BHATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI-24.

P.G. DIPLOMA IN ACTURIAL SCIENCE

Revised Syllabus

(Applicable to the candidates admitted from the academic year 2005 - 2006 onwards)

CONDITIONS FOR ADMISSION

Graduates in Science with Mathematics or Statistics as major or allied subjects OR Graduates in commerce with Mathematics / Statistics as allied subjects.

SCHEME OF EXAMINATIONS

Semester	Title of the Paper	Inst. Hrs/Wk	Exam Hours	Marks Int.	Marks Ext.	Total
I	Paper I – Statistical Modelling – I	6	3	25	75	100
	Paper II – Financial Mathematics – I	6	3	25	75	100
	Paper III – Survival Models	6	3	25	75	100
	Paper IV – Contingencies	6	3	25	75	100
	Paper V – Economics	6	3	25	75	100
II	Paper VI – Statistical Modelling – II	6	3	25	75	100
	Paper VII – Financial Mathematics – II	6	3	25	75	100
	Paper VIII – Actuarial Mathematics	6	3	25	75	100
	Paper IX – Corporation Finance	6	3	25	75	100
	Paper X – Project Work (Dissertation 75 marks and viva voce 25 marks)	6	-	-	-	100
	TOTAL MARKS					**1000**

Note : Project work is to commence at the beginning of the second semester under the supervision of a staff member and the project work must be submitted at the end of the second semester.

Question Paper Pattern

* No choice
* 5 Questions each consists of two / three parts and marks for each question is 15
* One question from each unit shall be chosen.

First Semester

Paper – I - Statistical Modelling – I

Unit – I

Summarize as appropriate the main features of a set of data – Definition and Determination of Mean, Median and Mode for a given set of data – Definition and determination of Variance and Standard Deviation for a given set of data – Probabilities and simple problems.

Unit – II

Explain the concepts of Random variable – Probability distribution – distribution function – Expected values – Variance and higher moments – Calculation of Expected values and probabilities associated with the distributions of random variables.

Unit – III

Define a probability generating function (PGF) – Moment generating function (MGF) – a cumulant generating function (CGF) and cumulants – Derivation of PGFs, MGFs and CGFs in simple cases and use them to evaluate moments.

Unit – IV

Explain the concepts of independence and convolution – Use of generating functions to establish the distribution of linear combinations of independent random variables – Standard discrete and continuous distributions and their PGFs/MGFs and mean and variance.

Unit – V

Compound distribution and its application, Chebyshev's Inequality – Central Limit Theorem and its applications.

Books for Reference :

1. John E Freund's Mathematical Statistics – Miller, Irwin; Miller, Marylees; (Freund, John E)- 6th Edition – Prentice Hall International, 1999 – ISBN; O 13 9741550 Available from the Publications Unit
2. ASI/IOA study Materials.

Paper – II – Financial Mathematics – I

Unit - I

Rates of interest – Simple and Compound interest rates – Effective rate of interest – Accumulation and Present value of a single payment – Nominal rate of interest – Constant force of interests δ – Relationship between these rates of interest – Accumulation and Present value of single payment using these rates of interest – accumulation and present value of a single payment using these symbols – when the force of interest is a function of †, $\delta(\dagger)$. Definition of $A(t_1, t_2)$, $A(\dagger)$, $\nu(t_1, t_2)$ and $\sqrt{(\dagger)}$. Expressing accumulation and present value of a single payment using these symbols – when the force of interest is a function of †, $\delta(t)$.

Unit – II

Series of Payments (even and uneven) – Definition of Annuity (Examples in real life situation) – Accumulation and Present values of Annuities with level payments and where the payments and interest rates have same frequencies – Definition and Derivation of $a_{n\urcorner}$, $s_{n\urcorner}$, $\circ a\circ_{n\urcorner}$, $\circ\, s_{n\urcorner}\circ$. Definition of Perpetuity and derivation for $a_{\infty\urcorner}$ and $\circ a_{\infty\urcorner}\circ$, - Examples – Accumulations and Present values of Annuities where payments and interest rates have different frequencies. Definition and derivation of $a^{(p)}{}_{n\urcorner}$, $\circ a^{\circ(p)}{}_{n\urcorner}$, $s^{(p)}{}_{n\urcorner}$, $\circ s^{\circ(p)}{}_{n\urcorner}$.

Unit III

Increasing and Decreasing annuities – Definition and derivation for $(Ia)_{n\urcorner}$, $(Is)_{n\urcorner}$ and $(Da)_{n\urcorner}$ - Annuities payable continuously – Definition and derivation of $a_{n\urcorner}$, $(Ia)_{n\urcorner}$, $s_{n\urcorner}$, $(Is)_{n\urcorner}$ - Annuities where payment are increasing continuously and payable continuously – definition and derivation of $(Ia)_{n\urcorner}$, $(Is)_{n\urcorner}$.

Unit IV

Loan schedules – Purchase price of annuities net of tax – Consumer credit transactions.

Unit V

Fixed interest securities – Evaluating the securities – Calculating yields – The effect of the term to redemption on the yield – Optional redemption dates – Index linked Bonds – Evaluation of annuities subject to Income Tax and capital gains tax.

Books for Reference :

1. An introduction to Mathematics of Finance, McCutcheon, J.J., Scott, William F. London Heinemann, 1986-463 pages.
2. ASI/IOA Study materials.

Paper – III – Survival Models

Unit – I

Concept of Survival Models

Unit – II

Estimation procedures of Life time Distributions – Cox Regression model – Nelson and Aalen Estimates.

Unit – III

Describe statistical models of transfers between multiple states – Processes with single or multiple decrements – Relationships between probabilities of transfer and transition intensities.

Unit – IV

Maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.

Unit – V

Binomial and Poisson models of mortality – MLE for probability of death – Comparison of the Binomial models with the Multi state models.

Books for Reference :

1. The analysis of mortality and other actuarial statistics by Benjamin, B.Pollard, J.H. 3rd Edition, Faculty and Institute of Actuaries, 1993-519 pages.
2. Survival Models and data analysis by Elandt-Johnson, Regina C; Johnson, Norman L. 2nd Edition, John Wiley, 1999, 476 pages.
3. ASI/IOA Study Materials.

Paper – IV – Contingencies

Unit – I

Simple Assurance and Annuity contracts – Mean and variance of the present value of the payments under these contracts assuming constant deterministic interest rates – Expected present values and variances of simple benefits by table look-up or by using life tables – Calculation of Net premium Gross Premium for fixed and variable benefits.

Unit – II

Annuities payable more frequently than once a year – Continuous annuities – Assurances payable on death – Relations between annuities and assurances – Premiums payable im times a year – Increasing and Decreasing Assurances.

Unit – III

Nature of Reserves – Prospective and Retrospective Reserves – Further Expressions for Reserves – Relationship between successive Reserves – Continuous Reserves.

Unit – IV

Paid-up Policies – Surrender values – Bonus: With Profit Assurances – Children's Deferred Assurances.

Unit – V

Return of Premiums with and without interest on Deaths – Alternations in Policies – Extra Risks – Loading for Extra risks.

Books for Reference :

1. Contingencies by – by Neill Alistaire, Heinemann, London.
2. Life Insurance Mathematics by Gerber, Hans U.3rd Edition, Springer, Swiss Association of Actuaries, 1997.217 pages.
3. ASI/IOA Study materials.

Paper – V – Economics

Unit I

Interaction between supply and demands in the provisions of a product and the way in which equilibrium market prices are determined.

Unit II

Elasticity of demand and supply – Effects on market of different levels of elasticity.

Unit III

Explaining how rational utility maximizing agents make consumption choices.

Unit IV

Discussion on how an Insurance System contributes to individual welfare through reducing the financial impact of future events on the individual.

Unit V

Description of how profit maximizing firms make short run and long run production choices.

Books for Reference :

1. Economics : IOA/ASI Study materials
2. Economics by Begg, David K.H., Fishor, Stanby;
3. Dornbusch, Rudiger, 7th Ed., McGraw Hill.

Second Semester

Paper – VI – Statistical Modelling II

Unit – I

Concepts of random sampling – Statistical interference and sampling distribution – Stating and using sampling distributions.

Unit – II

Main methods of estimation – Main properties of estimators – Construction of confidence intervals for unknown parameters.

Unit – III

Test of Hypotheses- Investigation of linear relationships between two or more variables using correlation analysis.

Unit – IV

Concepts of Analysis of variance – one-way and two – way factors.

Unit – V

The concept of SQC. Chance and assignable causes of variation. Tools of SQC – X, R and C-Charts.

Books for Reference :

1. John E Freund's Mathematical Statistics – Miller, Irwin; Miller, Marylees; (Freund, John E) – 6th Edition – Prentice Hall International, 1999 – ISBN; O 13 9741550. Available from the Publications Unit.
2. S.C.Gupta and V.K.Kapoor: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
3. ASI / IOA Study materials.

Paper – VII – Financial Mathematics – II

Unit – I

Investment Project Appraisal – Discounted Cash flow techniques – DPP (Discounting Payback Period) – MWRR, TWRR, LIRR – Yields on funds.

Unit – II

Investment and Risk characteristics of different types of Assets for Investment for investment purposes.

Unit – III

Delivery price and the value of a Forward contract using arbitrage free pricing methods.

Unit – IV

Term structures of interest rates – n-year spot rates & n-year forward rates – DMT & Volatility – Convexity – Redington's Immunization Theory.

Unit – V

Simple Stochastic interest rate Models – Sn, An, Mean d and variance of Sn and An – Problems.

Books for Reference :

1. An introduction to Mathematics of Finance, McCutcheon, J.J., Scott, William F. London Heinemann, 1986-463 pages

2. Mathematics of Compound interest, Butcher, M.V., Nesbitt, Cecil J. Ulrich's Books, 1971, 324 pages
3. ASI/IOA Study Materials

Paper – VIII – Actuarial Mathematics

Unit I

Concept of Decision theory and its applications – Concepts of Bayesian Statistics – Calculation of Bayesian Estimators.

Unit II

Calculate probabilities and moments of loss distributions both with and without simple reinsurance arrangements – Construct risk models appropriate to short term insurance contracts and calculate MGFs and moments for the risk models both with and without simple reinsurance arrangements – Calculate and approximate the aggregate claim distribution for short term insurance contracts.

Unit III

Explain the concept of ruin for a risk model – Calculate the adjustment coefficients and state Lundberg's inequality – Describe the effect on the probability of ruin of changing parameter values and of simple reinsurance arrangements.

Unit IV

Describe and apply the fundamental concepts of credibility theory – Describe and apply the fundamental concepts of simple experience rating systems – Describe and apply techniques for analyzing a delay (or run-off) triangle and projecting the ultimate position.

Unit V

Explain the fundamental concepts of a generalized linear model (GLM), and describe how a GLM may be applied.

Books for Reference :

1. Introductory Statistics with applications in General Insurance – Hossact, Ian B; Pollard, John H; Zenhwirth, Benjamin. 2nd Edition, Cambridge University Press.
2. Loss Models : From data to decisions Klugman, Stuart Aetal. John Wiley.
3. Practical Risk theory for Actuaries. Daykin Chris, D; Pentikainen, Teivo; Pesonen, Mart Chapman & Hail, 1994-545 pages
4. ASI/IOA Study materials.

Paper IX – Corporation Finance

Unit I

Corporation Finance – Sources of Finance – Equity shares preference shares – Debentures – Types – Convertible debentures Global Depository receipts – Warrants – Institutional Finance.

Unit II

New Issue Market – Initial Public Offer – Book Building Right issue – Stock exchanges – Trading – Screen based Trading – Derivative markets.

Unit III

Financial Statement Analysis – Ratio Analysis – Analysis of Liquidity, Profitability, Solvency, Common size statements – Capital Budgeting - Methods of Capital Budgeting.

Unit IV

Cost of Capital – Determination of costs of different sources of finance – equity – preference shares – debentures / long –term debt – weighted average cost of capital.

Capital structure – Determination of Capital structure – Financial leverage and its effect on earnings of shareholders.

Unit V

Personal Investments – Types of Investment – Features objectives of Investment Management – Investment Institutions – Mutual Funds - Types of Schemes – Pension Funds.

Books for Reference :

1. ASI/IOA Study materials.
2. Financial Management – Shame & Gupta. Kalyani Publishers.
3. Financial Management I.M.Pandey Vikas Publishing House.

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