UNIVERSITY OF MADRAS
DEPARTMENT OF STATISTICS

M.Sc., (Actuarial Science) Revised Syllabus (w.e.f. 2013-2014)

CORE COURSES

Course Code	Title of the Course	C/E/S	L	T	P	C
I SEMESTER						
MSI C 201	Probability Theory	C	3	1	0	4
MSI C 202	Financial Mathematics – I	C	3	1	0	4
MSI C 203	Probability Distributions	C	3	1	0	4
MSI C 218	Finance and Financial Reporting	C	3	1	0	4
	Elective 1	E	2	1	0	3
	Elective 2	E	2	1	0	3
UOM S001	Soft Skill	S				2
II SEMESTER						
MSI C 206	Statistical Inference	C	3	1	0	4
MSI C 207	Financial Mathematics – II	C	3	1	0	4
MSI C 208	Life Contingencies – I	C	3	1	0	4
MSI C 209	Computational Laboratory - I	C	0	0	2	2
	Elective 3	E	2	1	0	3
	Elective 4	E	2	1	0	3
UOM S002	*Soft Skill*	S				2
III SEMESTER						
MSI C 210	Stochastic Modeling	C	3	1	0	4
MSI C 211	Risk Models	C	3	1	0	4
MSI C 212	Life Contingencies – II	C	3	1	0	4
MSI C 213	Financial Economics	C	3	1	0	4
	Elective 5	E	2	1	0	3
	Elective 6	E	2	1	0	3
UOM S003	*Soft Skill*	S				2
UOM I001	*Internship*	S				2
IV SEMESTER						
MSI C 214	Joint Life and Pension Benefits	C	3	1	0	4
MSI C 215	Corporate Financial Management	C	3	1	0	4
MSI C 216	Computational Laboratory - II	C	0	0	2	2
MSI C 217	Project & Viva voce	C		6	0	6
	Elective 7	E	2	1	0	3
UOM S004	Soft Skill	S				2

B – ELECTIVE COURSES:

Course Code	Title of the Course	C/E/S	L	T	P	C
MSI E 201	Object oriented programming with C++	E	2	1	0	3
MSI E 202	Principles of Economics	E	2	1	0	3
MSI E 204	Numerical Methods	E	2	1	0	3
MSI E 205	Survival and Markov Models	E	2	1	0	3
MSI E 207	Resource Optimization Principles	E	2	1	0	3
MSI E 209	Principles and Practice of Insurance	E	2	1	0	3
MSI E 210	Computer Based Statistical Analysis	E	2	1	0	3

Note: A student has to take all core courses offered by the department, minimum of 20 credits for electives and 10 credits for soft skills. In total a student has to require 90 credits to qualify for the award of PG degree.

MSI C 201: PROBABILITY THEORY

UNIT 1 : Sample space – events. Random variables – distribution functions and its properties – moments – expectation – variance – conditional probability – Baye's theorem – computational probabilities – simple problems from Industrial and Actuary.

UNIT 2 : Moment generating function – pgf – cumulant generating functions – evaluation of moment using these functions – functions of random variables – simple applications.

UNIT 3: Characteristic functions – properties – inversion formulae – uniqueness theorem – moments problem – simple problems.

UNIT 4: Independence – pair wise and complete independence - convolution - conditional expectation - simple problems.

UNIT 5: Chebychev's inequality – simple applications – central limit theorems (iid and id) – normal approximation – simple applications.

Books for Study and Reference:

Hogg,R.V. and Craig,T.G.(1984): Fundamentals of Mathematical Statistics

Ross,Sheldon,M.(1984): *A First Course in Probability*, 2nd ed. McMillan, New York.

Freund, JE (1998) : *Mathematical Statistics*, Prentice Hall International\

MSI C 202   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 interest δ - Relationships 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 t, $\delta(t)$. Definition of $A(t_1, t_2)$, $A(t)$, $\upsilon(t_1, t_2)$ and $\upsilon(t)$. Expressing accumulation and present value of a single payment using these symbols - when the force of interest is a function of t, $\delta(t)$.

UNIT II: Series of Payments(even and uneven) - Definition of Annuity(Examples in real life situation) Accumulations and Present values of Annuities with level payments and where the payments and interest rates have same frequencies - Definition and Derivation of $a_{\overline{n|}}$, $s_{\overline{n|}}$, $\ddot{a}_{\overline{n|}}$, $\ddot{s}_{\overline{n|}}$, Definition of Perpetuity and derivation for $a_{\overline{\infty|}}$ and $\ddot{a}_{\overline{\infty|}}$ - increasing and Decreasing annuities – Definition and derivation for $(Ia)_{\overline{n}|}$, $(Ia)_{\overline{\infty|}}$, $(I\ddot{a})_{\overline{n|}}$ $(I\ddot{a})_{\overline{\infty|}}$ $(Is)_{\overline{n|}}$ $(I\ddot{s})_{\overline{n|}}$ and $(Da)_{\overline{n|}}$ $(D\ddot{a})_{\overline{n|}}$

UNIT III: Accumulations and Present values of Annuities where payments and interest rates have different frequencies. Definition and derivation of $a_{\overline{n|}}^{(p)}$, $\ddot{a}_{\overline{n|}}^{(p)}$, $s_{\overline{n|}}^{(p)}$, $\ddot{s}_{\overline{n|}}^{(p)}$ Annuities payable continuously - Definition and derivation of $\overline{a}_{\overline{n|}}$, $(I\overline{a})_{\overline{n|}}$, $\overline{s}_{\overline{n|}}$, $(I\overline{s})_{\overline{n}|}$ - Annuities where payments are increasing continuously and payable continuously – definition and derivation of $(\overline{I}\overline{a})_{\overline{n}|}$, $(\overline{I}\overline{s})_{\overline{n}|}$. Annuities of types: $\int_{t_1}^{t_2} \rho(t)\, v(t)\, dt$

UNIT IV: Loan schedules – Determination of Capital and interest content of a particular installment – Loan o/s After 't' installments - 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 – Effect of inflation over yield

Books for Study and Reference:

Institute of Actuaries ActEd. Study Materials.

McCutcheon, J.J., Scott William, F. (1986) : An introduction to Mathematics of Finance, London Heinemann

Butcher, M.V., Nesbitt, Cecil. (1971) : Mathematics of compound interest, Ulrich's Books.

Bowers, Newton L.et al (1997): Actuarial Mathematics, Society of Actuaries, 2nd ed.

MSI C203   PROBABILITY DISTRIBUTIONS

UNIT I: Discrete distributions – Binomial, Poisson, Multinomial, Hyper geometric, Geometric, discrete uniform – their characteristics and simple applications.

UNIT II: Continuous distributions – Uniform, Normal, exponential, Gama, Weibull, Pareto, lognormal, Laplace, logistic distributions – their characteristics and applications.

UNIT III: Sampling distributions t, χ^2 and F distributions and their interrelations and characteristics – applications in Tests of significance.

UNIT IV: Truncated distribution, Convolutions of distributions, compound binomial Poisson and negative binomial distributions – their applications.

UNIT V: Order statistics and their distribution – distribution of sample median and mid range – sample generation from basic discrete and continuous distributions.

Books for Study and Reference:

Freund, JE (1998) : Mathematical Statistics, Prentice Hall International.

Rohatgi, V.K. and Ebsanes Saleh, A.K. Md. (2002) : An introduction to Probability and Statistics, 2nd Ed., John Wiley & Sons, Inc.

Mood, A.M. Graybill, F.A. and Boes, D.C. (1974) : An introduction to the theory of Statistics, 3rd Ed., McGraw Hill Book Company.

ASI Materials.

MSI C218   FINANCE AND FINANCIAL REPORTING

UNIT I: Accounting Principles – Concepts – Standards – Journals – Ledgers and Statement of Accounts – Guiding Principles and steps for good Reporting

UNIT II: Scope of Financial Management – Functions of Finance Management – Finance Organization – Roles – Agency Theory – Sources of Long, Medium and Short term Finance.

UNIT III: Indian Financial Environment – Types of Business Entities – Limited Companies – Documentation – Legal aspects – Taxation – corporate and Personal – Sources of Finance – Financial Institutions – Banks – Insurance Companies – Financial Markets

UNIT IV: Financial Instruments – Valuations of Bonds and Stocks –Use of derivatives – Futures and Options – Issue of Shares – Capital Structure and Cost of Capital – Weighted Average Cost of Capital.

UNIT V: Company Valuation – Traditional, Net Income and Net Operating Income Approaches – M M arbitrage argument – Dividend Policy – Dividend Decisions and effect on valuation of the firm – Walter's, MM Models – Average and Personal Tax of Investors.

Books for Study and Reference:

Samuels, J.M., Wilkes, F.M., Brayshaw, R.E. (1995): Management of company finance, International Thomson, 6th ed.

Brealey, Richard, A. (1999): Principles of Corporate finance, McGraw Hill, 6th Ed.

Holmes, Geoffrey, Sugden, Alan (1999): Interpreting company reports and accounts, Prentice Hall, 7th Ed.

Pandey, I.M.: Financial Management.

Prasannachandra: Financial Management

Kuchhal: Financial Management

Moshal: Management Accounting Institute of Actuaries ActEd. Study Material

Maheswari, S.N., Maheswari, S.K. (2006): Accounting For Management, Vikas Publishing, 1st Ed.

Gupta, M.P., Agarwal, B.M. (2007) Grewal's Accounting, S.Chand & Company Ltd.,

MSI C 206   STATISTICAL INFERENCE

UNIT I: Estimation Methods : Properties of a good estimator – unbiasedness – efficiency – Cramer Rao bound – sufficiency – Methods of estimation – Methods of moments – Maximum likelihood method – minimum chi-square –

UNIT II: Parametric Inference: Tests of Hypotheses – Large sample and Exact – chi-square tests; Tests of significance- p value and its interpretation: Confidence sets and confidence interals – shortest confidence intervals

UNIT III: Non parametric inference-The Wilcoxon signed rank test – The Mann-Whitney – Wilcoxon Rank sum test – the runs test – chi-squire test of goodness of fit test – Kolmogorov-Smirnov goodness of fit test – Kruskal Wallies test – Friedman test.

UNIT IV: Linear models, Estimation – Least square estimation of parameters and properties (BLUE), Gauss Markov theorem – Estimation by MLE, Testing – general linear hypothesis and subhypothesis, Interval estimation – Residual analysis(Chapter 2 , 3 and 4).

UNIT V: Generalized linear models – models with Binary response variable, estimation and testing in a logistic regression model, Poisson regression, link functions, estimation and inference in the GLM (Chapter 13).

Books for Study and Reference:

Rohatgi, V.K. and Ebsanes Saleh, A.K. Md. (2002): An introduction to Probability and Statistics, 2nd Ed., John Wiley & Sons, Inc.

Mood, A.M. Graybill, F.A. and Boes, D.C. (1974): An introduction to the theory of Statistics, 3rd Ed., McGraw Hill Book Company.

D.C. Mongomery et al (2003) -. Introduction to Linear Regression Analysis (3rd ed.) Wiley & Sons

MSI C207   FINANCIAL MATHEMATICS – II

UNIT I: Investment Project Appraisal – Discounted Cash flow techniques. – Accumulated profit, pay beck period, preference shares & other equity types of finance – fixed interest.

UNIT II: Investment and Risk characteristics of different types of Assets for Investment for investment purposes, term to redemption on the price and yield – income tax – equities – real rate of interest in inflation – capital gain tax.

UNIT III: Delivery price and the value of a Forward contract using arbitrage free pricing methods- no arbitrage assumes – forward contract.

UNIT IV: Term structures of interest rates- discrete & continuous time rate – interest rates – convexity & immunization.

UNIT V: Simple Stochastic interest rate Models- simple models – log normal dist.

Books for Study and Reference:

Institute of Actuaries ActEd. Study Materials.

McCutcheon, J.J., Scott William, F. (1986): An introduction to Mathematics of Finance, London Heinemann

Butcher,M.V.,Nesbitt, Cecil,J. (1971) : Mathematics of compound interest, Ulrich's Books.

Bowers, Newton L.et al (1997): Actuarial Mathematics, Society of Actuaries, 2nd ed.

Van Home and Wachowicz: Fundamentals of Financial Management, Prentice Hall India.

MSI C208   LIFE CONTINGENCIES - I

UNIT I: Life assurance contracts Pricing of life insurance contracts – whole life, team, pure endowment, deferred (S.A. paid at the end of the year death and an immediately.

UNIT II: Life annuity contracts, Whole life (arrear and advance), Temporary (arrear and advance), deferred, deferred annuities due, continuous.

UNIT III: (i) Life Tables, Life Table -Functions at non-integer ages – UDD, CFM, Select mortality. Evaluation of assurances and annuities, Evaluating assurance benefits, annuity benefits – premium conversion equations – variance of benefits – Annuities payable in times a year – retrospective accumulations – pure, term annuity.

UNIT IV : Net premiums & provisions, Premium net premium, loss random variable researches, prospective, retrospective, equality reserve conventions, net premium reserves, recursive calculation, Thiele's differential equation - derivation.

UNIT V: Variable benefits & with profit policies, Variable payments, varying at constant rate, amount with profit contracts, bonus – net premiums and net premium reserves for with profit contracts.

Books for Study and Reference:

Institute of Actuaries Acted. *Study Materials*.

Neill, Allistair (1977): *Life Contingencies, Heinemann.*

Gerber, Hans U. (1997) : *Life insurance Mathematics,* Springer, Swiss Association of Actuaries 3rd edition.

MSI C 209 COMPUTATIONAL LABORATORY-I

This subject is based their core papers and the problems should be solved through Excel.

MSI C210   STOCHASTIC MODELING

UNIT I: Stochastic process: Definitions and classification (based on state space and time) of Stochastic Processes – various types of stochastic processes. Markov chains: n-step TPM – classification states canonical representation of TPM – finite MC with transient states – No Claim Discount policy – Accident Proneness.

UNIT II: Irreducible Markov Chain with ergodic states : Transient and limiting behaviour – first passage and related results – applied Markov chains – industrial mobility of labor – Educational advancement – Human resource management – term structure – income determination under uncertainty – A Markov decision process.

UNIT III: Simple Markov processes: Markov processes – general properties – Poisson processes – Birth problem – death problem – birth and death problem – limiting distribution. Flexible manufacturing systems – stochastic model for social networks – recovery, relapse and death due to disease – Health, sickness and Death model – Marital status.

UNIT IV: Stationary processes and time series – Stochastic models for time series – the auto regressive process – moving average process – mixed auto regressive moving average processes – time series analysis in the time domain – Box-Jenkins model for forecasting.

UNIT V: Brownian motion and other Markov processes – Hitting times – maximum variable – arc sine laws – variations of Brownian motion – stochastic integral – Ito and Levy processes – applications to Actuarial Science.

Books for Study and Reference:

Bhat, U.N. and Miller, G.K. (2002): Elements of applied stochastic processes 3rd ed. Wiley Inter, New York.

Brzezniak, Z and Zastawniak, T. (1998): Basic Stochastic Processes: A course through Exercises, Springer, and New York.

Grimmett, G., Stirzaker, D. (1992): Probability and Random Processes, Oxford University Press.

Kulkarni, V.G. (1995): Modelling and Analysis of Stochastic Systems, Thomson Science and Professional.

Ross, S.M. (1996): Stochastic processes, John Wiley & Sons, Inc., New York Institute of Actuaries: ActEd Study materials

MSI C211   RISK MODELS

UNIT-1: Decision Theory: Zero-sum two-player games – Domination - The Minimax criterion - Saddle points - Randomized Strategies – Statistical games – The Bayes criterion.Bayesian Statistics: Baye's theorem – Prior and Posterior distributions – Determining Posterior density – Continuous prior distributions – Conjugate priors – The Loss function – Three types of loss functions viz Quadratic loss , Absolute Error loss and All or nothing loss (Zero-one loss) Some Bayesian posterior distributions – Mixture distributions

UNIT – II: Loss distributions: MGFs of Basic loss distributions – Binomial distribution (n, p), Poissson distribution (λ), Negative Binomial distribution (r, p), Uniform distribution on (a, b) Exponential distribution (λ), Gamma distribution (α, λ), Normal distribution (μ, σ^2), Pareto (α, λ) and Generalised Pareto distributions (α, λ, k), log-normal distribution (μ, σ^2), Weibull distribution (c, γ), Burr distribution (α, λ), Estimation: Method of moments – Method Maximum Likelihood

UNIT – III: Reinsurance: Proportional Reinsurance – Non proportional reinsurance – Excess of loss reinsurance (insurer's angle) - Excess of loss reinsurance (reinsurer's angle) –Proportional reinsurance – The effect inflation over loss distribution – Estimation – Policy Excess

UNIT–IV: General features of a product Models for short term contracts: The basic model - Assumptions for the basic model – The collective risk model - Distribution functions and convolutions – MGF and moments of a compound distributions – The compound Poisson distributions – The compound Binomial distribution - The compound Negative Binomial distribution
 Aggregate claims distribution under proportional and excess loss of reinsurance – The Individual risk model – Parameter variability and uncertainty – Variability in a homogeneous portfolio - Variability in claim numbers and claim amounts and parameter Uncertainty.-

UNIT –V: Ruin theory: The surplus process – The probability of ruin in continuous time – The probability of ruin in discrete time – The probability of ruin in the short term – The Poisson and Compound Poisson process – Time to the first claim – Time between claims – Premium security loadings – The adjustment coefficient R and Lundberg's inequality – The adjustment coefficient for compound Poisson process – A lower bound for R - The effect of changing parameter values on finite and infinite time ruin probabilities - A formula for ψ(U) when F(x) is the exponential distribution - ψ(U,t) as a function of t – Ruin probability as function of initial surplus - Ruin probability as function of premium loading - Ruin probability as function of Poisson parameter – Reinsurance and Ruin (Proportional reinsurance and Excess loss of reinsurance) – Maximising adjustment coefficient under proportional reinsurance - Maximising adjustment coefficient under Excess loss of reinsurance

Books for Study and Reference:

Institute of Actuaries Acted. Study Materials.

Hossack, Ian B; Pollard, John H; Zenhwirth, Benjamin (1999): Introductory Statistics with applications in General Insurance, Cambridge University Press. 2nd Ed.

Klugman, Stuart A. et al. (1998): Loss Models: from data to decisions, John Wiley

Daykin Chris, D; Pentikainen, Teivo; Pesonen, Martti (1994): Practical Risk theory for Actuaries, Chapman & Hall.

MSI C212   LIFE CONTINGENCIES – II

UNIT I: Gross premiums and provisions-– gross future random loss-equivalence principle & simple criteria – gross premium reserves - constant mortality – with profit contract.

UNIT II: Profit Testing- unit & non-unit linked contract – types of cash flows – annual premium contract.

UNIT III: Determining provisions using profit testing- profit criteria.

UNIT IV: Factor affecting mortality & selections- mortality & morbidity – selection – life assurance & pension business – selective effects – types of risk – genetic information.

UNIT V: Single figure indices- crude mortality rate – direct & indirect standardized mortality – mortality ratio.

Books for Study and Reference:

Institute of Actuaries ActEd. Study Materials.

Benjamin, B. Pollard, J.H. (1993): The analysis of mortality and other actuarial statistics, Faculty and Institute of Actuaries, 3rd Ed.

Gerber, Hans U. (1997): Life insurance Mathematics, Springer, Swiss Association of Actuaries, 3rd Ed.

Booth, Philip M et al., (1999): Modern Actuarial Theory and Practice, Chapman & Hall.

Bowers, Newton L.et al (1997): Actuarial Mathematics, Society of Actuaries, 2nd Ed.

MSI C213: FINANCIAL ECONOMICS

UNIT I: Introduction to Financial Economics: - Recap of Utility Theory. The Efficient Markets Hypothesis: The three forms of EMH - The Evidence for or against each form of EMH, Measures of Investment Risk: - Measures of Risk - Relationship between Risk measures and returns.

UNIT II: Portfolio Theory: - Portfolio Theory - Benefits of Diversification, Models of Asset Returns: - Multifactor Models - The Single Index Model, Asset Pricing Models: - The Capital Asset Pricing Models (CAPM) – Limitations of CAPM – Arbitrage Pricing Theory (APT).

UNIT III: Introduction to valuation of derivative securities, the principle of no arbitrage, European Call and Put options, American options, factors affecting option prices, pricing forward contracts, Put call parity, The Greeks – delta, gamma, theta, Vega, rho and lambda.

UNIT IV: The binomial model – the share price and cash process, One period, Two period and n-period binomial trees, risk neutral probability measure, Black Scholes option pricing formula and assumptions, the PDE approach, implied volatility.

UNIT V: Introduction to behavioral finance, various theories governing investment decisions, caselets and case studies on the same.

BOOKS FOR STUDY AND REFERENCE:

Institute of Actuaries Acted, CT8 Study material.

Panjer, Harry, H. (1998) :Financial economics : with applications to investments, insurance and pensions.

The Actuarial foundations

Futures, Options and financial derivatives: John Hull, Prentice hall publication.

MSI C214 JOINT LIFE AND PENSION BENEFITS

UNIT I: Simple annuities and assurances involving two lives-– joint life – simple probabilities of 2 lives – p.v of 2 lives.

UNIT II: Contingent and reversionary benefits- contingent probabilities of death – p.v of contingent assurance and reversionary annuities – functions – annuity payments.

UNIT III: Competing risks- multiple state modeling – value benefits.

UNIT IV: Multiple decrement tables- service table – relationships.

UNIT V: Pension benefits- salary scales – salary related pension benefits – expected cash flows – commutation functions – valuing health & care insurance benefits – non-life contingencies.

Books for Study and Reference:

Institute of Actuaries Act.Ed. Study Materials.

Benjamin, B. Pollard, J.H. (1993): The analysis of mortality and other actuarial statistics, Faculty and Institute of Actuaries, 3rd Ed.

Booth, Philip M et al., (1999): Modern Actuarial Theory and Practice, Chapman & Hall.

Gerber, Hans U. (1997): Life insurance Mathematics, Springer, Swiss Association of Actuaries, 3rd edition.

MSI C215 CORPORATE FINANCIAL MANAGEMENT

UNIT I: Foundations of Finance – Time Value of Money – Concept of NPV, IRR and other measures. Concept of Risk and Return – Portfolio and Diversification – CAPM Model

UNIT II: Investment Analysis – Modern theory of Finance – Capital Budgeting Decision Rules – Capital Budgeting and Cash Flow Analysis – Capital Budgeting and Risk

UNIT III: Variance Analysis – Importance of Variance Analysis – Material Variance, Labor Variance, Overhead Variances – Accounting treatment for Variance.

UNIT IV: Financial Planning – Financial statement analysis – Ratio analysis – Leverage – Short term and long term financial decisions.

UNIT V: Special topics in finance – Mergers and Acquisitions and Corporate Governance – Derivatives – Options and Futures – Financial Ethics and Corporate Governance.

Books for Study and Reference:

Brealey, Myers and Marcus: Fundamentals of Corporate Finance, McGraw Hill.

Ross, Westerfield and Jordan: Fundamentals of Corporate Finance, Tata McGraw Hill.

Van Home and Wachowicz: Fundamentals of Financial Management, Prentice Hall India.

MSI C 216 COMPUTATIONAL LABORATORY- II

This subject is based their core papers and the problems should be solved through SPSS.

MSI C 217 PROJECTS AND VIVA VOCE

Course Outline:

The faculty will propose an array of problems in industrial / actuarial studies. Students may choose a problem from this list or propose of their own, provided a faculty member / Guide approves it.

Objectives : To provide written, oral and visual presentation skills -To develop team work.

On completion of the project work, each student is expected to

Submit a written document describing the results, mathematical developments, background material, bibliographical search etc.
Present orally in a seminar setting of the work done in the thesis. Submit the software (if relevant) with appropriate Documentation. The students will meet regularly with the project guide / adviser to work out problems that appear and adjust the goals and time frame accordingly.

ELECTIVE COURSES

MSI E201   OBJECT ORIENTED PROGRAMMING WITH C++

UNIT I: Principles of object oriented programming – beginning with C++ - Token, Expressions and Control structures.

UNIT II: Functions in C++ - Classes and objects, Constructors and Destructors – operator overloading and type conversions

UNIT III: Inheritance: Extending classes – Pointers, Virtual Functions and Polymorphism.

Books for Study and Reference:

Balagurusamy (1999): Object oriented programming with C++, Tata McGraw Hill Company Ltd., New Delhi, 16th reprinting.

Hubbard, J.R. (2000): Programming with C++ 2nd ed., McGraw Hill, New York.

MSI E202   PRINCIPLES OF ECONOMICS

UNIT I: Market Mechanism – Supply and Demand interaction – Determination of equilibrium Elasticity of demand and Supply – Rational utility and consumption choice

UNIT II: Costs Revenue and output – Market structure – short and long run equilibrium in different markets – perfect competition, Monopoly, Monopolistic competition.

UNIT III: Macro Economics – Concepts of GDP, GNP, NNP – methods of calculating National Income – problems – difficulties and uses of National Income Analysis. Propensity to consumer – multiplier – determinants of consumption, financial markets – Inflation types – interest rate and exchange rate.

Books for study and Reference:

Stonier and Hague: Economic Theory

Kovtsoyiannis: Modern micro economics ELBS publications.

Samuelson Paul & Norhaus William (1998): Economics, McGraw Hill.

Allen, R.G.D.: Mathematical analysis for Economics, Macmillan.

Panjer, Harry, H. (ed) (1998): Financial Economics with applications to investments, Insurance and pension. The Actuarial foundation.

MSI E204   NUMERICAL METHODS

UNIT I: Numerical computing and computers – Solving non-linear equations, Solving set of equations

UNIT II:, Interpolation and curve fitting.

UNIT III: Numerical differentiation and Numerical integration, Numerical solution of ordinary differential equations.

Books for Study and Reference:

Gerald, C.F. and Wheatley, P.O. (1994): Applied Numerical Analysis, Addison Wesley, New York, 5th Ed.

Press, W.B., Flannery, S. Teuddsky and Vetterling, W. (1989): Numerical Recipes in C :

The art of scientific computing. Rev. 1st ed., Cambridge University Press.

Rice, John, R. (1983): Numerical Methods, Software and Analysis, McGraw Hill,   New York.

Atkinson, K.E. (1978): An introduction to Numerical Analysis, Wiley & Sons, New York.

Sastry, S.S. (1987): Introductory methods of numerical analysis, Prentice Hall of India, New Delhi, (10th printing).

MSI E 205   SURVIVAL AND MARKOV MODELS

UNIT I: Concept of Survival Models, censored data, Estimation procedures of Life time Distributions – Cox Regression model – Nelson and Aalen Estimates

UNIT II: Two state Markov Model, Multi state Markov Models - Statistical Models of transfers between multiple states, Derivation of relationships between probabilities of transfer and transition intensities. Maximum Likelihood Estimators (MLE) for the transition intensities in models of transfers between states with piecewise constant transition intensities.

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

Books for Study and Reference:

Institute of Actuaries Acted. Study Materials.

Neill, Allistair (1977) : Life contingencies, Heinemann.

Elandt-Johnson, Regina C; Johnson, Norman L., 2nd ed. (1999) : Survival Models and data analysis, John Wiley.

Marubini, Ettore, Valsecchi, Marai Grazia, Emmerson, M. (1995) : Analysis of Survival data from Clinical Trials and observation of studies, John Wiley.

MSI E207   RESOURCE OPTIMIZATION PRINCIPLES

UNIT I: Linear programming problems - model formulation and graphical solution – various types of solutions – simplex method of solving linear programming –duality principles – dual simplex method.

UNIT II: Artificial variable techniques Big M method – two phase method – assignment problem – transportation problem – MODI method of finding optimal solutions.

UNIT III: Sequencing problem – replacement problems – game theory – zero sum games – graphical method – solution of games by LPP.

Books for Study and Reference:

Sharma, J.K. (1997): Operations Research, Theory and applications, Macmillan.

Taha, H.A. (1996): Operations Research, 5th edition, Prentice Hall of India, New York.

MSI E 209   PRINCIPLES AND PRACTICE OF INSURANCE

UNIT I: Concept of Risk- The concept of Insurance. Classification of Insurance- Types of Life Insurance, Pure and Terms- Types of General Insurance, Insurance Act, Fire, Marine, Motor, Engineering, Aviation and Agricultural - Alternative classification- Insurance of Property, Pecuniary interest, liability and person. Distribution between Life and General Insurance. History of Insurance in general in India. Economic Principles of Insurance – Insurance

regulatory and development Act. Legal Principles of Insurance- the Indian Contract Act, 1872- insurable interest - Utmost Good faith- indemnity- subrogation – Contribution- Proximate Cause - Representations- Warranties- Conditions. Theory of rating- Actuarial principles- Mortality Tables- Physical and Moral Hazard. Risk appraisal- Risk Selection- Underwriting. Reinsurance- Concept and Methods.

UNIT II: Life insurance organization: The Indian context. The distribution system, function of appointment and continuance of agency, remuneration to agents, trends in Life insurance distribution channels. Plans of Life Insurance – need levels, term life insurance increasing / decreasing term policy, whole life insurance, endowment insurance, money back endowment plan, marriage endowment plan, education annuity plan, children deferred assurance plans, annuities. Group insurance – nature of group insurance, types of group insurance, gratuity liability, group superannuating scheme, other group schemes, social security schemes. Other special need plan – industrial life insurance, salary saving scheme, disability plans – critical illness plans.

UNIT III: Application and acceptance – prospectus – proposal forms and other related documents, age proof, special reports. Policy document – need and format – preamble, operative clauses, proviso, schedule, attestation, conditions and privileges, alteration, duplicate policy. Premium, premium calculation, Days of grace, Non-Forfeiture options, lapse and revival schemes. Assignment nominations loans – surrenders, foreclosures, Married Women's property Act Policy, calculations. Policy claims, maturity claims, survival benefit payments, death claims, waiver of evidence of title, early claims, claim concession, presumption of death, Accident Benefit and Disability Benefit , settlement options, Valuations and Bonus, distribution of surplus. Types of re-insurance, exchange control regulations, payment of premia, payment of claims etc.

Books for study and Reference:

Neill, Alistair, Heinemann, (1977): Life contingencies.

Gerber, Hans, U. (1997): Life insurance mathematics, Springer, Swiss Association of Actuaries.

Booth,Philip,M.et al(1999):Modern Actuarial theory and practice, Chapman & Hall.

Daykin,Chris,D. et al(1994): Practical risk theory for Actuaries, Chapman and Hall.

Panjer, Harry,H. (1998) : Financial economics with applications to investments, Insurance and pensions.

The Actuarial foundation.

MSI E210: COMPUTER BASED STATISTICAL ANALYSIS

Unit I: R fundamentals – Components of R Console – Use of Packages – Data Types in R – Arithmetic, Relational and Logical Operators.

Unit II : Loop Structures – Conditional Structures – Functions.

Unit III: R Graphics – Creating simple graphic applications for Statistical and Actuarial problems -R packages for computing probabilities.

Books for Study and Reference:

1. Sudha Purohit; Sharad D Gore & Shailaja R. Deshmukh (2015) Narosa Publishing House, New Delhi
2. Jured P. Lander (2014) R for everyone, advance Analytics and Grpahics, Addison- Wesley, USA
3. Online help manuals and other materials available in R project site will form basis for the course.

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