATION

The course will be assessed based on:

- A written exam, which may include both theoretical questions and problems and/or real cases. It could also be entirely multiple-choice and/or include some multiple-choice questions.
- The activities carried out by the student during the course, such as preparing assignments, solving exercises or problems, taking quizzes, submitting reports, oral presentations, etc.

The written exam will account for 50% of the final grade, and continuous assessment will make up the remaining 50%. In any case, a minimum grade of 5 out of 10 is required to pass the course, and the written exam must reach a minimum score (5 out of 10).

To be assessed, activities and assignments must be submitted on the date and in the manner specified for each.

Notes:

-Grades obtained from assignments and continuous assessment during the course will be retained if the student does not pass the course in the first sitting (it will not be possible to submit missed or failed

assignments for this sitting after the course has ended).

-The same assessment criteria will apply in the second sitting as in the first.

REFERENCES

VIDAL-MELIA, C. (2025): Course notes. Mimeograph. The updated course notes are available in the virtual classroom. Each topic includes its reference bibliography.