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UNIVERSITY OF MUMBAI
No.UG/ 363 of 2005

CIRCULAR :

Attention of the Head, University Department of Statistics, the Principals of the affiliated colleges in Arts, Science and Commerce and Professor-cum-Director, Institute of Distance Education, is hereby invited to this office Circular No.UG/213 of 2005 dated 1st June, 2005 and they are hereby informed that the recommendation made by the Board of Studies in Statistics at its meeting held on 2nd January, 2005 has been accepted by the Academic Council at its meeting held on 5th February, 2005 vide item No.4.26 and subsequently approved by the Management Council at its meeting held on 16th July, 2005 vide item No.27 and that in accordance therewith syllabi, scheme of examination, standard of passing and fee structure relating to the Post-Graduate Diploma course in Applied Statistics with Software (PGDASS) and the Post-Graduate Diploma course in Acturial Science (PGDAS) has been passed as per appendix with following amended structure of fee for the Post-Graduate Diploma course in Applied Statistics with Software (PGDASS) and Post-Graduate Diploma course in Acturial Science (PGDAS) :-

Tuition Fees	:	Rs.35,000/- per annum
Library Fees	:	Rs. 2,000/- per annum
Laboratory Fees	:	Rs. 2,000/- per annum
Miscellaneous Fees	:	Rs. 1,000/- per annum

		Rs.40,000/-
Examination Fees	:	Rs. 1,000/-

Total	:	Rs.41,000/-
		=====

Mumbai 400 032
5th September, 2005

C. J. Datta
for REGISTRAR, 5/9

To,

The Head, University Department of Statistics, the Principals of the affiliated colleges in Arts, Science and Commerce and Professor-cum-Director, Institute of Distance Education.

A.C.4.26/05.02.05

M.C.27/16.07.05

NALG 363-A of 2005

5th September, 2005

Copy forwarded with compliments for information to :-

- 1) the Deans, Faculties of Arts, Science and Commerce,
- 2) the Chairman, Board of Studies in Statistics.

41/6/05
for REGISTRAR

Copy to :

The Director, Board of College and University Development, Deputy Registrar (Eligibility and Migration), the Director of students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar Administrative sub-centre, Ratnagiri, for information.

The O.S.D. cum- Controller of Examinations (10 copies), the F. & A.O. (Accounts Section), Fort (2 copies), Record Section (5 copies), Publication Section (5 copies), D.R., Enrolment (2 copies), D.R. (Statistical Unit), D.R., Accounts Section, Vidyanagari, (2 copies), D.R. (Affiliation Section) (2 copies), A.R., A.A. Unit (2 copies). He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council/Management Council referred to in the above Circular and that no separate A.T.R. will be sent in this connection. A.R. CONCOL (1 copy), BUCTU (2 copies), In-charge, Central Computing Facility (1 copy), D.R., I.D.E. (10 copies), , D.R., P.R.O., (2 copies), Supdt., Thesis Section (2 copies), Supdt., P.G. Section (2 copies), BUCTU (1 copy), Secretary, MUASA (1 copy), Dy. Acctt. (Unit V) (1 copy), Receptionist (1 copy), Telephone Operator (1 copy).

UNIVERSITY OF MUMBAI



Ordinances, Regulations and Syllabus
relating to
‘Post-graduate Diploma
in
Applied Statistics with Software’

(with effect from the academic year 2005-2006)

Introduction :

Statistics has become a vital tool of data analysis and valid inference in almost all fields in the present era. Statistical techniques are applied in Finance, Insurance, Marketing, Manufacturing, Social Sciences, Health Sciences and Software Designing etc. A huge Volume of data is generated in these fields every day. Processing and Management of this data has become a vital need of the hour. This necessitates a pertinent exposure to various Statistical Techniques to all the users.

Processing and management of this voluminous data using computerized Statistical packages has become essential in the current era.

Over the next three years industry sources expect the number of statistician in Private Sector to double. Demand for statistician is likely to intensify as new entrants in clinical trials and pharma industry look at India.

Hence the Board of Statistics resolved to evolve a "Post Graduate Diploma in Applied Statistics with Software" in its meeting held on 12/01/2005.

Ordinance and Regulation relating to "Post Graduate Diploma In Applied Statistics with Software".

O. 5489 : Title of the Course :

"Post Graduate Diploma in Applied Statistics with Software".

O. 5490 : Eligibility :

Graduate in any faculty from University of Mumbai or any other recognized University.

R. 4869 : Duration of the Course :

One year.

R. 4870 : Sanction Capacity :

50 Students.

R. 4871 : Fees Structure :

Rs. 40,000/- fee per year

Rs. 1,000/- Examination fee per student per year.

Remuneration to faculty :

Rs. 500/- per clock hour.

R. 4872 : Teacher's Qualification :

Co-ordinator :

M.A./M.Sc. Statistics with minimum five years teaching experience.

R. 4873 : Visiting Faculty :

M.A./M.Sc. Statistics with minimum five years teaching and/or Industrial experience.

Non-Teaching Staff :

Statistical Assistant :

M.A./M.Sc. Statistics

Computer Technician :
Diploma in Hardware and Software

Office Assistant :

Any graduate with computer knowledge

Peon :

S.S.C. Pass

R. 4874 : Teaching Hours :

45 clock hours per paper including Internal Assessment
(45 hours $\times$ 7 papers = 315) and 90 clock hours for Project (315 + 90 = 405 hrs).

R. 4875 : Practice Session :

30 clock hours per paper on computers.

R. 4876 : Scheme of Examination :

The evaluation of the performance of a student in each paper shall be based upon both internal and external examination. The external examination will be held only once at the conclusion of an academic term. The external examination will consist of SEVEN papers and each of THREE hours.

Subject	Title	Internal	External	Total
Paper I	Basic Statistics	40	60	100
Paper II	Marketing Research	40	60	100
Paper III	Communication and Presentation Skills	40	60	100
Paper IV	Decision Making and Forecasting	40	60	100
Paper V	Quality Management	40	60	100
Paper VI	Health and Social Sciences	40	60	100
Paper VII	Multivariate Techniques	40	60	100
Paper VIII	Project Work	100	—	100

First term will consist of first four papers and Second term will consist of next three papers and project work.

Infrastructure required :

- Networking of computer in lab and Internet facility
- Availability of Statistical Software SAS/SPSS/MINITAB
- Colour Printers
- CD Writer
- LCD projector and White Boards
- Scanner
- Air Conditioner for Computer Laboratory
- Audio System.

Detailed Syllabus for the Subject :

PAPER-I BASIC STATISTICS

1. **Introduction** : Scope and future of Statistics in different areas of business like Marketing, Finance, Production, Personnel, Distribution.
2. **Data and its types** :
Qualitative and Quantitative Data :
Scales of measurement : Nominal, Ordinal, Interval, Ratio;
Cross-sectional and Time series data;
Criterion of good measurement; Reliability, Validity, Sensitivity, Versatility and Ease of Response.
3. **Data presentation** :
Tabular presentation of data-frequency table;
Graphical presentation of data-bar charts, histogram, pie charts, frequency/relative frequency curve, ogives, stem and leaf display;
Descriptive Statistics : Measures of central tendency-arithmetic, geometric and harmonic mean, median, quartiles, deciles, quintiles, percentiles, mode; Measures of dispersion-range, mean deviation, inter-quartile range, variance, standard deviation, coefficient of variation; Measures of skewness and kurtosis; Cross-tabulation and scatter diagram.
4. **Measures of relative location and detecting outliers** :
Chebychev's theorem; Box and Whiskers plot.
5. **Various Measures of association and correlation** :
Pearson's rank correlation, partial correlation, multiple correlation; Spurious correlation.
6. **Probability** :
Counting rules -multiplicative, combinations, permutations;
Meaning of sample space, event and its complements, experiment, outcomes;
Methods of computing probabilities-classical, experimental, judgemental;
Marginal and conditional probabilities;
Additive and multiplicative rules of probabilities;
A priori and posterior probabilities, Bayes' theorem.
7. **Random variables and their probability distributions** :
Discrete and continuous variables, meaning of probability distribution of a variable ; Discrete probability distributions : Binomial, Poisson ;
Continuous probability distributions : Exponential, Normal, Chi-square, t. F.
8. **Sampling distributions** :
Sampling distribution of sample mean, sample proportion and sample variance.
9. **Hypothesis testing** :
Parametric methods of hypothesis testing;

10. **Analysis of variance :**
Testing equality of 'k' population means ;
Fisher's LSD for multiple comparison of means;
11. **Testing goodness of fit and independence :**
Use of chi-square for testing goodness of fit and independence of attributes/variables.
12. **Point & Interval estimations :**
Point and interval estimation for population mean, population proportion and population variance.
13. **Linear regression :**
Bivariate and multivariate linear regression;
Least square estimates of regression coefficients, and intercept in multivariate regression; Coefficient of determination; Stepwise regression.
14. **Index numbers :**
Unweighted Aggregates Index; Weighted Aggregates Index;
Average of Relative Methods; Quantity and Value Indices;
Issues in Constructing and Using Index Numbers in Practice;
Deflating series by price indexes.

Referenced Books :

1. Statistics for Business and Economics—Anderson, Sweeney, Williams, Thomson Publication 8th Edition.
2. Doing data analysis with SPSS 10.0— Carver, Nash; Duxbury Thomson Publication.

PAPER-II : MARKETING RESEARCH

1. **Introduction :**
Definition of marketing research and market research, need for marketing research, requirement of good marketing research, manager researcher relationship, marketing research and market research, competitive and complex nature of Indian markets, role of research in new product development packaging, branding, positioning, distribution and pricing, cases and practical examples from Indian markets..
2. **Research Process :** Objective formulation, specifying information needs, determining research design and data sources, searching internal secondary data, searching external secondary data, deciding sources of primary data collection, preparation of questionnaire, pilot study, field works, report presentation, report writing.
3. **Ethics in Business Research :**

4. **Types of Research Design :**
Explanatory research, descriptive research, causal/experimental research, performance monitoring research.
5. **Types, Sources and Collection of Data :**
Secondary data, primary data, information, knowledge, internet, library.
6. **Methods of Data Collection :**
Survey methods, group discussions, in-depth interview, observation.
7. **Survey Methods :**
Personal interviews, telephone interviews, mail interviews, Internet interviews.
8. **Design of Survey Instrument—Questionnaire Design :**
Basic rules of designing questionnaire.
9. **Research Proposal :**
Meaning, scope, preparation research proposal.
10. **Writing Business Report :**
Executive summary; introduction-company/business background, objectives, methodology, sampling plan and design; situation analysis, survey findings; strategy recommendations; annexure.
11. **Qualitative Research :**
Definition, concepts and applications of Q.R., strengths of qualitative and quantitative research, group discussions-techniques of conducting GDs and advantages and disadvantages of GDs, in-depth interviews, projective techniques, applications of qualitative research in business decision-making.
12. **Sales Forecasting :**
Different statistical techniques of sales forecasting and their applications, techniques used in practice, practical exercises in sales forecasting.
13. **Advanced Data Analysis Techniques :**
Factor analysis and its applications in data reduction and positioning; discriminate analysis and its applications in banking/financial institutions in loan sanctioning, classification of heavy and light users; conjoint analysis and its applications in new product development; cluster analysis and its applications in market segmentation; multidimensional scaling and its applications in product positioning, new product development; modified perceptual mapping and its applications in measuring customers' perceptions; corporate image measurement.
14. **Advertising Research :**
Concept, top of mind recall, aided recall, unaided recall, total recall, copy testing, punch-line and base line testing, ad. Comprehensions and ad. Effectiveness.
15. **Promotions Research :**
Measuring effectiveness of promotions.
16. **Brand Valuation :**
Methods and applications in business.
17. **Market Audits :**
Syndicated audit reports of auditing retail and stockiest markets, doctors, prescriptions reports, and their applications in FMCG and pharmaceuticals industry's decision making.

Reference Books :

1. Marketing Research-An Applied Approach-Kinneer and Taylor; Tata McGraw Hill Publication.
2. Research Marketing Decisions—Green Paul and Tull.
3. Marketing Research—Rajendra Nargundkar; Tata McGraw Hill Publication.
4. Marketing Research—David Aakar
5. Marketing Research—Alwin C. Burn and Ronald Bush.
6. Marketing Research : Text and Cases—Harmer W. Boyd.
7. Select Articles on Marketing Research—Harvard Business Review.

PAPER—III : COMMUNICATION AND PRESENTATION SKILLS

1. Communication :

Spoken, Written.

2. Spoken Communication :

Preparing and organizing a public speech : Topic selection, Research Methods, Overcoming anxiety, arranging main points, Constructing introductory and concluding remark; Developing and delivering informative-style and persuasive-style speeches;

Debating : Fundamentals of debating, Premise and process and debate, Basic rules and language, Building and processing cases, Rebuttal arguments, Timing, Roles of the speakers; judges and moderator;

Debating style : Parliamentary, Academic, Cross-examination.

Informal and imprompt speaking exercises.

3. Topics :

Politics and governance, Business, Social, Morals and ethics, Culture and education, Law and order, Science and technology, Handling questions.

4. Written Communication :

Personal communication, Business communication, Report writing.

5. Presentations :

Fundamentals of presentations : Effective presentation, understanding effective presentation, understanding different types of presentations;

Planning presentation : Establishing objectives, Determining objectives, Making realistic objectives;

Audience analysis and supporting material : Analysing audience, selecting supporting material, Understanding the types of supporting materials, Exploring retention and visual aids;

Building presentation : developing introduction, capturing attention of audience, Organizing body of presentation, Creating conclusions, Closing presentation;

Presentation mechanism : Power points, Visual aids, speaker notes and footnotes, Reviewing presentations.

Reference Books :

1. Business Communication Today—Sushil Bahl.
2. Communication Theories and Models—Andal N. Rayadu.
3. Media and Communication Management—C. S. Rayadu.
4. Excellence in Business Communication—John V. Thrill.
5. Harvard Business review on Effective Communication—Harvard Business School Publishing.

PAPER—IV : DECISION MAKING AND FORECASTING

1. Financial Applications :

Investment/ Loan decisions :

Computation of net present value, future value and internal rate of return;

Converting effective interest rate to nominal rate and vice-versa;

Computing compound interest, accumulated value, discount, annuities, perpetuities.

Designing amortization table;

Break-even analysis.

2. Inventory Decisions :

Computing EOQ with / without price discounts, with buffer stock, with probabilistic models;

ABC analysis.

3. Standard/Marginal Costing :

To prepare templates that will do cost analysis on standard costing/marginal costing basis.

4. MS-Excel :

Reference Books :

1. Financial Analysis with Microsoft Excel—T. R. Mayes, T. M. Snack.
2. Mastering Excel 2000 Premium Edition—Martin, Hansen, Klingher, BPB Publication, 1st Indian edition.

PAPER—V : QUALITY MANAGEMENT

1. 7QC Tools :

Simple Problem Solving Techniques

2. 7 New QC tools :

3. Sampling Plan and Sampling Systems :

4. Design of Experiment :

Technical, Financial, Statistical

5. Taguchi Techniques :

6. Six Sigma :

Business Process Black Belt, Green Belt, Diagnostic Tools, DOE using Statistical Software.

7. Japanese Systems :

Haichi Ban—Work Allocation System, 5 'S'—Administrative Management System, Kaizen Teian—Improvement through Suggestion System.

8. ISO 9000 :

Quality Management Systems, ISO Clauses, Documentation, Internal Quality Audits, Auditor Role.

9. Total Quality Management

Reference Books :

1. 7 QC Tools

—Guide to Quality Control by Kaoru Ishikawa
—The Memory Jogger by Michael Brassard and Diane Ritter

2. 7 New QC Tools

—D. L. Shah Trust Book
—The Memory Jogger by Michael Brassard and Diane Ritter.
—The Quality Management Handbook by Roger C. Swanson—Kogan Page
—Handbook of Quality Tools—The Japanese Approach by Kazuo Ozeki and Tetsuichi Asaka—Productivity Press.

3. Sampling Plan & Sampling System

—Introduction to Statistical Quality Control by Douglas Montgomery/ISO 2859.

4. Design of Experiments

—Introduction to Quality Engineering by Genichi Taguchi—Asian Productivity Organisation.
—Principles of Robust Design by Madhav Phadke.

5. Taguchi Techniques

—Principles of Robust Design by Madhav Phadke
—Design of Experiments by Genichi Taguchi.

6. Six Sigma

—Six Sigma The Breakthrough Management by Mikel Harry and Richard Schroeder—Currency Doubleday.

7. 5 S/Kaizen

—The Six sigma Way by Peter S. Pande, Robert P. Neuman—McGraw Hill
—Kaisen Systems—Masaki Imai
—Kaisen Teian 1 : Guiding Continuous Improvement through Employee Suggestions.
—Kaisen Teian 1 : Developing systems for Continuous Improvement through Employee Suggestions by Productivity Press—Japanese Human Relations Associations.
—World of Kaizen by Shyam Talavdekar—Quality Management Systems.

8. TQM (Total Quality Management)
 - Out of Crises—Dr. W. E. Deming/Guide to Quality Management—Logothetis.
 - TQM by Samuel Kho
 - TQM Quality Management Handbook by John I. Hradesky-McGraw Hill Inc.
 - TQM for Indian Industries by Dr. Sunil Sharma—Business Publication Inc. Jaico Publishing House.
 - Total Quality Management Text and Cases by K. Shridhar Bhat—Himalaya Publishing House.
9. ISO
 - ISO 9000 Quality System Handbook by David Hoyle—Butterworth—Heinemann.

PAPER—VI : HEALTH AND SOCIAL SCIENCES

1. Health Sciences :

Design of clinical trials; role of randomisation; control group; single and double blind; size of expected treatment effect; estimate of required sample size; observational studies, case control; cohort studies, standardization of rates : crude rates, age specific rates, standardized rates, direct and indirect standardization, standardized mortality ratio; critical assessment of published papers.

2. Social Sciences :

Applications of statistics in studying the following issues :
Population and demographic details; family planning practices; child labour, child marriages; education of girls, AIDS and leprosy awareness; drinking water problems; casteism in villages; role of Panchayat in villages; agricultural marketing problems; illiteracy and its impact on quality of village life; rural health; use and abuse of fertilizers; role of women in rural life.

3. Logistic Regression Model :

Introduction to the Logistic Regression Model, Multiple logistic regression model, Interpretation of the Coefficients of the Logistic Regression, Model, Model-Building Strategies and Methods for Logistic Regression, Assessing the Fit of the Model, Application of Logistic Regression with Different Sampling Models, Logistic Regression for Matched Case-Control studies.

Reference Books :

1. Clinical trials : A Methodological Approach—Seven Piantadosi.
2. Management of Data in Clinical Trials—Eleanor Mcfadden.
3. A Manager's Guide to the design and conduct of Clinical Trials—Philip I. Good.
4. Design and Analysis of Clinical Trials : Concepts and Methodology—Shein—Chung Chow and Jen Pei Liu.
5. Essentials of Business Communication—P. N. Reddy.
6. Perspective of Indian Economy—C. Rangarajan.
7. Healthcare Expenditure in Rural India—National Council for Applied Economic Research.
8. The Indian State in Transition—National Council for Applied Economic Research.
9. Indian Market Demographics—National Council for Applied Economic Research.
10. India Human Development report—A Profile of Indian States in the 1990s—National Council for Applied Economic Research.
11. Determinants of Household Expenditure on education in Rural India—National Council for Applied Economic Research.
12. Rural Marketing—Ramaswamy.
13. Hosmer David W. and Stanley Lemshow—Applied Logistic Regression, John Wiley and Sons.

PAPER-VII : MULTIVARIATE TECHNIQUES :

1. The Organizaztion of data.
2. Applications of Multivariate Techniques.
3. Data Display and Pictorial Representation.
4. Assessing the Assumption on Normality.
5. Detecting Outliners and Data Cleaning.
6. Transformations to Near Normality.
7. Hotelling's T^2 and Likelihood Ratio Tests.
8. Confidence Regions and Simultaneous Comparisons of Component Means.
9. Large Sample Inferences about a Population Mean Vector.
10. The Classical Linear Regression Model.
11. Graphing the Principal Components.
12. Large Sample Inferences.
13. The Orthogonal Factor Model.
14. Methods of Estimation.
15. Factor Scores.
16. Factor Rotation.
17. Perspectives and a Strategy for Factor Analysis.
18. Canonical Variates and Canonical Correlations.
19. Discrimination and Classification.

Reference Books :

1. Johnson, Richard A. : Applied Multivariate Statistical Analysis.
2. Seber, G. A. F. : Multivariate Observations.
3. Yvonne M. M. Bishop, S. E. Fienbeng, P. W. Holland : Discrete Multivariate Analysis Theory and Practice.

Note : All the course will be taught using Statistics Software such as SAS/SPSS/MINITAB.

R. 4877 Standard of Pasing :

1. A candidate securing a minimum of 50% marks in each paper consisting of internal and external examination taken together will be declared to have passed in that paper and will be exempted from that paper.
2. A candidate will be declared to have passed the examination if he/she passes in all papers including project.
3. A candidate will be awarded the following grades on the basis of percentage of total marks obtained by the candidate in one or more attempt(s).

Percentage	Grade
50—below 60	C
60—below 70	B
70—below 80	A
80—100	A+

4. A registration of the candidate is valid only for three years for the course. After the three years he/she will have to register again.

UNIVERSITY OF MUMBAI



**Ordinances, Regulations and Syllabus
relating to
Post-graduate Diploma
in
Actuarial Science**

(with effect from the academic year 2005-2006)

UNIVERSITY OF MUMBAI

Introduction :

Actuaries are statisticians involved in number crunching and handling tons of mortality and other statistics to device the correct pricing of insurance policies. As an actuary, they have the opportunity to work in a wide number of areas in life insurance, general insurance, reinsurance, pension funds, risk management and so on. The work profile includes product design, policy pricing and assets-liability management among others.

The Insurance Regulatory and Development Authority (IRDA) mandates that life insurance companies must have at least one appointed actuary, while general insurers can meet their actuarial needs with the help of consultants.

Over the next three years, industry sources expect the number of actuaries in private sector life insurance to double.

Consultants feel that over five years, the number can reach 600 in life and about 300 in non-life. Demand for actuaries is likely to intensify as new entrants look at India and some expatriates in existing companies return home. While the opportunities for young, experienced students is currently good, long-term demand will come at the experienced, senior, appointed actuary level.

Hence the Board of Statistics resolve to evolve a "Post Graduate Diploma in Actuarial Science" in its meeting held on 12/-1/2005.

Ordinance and Regulation relating to "Post Graduate Diploma in Actuarial Science".

0.5491 Title of the Course

"Post Graduate Diploma in Actuarial Science".

0.5492 Eligibility

Graduate in any faculty from University of Mumbai or any other recognized University.

R.4878 Duration of the Course :

One year

R. 4879 Sanction Capacity

50 Students

R. 4880 Fees structure :

Rs. 40,000/- fee per year

Rs. 1,000/- Examination fee per student per year.

Remuneration to faculty :
Rs. 500/- per clock hour

R. 4881

Teacher Qualification :

Co-ordinator :

M.A./M.Sc. Statistics with minimum five years teaching experience.

Non-Teaching Staff :

Statistical Assistant :

M.A./M.Sc. Statistics.

Computer Technician :

Diploma in Hardware or Software

Office Assistant :

Any graduate with computer knowledge

Peon :

S.S.C. Pass

R. 4883

Teaching Hours :

60 clock hours per paper including Internal Assessment.

(60 hours $\times$ 8 papers = 480).

Tutorial Session :

20 clock hours per paper on computers.

R. 4884

Scheme of Examination :

The evaluation of the performance of a student in each paper shall be based upon both internal assessment and external examination. The external examination will be held only the conclusion of an academic term. The external examination will consist of EIGHT papers and each of THREE hours.

Subject	Title	Internal	External	Total
Paper I	Financial Mathematics	40	60	100
Paper II	Finance & Financial Reporting	40	60	100
Paper III	Probability and Mathematical Statistics	40	60	100
Paper IV	Statistical Models	40	60	100
Paper V	Contingencies	40	60	100
Paper VI	Statistical Methods	40	60	100
Paper VII	Economics	40	60	100
Paper VIII	Financial and Statistical Economics	40	60	100

First term will consist of first four papers and Second term will consist of next three papers and project work.

Detailed Syllabus for the Subject :

PAPER-I : FINANCIAL MATHEMATICS

1. Generalized cash—flow model.
2. Concepts of compound interest and discounting.
3. Interest rates or discount rates in terms of different time periods.
4. Real and money interest rates.
5. The present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
6. Definition of compound interest functions including annuities certain.
7. Definition of an equation of value.
8. Repayment of loan by regular instalments of interest and capital.
9. Discounted cash flow techniques.
10. The investment and risk characteristics.
11. Elementary compound interest problems.
12. The delivery price and the value of a forward contract using arbitrage free pricing methods.
13. Structure of interest rates.
14. Simple stochastic models for investment returns.

Reference Books :

1. UK Institute of Actuaries core leading for the subject CT1 financial mathematics.
2. Baxter, Robert. Finance Mathematics, Medford, OR Baxter Instructional Materials, 1992. Sixth edition Revised and Expanded.
3. Hart, W. L. Mathematics of Investment, Lexington, MA. D.C. Heath, 1975, Fifth edition.
4. Karatzas, Ioannis and Shreve Steven E., Methods of Mathematical Finance, New York, NY : Springer, 1998.
5. Kellison, Stephen G. The Theory of Interest, Homewood, IL : Richard D. Irwin, 1970, 1990. Second Edition.
6. Martin, Peter G. and Burrow, Michael, Applied Financial Mathematics, New York, NY; Sydney; Prentice Hall, 1991.
7. Roman, Steven. The Mathematics of Finance, Irvine, CA: Innovative textbooks, 1993.
8. Watsham, Terry J. and Parramore, Keith, Quantitative Methods in Finance, London; Boston, MA. : International Thomson Business Press, 1997, First edition.

PAPER-II : FINANCE & FINANCIAL REPORTING

1. Principal terms in investment and asset management.
2. Key principles of finance.
3. Structure of Joint Stock Company and the different methods of financing by which it may be financed.
4. Basic principles of personal and corporate taxation.
5. The characteristics of the principal forms of financial instrument used by companies.
6. Factors to be considered by a company when deciding on its capital structure and dividend policy.

9. Interpretation of the accounts of a company or a group of companies and limitations of such interpretation.
10. Financial techniques used in the assessment of capital investment projects.

Reference Books :

1. UK Institute of Actuaries Core Reading for subject CT2 Finance and Financial Reporting.
2. Brigham, Eugene F and Houston, Joel F., Fundamentals of Financial Management 9th ed.. Harcourt Brace, 2000 ISBN 0030314615.
3. Holmes, Geoffrey and Sugden, Alan, interpreting company reports and accounts 7th ed. Prentice Hall, 1999 ISBN 027364615X.
4. Samuels, J. M; Wilkes, F. M. Bray Shaw, R.E., Management of Company Finance. 6th ed. International Thomson, 1995 ISBN 1861522290.
5. Brealey, Richard A and Myers, Stewart C., Principles of Corporate Finance. 6th ed. McGraw-Hill, 1999 ISBN 0077095650.

PAPER-III : PROBABILITY AND MATHEMATICAL STATISTICS

1. Main features of a data set (exploratory data analysis)
2. Concepts of probability.
3. Concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments.
4. Probability generating function, moment generating function, cumulate generating function and cumulant.
5. Basic discrete and continuous distributions.
6. Concepts of independence, jointly distributed random variables and conditional distributions, use of generating functions.
7. Central limit theorem and its application.
8. Concepts of random sampling, statistical inference and sampling distribution.
9. Methods of estimation and properties of estimators.
10. Confidence intervals for unknown parameters.
11. Testing of hypotheses.
12. Correlation and regression analysis.
13. Concepts of analysis of variance.
14. Concepts of conditional expectation and compound distribution.

Reference Books :

1. UK Institute of Actuaries core reading for reading for subject CT3 Probability and Mathematical Statistics.
2. Rohatgi V. K. and R. k. MD. Ehsanes saleh : An introduction to probability theory and Mathematical Statistics 2nd ed John Wiley and Sons, 2001.
3. Wackesly D. D. Mondonhall III, William and Scheffer, R. L. Mathematical Statistics with applicable Duxbury, 2002.

PAPER-IV : STATISTICAL MODELS

1. Principles of actuarial modelling.
2. General principles of stochastic processes, their classification into different types.
3. Markov chain.
4. Markov process.
5. Concept of survival models.
7. Statistical models of transfer between multiple states.
8. Maximum likelihood estimators for the transition intensities.
9. Binomial model of mortality, maximum likelihood estimator for the probability of death.
10. Estimation of transition intensities depending on age.
11. Crude estimates for consistency with a standard table or a set of graduated estimates and the process of graduation.

Reference Books :

1. UK Institute of Actuaries core Reading for the Statistical models.
2. Kleinbaum D. G. Survival analysis, A self-learning text, Springer, 1994.
3. Lee E. T. Statistical Methods for Survival Data Analysis.
4. Basic stochastic processes : a course through exercises.
5. Karlin, Samuel and Taylor A Second Course in Stochastic Processes, Howard M. Academic Press, 1981.
6. Kulkarni, Vidyadhar Modeling and Analysis of Stochastic Systems, G. Thomson Science and Professional, 1995.
7. Medhi, Jyotiprasad, Stochastic Processes, Wiley Eastern Limited, 2nd ed. 1994.
8. Cox D. R. and Miller H. D. The Theory of Stochastic Processes, Methuen and Co. Ltd. 1964.

PAPER - V : CONTINGENCIES

1. Simple assurance and annuity contracts.
2. Practical methods of evaluating expected values and variances of the simple contracts.
3. Calculation of ultimate or select mortality, net premiums and net premium provisions of simple insurance contracts.
4. Calculation of ultimate or select mortality, of net premiums and net premium provisions for increasing and decreasing benefits and annuities.
5. Calculation of gross premiums and provisions of assurance and annuity contracts.
6. Definition of functions involving two lives.
7. Methods used to model cash-flows contingent upon competing risks.
8. Technique of discounted emerging costs, pricing, reserving and assessing profitability.
9. Principal forms of heterogeneity within a population and the ways in which selection can occur.

Reference Books :

1. UK Institute of Actuaries Core Reading for subject CT5 Contingencies.
2. Bowers, Newton Let all, Actuarial Mathematics 2nd ed. Society of Actuaries, 1997.

3. Neill, Alistair, Life Contingencies. Heinemann, 1977.
4. Gerber, H. U., Life Insurance Mathematics 3rd ed. Springer, Swiss Association of Actuaries, 1997.
5. Benjamin, Bernard and Pollard, John H., The Analysis of Mortality and other Actuaries Statistics. 3rd ed. Institute of Actuaries and Faculty of Actuaries, 1993.
6. Haberman, S. and Pitacco, E., Actuarial Models for Disability Insurance, Chapman & Hall, 1999.
7. Booth, P. M. et al., Modern Actuarial Theory and Practice, Chapman & Hall, 1999.

PAPER VI - STATISTICAL METHODS

1. Concept of decision theory.
2. Probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements.
3. Risk models involving frequency and severity distributions, calculation of the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.
4. Concept of ruin for a risk model.
5. The fundamental concepts of Bayesian statistics.
6. The fundamental concepts of rating.
7. Techniques for analyzing a delay (or run-off) triangle and projecting the ultimate position.
8. The fundamental concepts of a generalized linear model.
9. The main concepts underlying the analysis of time series models.
10. Concepts of "Monte Carlo" simulation.

Reference Books :

1. UK Institute of Actuaries core reading for subject CTVI statistical methods.
2. Box G.E.P. and Jenkin's : Time Series Analysis Forecasting and Control. Holden Day 1970.
3. Degroot M. H. Optimal Statistical Decision.
4. Berger J : Statistical Decision Theory and Bayesian Analysis.
5. Searler S. R. Linear Models, John Wiley and Sons, 1971.
6. Ross S. M. Introduction to Probability Models-7th Edition Academic Press/Harcourt 2000.
7. Morgan B. J. T. Elements of Simulation, Chapman and Hall, 1995.

PAPER VII—ECONOMICS

1. The interaction between supply and demand of a product and the way in which equilibrium market prices are determined.
2. Elasticity of demand and supply and the effects on a market of different levels of elasticity.
3. Application of utility theory to economic and financial problems.
4. Profit maximizing firms.
5. Different sorts of competition, or lack of it, the practical effect on supply and demand.
6. Microeconomic principles to increase their understanding of the markets and the regulatory issues and the ramifications of strategic decisions.
7. Structure of the public sector finances of an industrialised economy.

8. Definition of GDP, GNP and Net National Product, concepts useful in describing the economy and in making comparisons between countries, their limitations.
9. The propensity to save or to consume by the private sector or the corporate sector affects the economy.
10. The impact of fiscal monetary policy and other forms of government intervention on different aspects of the economy, and in particular on financial markets.
11. Role of exchange rates and international trade in the economy and the meaning of the term balance of payments.
12. The major factors affecting the rate of inflation, the level of interest rates, the exchange rate, level of unemployment, rate of economic growth in the economy of an industrialized country.

Reference Books :

1. Institute of Actuaries core reading for the subject CT7 Economics
2. Begg David, Stanley Fischer and Rudiger Dornbusch (1997), Economics (5th ed.) and Economics workbook, McGraw Hill.
3. Samuelson Paul and William Norhaus (1990), Economics (16th ed.) McGraw Hill.
4. Wonnacott P. and R. Wonnacott (1990), Economics (4th ed.) John Wiley
5. Gwartney James D. and Richard L. Stroup (1997) Economics. Private and Public Choice (8th ed.), HBJ College and School Division.
6. Lipsey Richard G. and Chrystal K. Alec (1999), Principles of Economics, Oxford University Press.

PAPER VIII—FINANCIAL AND STATISTICAL ECONOMICS

1. Advantages and disadvantages of different measures of investment risk.
2. The assumptions of mean-variance portfolio theory and its principal results.
3. The properties of single and multifactor models of asset returns.
4. Asset pricing models, assumptions and the limitations of such models.
5. The various forms of the Efficient Markets Hypothesis and the evidence for and against the hypothesis.
6. Stochastic models of the behaviour of security prices.
7. Concepts of Brownian motion.
8. The properties of option prices, valuation methods and hedging techniques.
9. Models of the term structure of interest rates.

Reference Books :

1. Institute of Actuaries core reading for the subject CT8 Finance Economics.
2. Hall John C. Options, Futures and Other Derivatives 3rd ed. Prentice Hall of India Private Ltd. New Delhi, 1997.
3. Seal H. L. Stochastic Theory of Risk Business, John Wiley, 1969.
4. Okesendal B. Stochastic Differential Equation, An introduction with Applications Springer, 2003.

R. 4885 Standard of Passing :

1. A candidate securing a minimum of 50% marks in each paper consisting of internal and external examination taken together will be declared to have passed in that paper and will be exempted from that paper.
2. A candidate will be declared to have passed the examination if he/she passes in all papers.

3. A candidate will be awarded the following Grades on the basis of percentage of total marks obtained by the candidate in one or more attempt(s).

Percentage	Grade
50—below 60	C
60—below 70	B
70—below 80	A
80—100	A+

4. A registration of the candidate is valid only for three years for the course. After the three years he/she will have to register again.
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