ACTUARIAL MATHEMATICS I (30 hours)

1. Straightforward functions involving two lives
    - Introduction
    - Review of single life functions (notation and basic results)
    - Basic definitions (joint life functions)
    - Evaluation of the probabilities of death or survival of either or both of two lives
    - Present values of joint life and last survivor assurances and annuities, of contigent assurances, of reversionary annuities; including the corresponding expected values which depend upon term
    - Annuities payable more frequently than annually

2. Use of straightforward functions involving selection
    - quick review of the notation and results from subject: survival models; on the use of select mortality functions

3. Variable benefit, disability and long term care contracts
    - Describe and state the main objects of the various variable benefit contracts
    - Develop the net future loss random variable for the contracts above, and calculate the net premium and the net premium prospective reserve for these contracts

4. Expenses and bonuses of life insurance contracts
    - Describe the types of future expenses for life insurance contracts; include the influence of inflation
    - Describe the types of bonus on with-profit contracts (UK experience!)

5. Gross premiums and reserves for fixed and variable benefit contracts
    - Define the gross future loss random variable for standard contract types
    - Calculate the gross premium under various assumptions
    - The gross premium retrospective reserve and prospective reserve; their relationship and coresponding calculations
    - Recursive relation between successive annual reserves
    - The Zillmer adjustment and its effects

6. The technique of discounted emerging costs
    - Evaluate expected cash flows. Examples.
    - Profit tests for annual premium contracts; with applications on determining premiums and determining reserves
    - Pricing and reserving bases and their effect on a profit test
    - Multiple decrement service table for pensions calculations
    - Salary-related pensions benefits and contributions

7. The technique of asset shares in the context of life insurance contracts
    - Asset shares for life insurance contracts and their relationship to retrospective reserves and bonus distribution

8. Alterations to contracts
    - Calculate the benefits on the early termination of a contract, including transfer, and the premium of benefits after a change in the terms of a contract

9. Costs of guarantees under life insurance contracts
    - Investment guarantees
    - Mortality options; valuation (North American method and conventional method)

10. Mortality; selection and standardization
    - Overview of the basic factors (from subject: survival models)
    - Selection in life assurance and pension business
    - Risk classification in life insurance
    - Use of single figure indices to summarise and compose mortality levels

11. The process of population projection and its main determinants
    - Basic mathematical models of population projection
    - Fertility rates

12. Valuation of benefits under a disability insurance contract
    - Valuing disability benefits
    - "Manchester-Unity" approach to disability

Literature:

1. H.U. Gerber, *Life Insurance Mathematics,* Springer-Verlag Berlin Heidelberg and Swiss Association of Actuaries Zürich, 1990.
2. N.L Bowers *et al.*, *Actuarial Mathematics,* 2nd edition, Society of Actuaries, 1997.
3. B. Benjamin, J.H. Pollard, *The Analysis of Mortality and Other Actuarial Statistics,* 3rd edition, Institute of Actuaries and Faculty of Actuaries, 1993.
4. A. Neill, *Life contingencies*, Heinemann, 1977.
5. P.M. Booth *et al.*, *Modern actuarial theory and practice*, Chapman & Hall, 1999.
6. *Subject*105: *Actuarial Mathematics 1*, *Core Reading 2000*, Faculty and Institute of Actuaries
7. *Subject*104: *Survival Models*, *Core Reading 2000*, Faculty and Institute of Actuaries