

M.Sc. ACTUARIAL SCIENCE

PROGRAMME STRUCTURE AND SYLLABUS

2019-20 ADMISSION ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)



EXPERT COMMITTEE IN ACTUARIAL SCIENCE (PG)

MAHATMA GANDHI UNIVERSITY

2019

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M.SC. ACTUARIAL SCIENCE

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 Academic Year)

Actuarial science is a discipline that identifies, assesses and analyzes financial risks in insurance and financial sector using mathematical and statistical methods. Actuarial science applies statistics and probability analysis in modelling uncertain future events and reducing the financial implications of such events. Actuarial science has applications in the field of insurance, reinsurance, valuation of retirement benefits, valuation of assets, pricing of insurance and financial products and risk Management. The post graduate programme in Actuarial Science is designed to create a sound academic foundation in the disciplines of Mathematics, Statistics, Finance and Economics. This comprehensive combination of interrelated disciplines equips students with strong mathematical, analytical, computational and business skills to manage risks and complex issues facing society today.

AIM OF THE PROGRAMME

The aim of the programme is to provide theoretical knowledge in mathematical, statistical and actuarial principles and concepts and its application in constructing appropriate actuarial models to solve complex real-world problems. The programme also offers to develop non-technical skills of students to match the requirements of the actuarial profession.

Learning objectives of the programme are to:

1. Equip students with a sound grounding of mathematical and statistical techniques and actuarial principles of modelling relevant to solving actuarial problems.
2. Introduce economic and financial concepts and principles enabling students to identify and analyze the business environment and apply the knowledge in making sound financial decisions
3. Develop software programming skills in languages such as Excel and R to enable students to use quantitative techniques effectively.

4. Develop data organizing, analyzing and interpreting skills to help organizations make sense of the data
5. Develop critical thinking, self-learning abilities, problem-solving and business skills as these are some of the core skills identified for the actuarial profession.
6. Develop interpersonal skills and oral and written communication skills
7. Assist and prepare students to write actuarial examinations conducted by professional bodies of actuaries required for employment in the actuarial field.
8. A dissertation at the end of the programme would allow students to develop an understanding of how theories and principles are applied in practice

PROGRAMME OUTCOMES

Upon completion of the programme, the students will be able to:

1. Describe, explain and apply the fundamental theories of actuarial science, financial and economic theories, principles and techniques in solving actuarial real-world problems
2. Assess and critically analyze the suitability of actuarial models in developing viable solutions for insurance and financial issues
3. Apply actuarial techniques in calculating premiums, superannuation and reserve contributions
4. Identify and assess risk and apply appropriate risk management tool
5. Demonstrate subject knowledge and critical, analytical and problem-solving skills for obtaining an entry-level position in the actuarial companies.
6. Demonstrate competency in locating, retrieving, synthesizing and using relevant information in improving the competitiveness of the organization.
7. Apply statistical methods using relevant software programs in solving actuarial problems

8. Prepare technical reports and communicate actuarial ideas and solutions to peer, clients and community
9. Demonstrate ability to work effectively in teams
10. Demonstrate skills and competencies necessary for passing actuarial examinations conducted by actuarial professional bodies.
11. Demonstrate ethical and professional behaviour.

1. Eligibility:

- Graduation in any degree with Mathematics/Statistics as one of the core/subsidiary course with not less than 50% of marks.
- B.Com (Mathematics is mandatory at Plus Two level) with not less than 50% of marks.
Note: A weightage of 10 marks shall be given to the candidate who has studied Mathematics as Main/Core subject.

- 2. Duration:** The duration of PG programme shall be 4 semesters. The duration of each semester shall be 90 working days. The programme includes two types of courses namely Core courses and Elective courses. There shall also be a Project to be undertaken by all students in the fourth semester.

3. Medium of Instruction : English

4. Faculty under Which Degree is Awarded: Faculty of Sciences

5. Specializations offered if any: Nil

6. Note on compliance with the UGC minimum standards for the conduct and award of post graduate degrees: The programme structure, scheme and syllabus of M.Sc. Actuarial Science is in compliance with the UGC minimum standards for the conduct and award of post graduate degrees.

7. Medium of Assessment:

7.1 Direct Grading System

Direct Grading System based on a 7- point scale is used to evaluate the performance (External and Internal Examination of students).

For all courses (Theory & Practical) / Semester/Overall program Letter grades and **GPA/SGPA/CGPA** are given on the following scale:

Range	Grade	Indicator
4.50 to 5.00	A+	Outstanding
4.00 to 4.49	A	Excellent
3.50 to 3.99	B+	Very good
3.00 to 3.49	B	Good(Average)
2.50 to 2.99	C+	Fair
2.00 to 2.49	C	Marginal
up to 1.99	D	Deficient (Fail)

No separate minimum is required for internal evaluation for a pass, but a minimum **C Grade** is required to pass in an external evaluation. However, a minimum **C Grade** is required to pass a course.

Evaluation first stage

Both internal and external (to be done by the teacher)

Grade	Grade points
A+	5
A	4
B	3
C	2
D	1
E	0

Theory (External) - Components and Weightage

Maximum weight for external evaluation is **30**. Therefore Maximum Weighted Grade Point (WGP) is **150**

Weight: Different types of questions shall be given different weights to quantify their range as follows:

Sl.No.	Type of Questions	Weight	Number of questions to be answered
1.	Short Answer type questions (Not exceeding 1 page)	1	8 out of 10
2.	Short essay/ problem solving type questions(Not exceeding 3 pages)	2	6 out of 8
3.	Long Essay type questions	5	2 out of 4

Theory-(Internal) - Components and Weightage

Sl.No.	Components	Weightage
1	Assignment	1
2	Seminar	2
3	Best Two Test papers	1 each (2)
Total		5

Project- (External) - Components and Weightage

Maximum weight for external evaluation is 15.therefore maximum weighted grade point (WGP) is 75

Sl.No.	Components	Weightage
1	Relevance of the topic and analysis	3
2	Project content and presentation	7
3	Project viva	5
Total		15

Project (Internal) - Components and Weightage

Sl.No.	Components	Weightage
1	Relevance of the topic and analysis	2
2	Project content and presentation	2
3	Project viva	1
Total		5

Comprehensive viva-voce (External) - Components and Weightage

Maximum weight for external evaluation is 15. therefore maximum weighted grade point (WGP) is 75

Component	Weightage
Course viva (all courses from first semester to fourth semester)	15
Total	15

Comprehensive viva-voce (Internal) - Components and Weightage

Component	Weightage
Course viva (all courses from first semester to fourth semester)	5
Total	5

Evaluation - Second stage: Calculation of Grade Point Average (**GPA**) of a course (To be done by the university)

Evaluation - Third stage: Calculation of Semester Grade Point Average (**SGPA**) (To be done by the university)

Evaluation - Fourth stage: Calculation of Cumulative Grade Point Average (**CGPA**) (To be done by the university).

THE PROGRAMME STRUCTURE

COURSE CODE	TITLE OF THE COURSE	COURSE TYPE	HOURS /WEEK	CREDITS
SEMESTER I (Total Credits 20)				
AS010101	Actuarial Statistics -I	Core	5	4
AS010102	Financial Mathematics –I	Core	5	5
AS010103	Business Economics –I	Core	5	4
AS010104	Survival Models	Core	5	4
AS010105	Actuarial Computing –I	Core	5	3
SEMESTER II (Total Credits 20)				
AS010201	Actuarial Statistics –II	Core	5	5
AS010202	Financial Mathematics –II	Core	5	4
AS010203	Business Economics –II	Core	5	4
AS010204	Contingencies –I	Core	5	4
AS010205	Actuarial Computing –II	Core	5	3
SEMESTER III (Total Credits 18)				
AS010301	Contingencies –II	Core	5	4
AS010302	Risk Modeling –I	Core	5	4
AS010303	Business Finance	Core	5	4
AS010304	Financial Accounting	Core	5	3
AS80---- AS81----	Elective From Group A Or B	Elective	5	3
SEMESTER IV (Total Credits 22)				
AS010401	Pricing & Reserving Of Life Assurances & Annuities	Core	5	4
AS010402	Risk Modeling –II	Core	5	4
AS010403	Actuarial Computing –III	Core	5	3
AS80---- AS81----	Elective From Group A Or B	Elective	5	3
AS80---- AS81----	Elective From Group A Or B	Elective	5	3
AS010405	Project Work And Report			3
AS010406	Viva – Voce			2

AS80-ELECTIVES – GROUP A	
AS800--	Elective I-Risk Management
AS800--	Elective II- Insurance and Retirement Benefits
AS800--	Elective III-Business Management
AS81-ELECTIVES – GROUP B	
AS810--	Elective I-Actuarial Risk Management
AS810--	Elective II-Research Methodology
AS810--	Elective III-Marketing of Services

SEMESTER I (Total Credits 20)				
Course Code	Title of The Course	Course Type	Hours / Week	Credits
AS010101	ACTUARIAL STATISTICS-I	Core	5	4
AS010102	FINANCIAL MATHEMATICS-I	Core	5	5
AS010103	BUSINESS ECONOMICS-I	Core	5	4
AS010104	SURVIVAL MODELS	Core	5	4
AS010105	ACTUARIAL COMPUTING-I	Core	5	3

AS010101: ACTUARIAL STATISTICS - I

Total Credits: 4

Total hours: 90

Objectives:

- Provide students with essential tools in probability theory and help them understand the application of statistics.
- Introduce essential knowledge of mathematical and statistical methods and understanding of R language that is widely used in actuarial coursework and data analysis.

MODULE I (13 Hours)

UNIT 1 (3 Hours)

Summarizing data - Grouped frequency distribution – Stem and leaf diagrams - Line plots - Cumulative frequency tables -- Measures of location -- The mean -- The median -- The mode -- Measures of spread – The standard deviation -- Moments – The range – The inter-quartile Range - Symmetry and skewness (Bowley’s Pearson’s & moments) - Box plots

UNIT 2 (6 Hours)

Probability: Definition -- Basic properties – Addition rule for probability – Conditional probability definition -- Random variables: Discrete random variables -- Random variables – Probabilities – Probability functions – Cumulative distribution functions – Continuous random variables- Definition -- Probability density function – Cumulative distribution function

UNIT 3 (4 Hours)

Expect Values – Mean - Variance and standard deviation – Linear functions of X -- Moments

MODULE II (25 Hours)

UNIT I (5 Hours)

Statistical distributions: Important discrete distributions – Uniform distribution – Bernoulli distribution-- Binominal distribution -- Geometric distribution – Negative binomial distribution – Hyper geometric distribution – Poisson distribution – Examples

UNIT 2 (8 Hours)

Important continuous distributions – Uniform distribution-- Exponential distribution – Gamma distribution – Beta distribution -- Normal distribution – Examples

UNIT 3 (8 Hours)

Poisson Process: Deriving Poisson process formulae – Monte Carlo simulation – Inverse transform method for discrete and continuous distributions

UNIT 4 (4 Hours)

The Central Limit Theorem and its applications: Definitions – Practical uses – Normal approximation for binomial distribution, Poisson distribution and gamma distribution - The continuity correction – Examples

MODULE III (27 Hours)

UNIT 1 (4 Hours)

Generating functions: Moment generating functions - General formula – Finding moments - Uses of moment generating functions – Important examples

UNIT 2 (3 Hours)

Cumulative generating functions - General Formula – Finding Moments - Uses of Moment Generating Functions – Linear functions - Important Examples

UNIT 3 (10 Hours)

Joint distributions: Joint probability (density) functions – Discrete case – Continuous case-- Marginal probability (density) functions: Discrete case – Continuous Case -- Conditional probability (density) functions : Continuous case – Independence of random variables – Discrete case

UNIT 4 (10 Hours)

Expectations of functions of two variables: Expectations -- Expectation of a sum -- Expectation of a product – Covariance and correlation coefficient – Useful results on handling covariance – Variance of a sum – Convolutions – Moments of linear combinations of independent random variables - Using generating functions to derive distributions of linear combinations of independent random variables

MODULE IV (25 Hours)

UNIT 1 (3 Hours)

Conditional expectation: The conditional expectations $E[Y/X]$ -- The random variables

$E[Y/X]$ - The random variables $V[Y/X]$ and the “ $E[V]+V[E]$ ” result - Examples

UNIT 2 (10 Hours)

Sampling and statistical inferences: Sample inference – Population inference – Statistical inference – Moments of sample mean and variance -- Sampling distribution for the normal – Independence of sample mean and variance

UNIT 3 (12 Hours)

Use of t – statistic for random samples from a normal distribution -- Using F distribution for the ratio of two sample variances from normal distributions (definitions and applications only without derivations for F and t distribution) - Examples

Recommended Textbook:

1. Miller, I., Miller, M., & Freund, J. E. (2014). John E. Freund's mathematical statistics with applications. Boston: Pearson.

Recommended References:

1. Yuly Koshevnik (2017). Fundamentals of Statistical Thinking Tools and Applications
2. Klugman, S. A., Beckley, J. A., Scahill, P. L., Varitek, M. C., & White, T. A. (2012). Understanding actuarial practice. Society of Actuaries.
3. Perna, C., & Sibillo, M. (Eds.). (2012). Mathematical and statistical methods for actuarial sciences and finance. Springer.
4. Frees, E. W. (2009). Regression modeling with actuarial and financial applications. Cambridge University Press.
5. McCullagh, P., & Nelder, J. A. (1999). Generalized linear models. Monograph on statistics and applied probability.

AS010102: FINANCIAL MATHEMATICS -I

Total Credits: 5

Total Hours: 90

Objectives:

- Develop mathematical sense of financial transactions through application of various mathematical techniques and ease calculations involving compound interest rates and annuity functions.
- Show how interest rates may be expressed in different time periods.
- Describe how to take into account time value of money using the concepts of compound interest and discounting.
- Demonstrate knowledge and understanding of real and money interest rates.
- Use the concept of equation of value to create loan schedule.

MODULE I **(19 Hours)**

UNIT 1 **(4 Hours)**

Cash flow models: Cash flow process -- Examples of cash flow scenarios -- Zero coupon bond, Fixed interest securities, Index linked securities, Cash on deposit, Equity, Annuity, An interest only Loan and Repayment loan.

UNIT 2 **(2 Hours)**

Insurance contracts: Pure endowment - An endowment assurance - Term assurance - Contingent annuity - Car insurance policy - Health cash plans.

UNIT 3 **(7 Hours)**

Time value of money: Interest-simple interest, Compound interest, Accumulation factors --The principle of consistency

UNIT 4 **(6 Hours)**

Present Values -- Discount rates -- Simple discount -- Compound discount -- Effective rates of interest and discount -- Equivalent rates.

MODULE II (20 Hours)

UNIT 1 (5 Hours)

Interest Rates: Nominal rates of Interest and discount – Accumulating and discounting using nominal interest and discount rates.

UNIT 2 (5 Hours)

The Force of interest: Accumulating and discounting using force of interest -- Derivation.

UNIT 3 (7 Hours)

Relationship between effective, nominal and force of interest – The force of interest as a function of time -- Present values.

UNIT 4 (3 Hours)

Real and money rates of interest: Definition of real and money interest rates -- Deflationary conditions -- Usefulness of real and money interest rates.

MODULE III (20 Hours)

UNIT 1 (5 Hours)

Discounting and accumulating: Present values of cash flows -- Discrete cash flows -- Continuous cash flows -- Valuing cash flows - Constant interest rates and sudden changes in interest rates - Interest income.

UNIT 2 (5 Hours)

Level Annuities-- Present values – Payments made in arrear - Payment made in advance- Accumulations – Perpetuities – Continuously payable annuities

UNIT 3 (3 Hours)

Annuities payable pthly: Present values, Accumulations and Perpetuities -- Annuities payable pthly where p is less than 1 – Non integer value of n

UNIT 4 (7 Hours)

Deferred annuities - Annual payments - Continuously payable annuities - Annuities payable pthly - Non integer values of n - Deferred annuities

MODULE IV (31 Hours)

UNIT 1 (7 Hours)

Increasing annuities --Varying annuities -- Annual payments -- Continuously payable annuities -
Decreasing annuities – Special cases -- Irregular payments and Compound increasing annuities

UNIT 2 (8 Hours)

Equations of value: The equation of value and the yield on a transaction - The theory – Solving
for an unknown quantity – Uncertain payment or receipt – Probability of cash flows -- Higher
Discount rate

UNIT 3 (7 Hours)

Loan schedule: Calculating the capital outstanding – Introduction - The theory prospective and
retrospective loan calculation – Calculating the interest and capital elements

UNIT 4 (4 Hours)

The Loan schedule -- Installments payable more frequently than annually

UNIT 5 (5 Hours)

Consumer credit: Flat rates and APRs.

Recommended Textbook:

1. Bower, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A., & Nesbitt, C. J. (1997).
Actuarial Mathematics

Recommended References:

1. Promislow, S. D. (2014). Fundamentals of Actuarial Mathematics. John Wiley & Sons
2. Garrett, S. (2013). An introduction to the mathematics of finance: a deterministic
approach. Butterworth-Heinemann.
3. Butcher, M. V., & Nesbitt, C. J. (1971). Mathematics of compound interest. Ulrich's
Books.
4. Kellison, S. G. The theory of interest. 3rd ed. McGraw-Hill-Irwin, 2008.

AS010103: BUSINESS ECONOMICS -I

Total Credits: 4

Total Hours: 90

Objectives:

- Provide students with the theoretical and practical understanding of the economic concepts and theories in the process honing their critical thinking, analytical and problem-solving skills.
- Enable students to analyze the economic environment in which organizations function to be able to make economic decisions.

MODULE I (25 Hours)

UNIT 1 (6 Hours)

Economics concepts and systems: What economists study – Problem of scarcity – Economic choices - Business economics – Introduction to microeconomics and macroeconomics – Production possibility curve – Circular flow of goods and income –Different economic systems.

UNIT 2 (6 Hours)

Main strands of economic thinking: The classical approach – Marxist socialism – Keynesian schools of thought: Neo-Keynesians, Post-Keynesians and New-Keynesians – The monetarist approach -- The new classical approach – The Austrian School

UNIT 3 (8 Hours)

Demand and supply: Demand – Relationship between demand and price – Determinants of demand – Demand curve – Movements along and shifts in the demand curve – Supply: Relationship between supply and price – Supply curve - Determinants of supply – Movements along and shifts in the supply curve

UNIT 4 (5 Hours)

Price and output determination: Equilibrium price and output – Movement to a new equilibrium – Incentives in markets

MODULE II (25 Hours)

UNIT 1 (8 Hours)

Elasticity: Price elasticity of demand – Measurement of elasticity - Price elasticity of supply - The importance of PED to business decision making – Other elasticity: Income and Cross-elasticity of demand – The time Dimension of market adjustment – Price expectations and speculations - The control of prices – Indirect taxes and subsidies.

UNIT 2 (8 Hours)

Consumer demand and Uncertainty: Marginal utility theory – Timing of cost and benefits – Indifference analysis -- Demand under condition of risk and uncertainty – Utility and insurance – Behavioural economics.

UNIT 3 (9 Hours)

Production and Cost: Meaning and types of costs – Production in the short-run – Cost in the short-run- Production in the long-run – Cost in long-run - Revenue – Profit Maximization.

MODULE III (24 Hours)

UNIT 1 (8 Hours)

Market structures: Alternative market structures – Perfect competition – Assumptions of perfect competition – Short-run and long-run equilibrium of the firm - Perfect competition and public interest.

UNIT 2 (8 Hours)

Monopoly: Definition – Barriers to entry – Equilibrium price and output – Monopoly and the public interest – The theory of contestable markets.

UNIT 3 (8 Hours)

Imperfect competition: Monopolistic competition – Equilibrium of firm – limitation of the model - Comparing monopolistic competition with other market structures – Oligopoly - Collusive oligopoly – Non-collusive oligopoly - Game theory.

MODULE IV (16 Hours)

UNIT 1 (8 Hours)

Product marketing and advertising: Product differentiation – Marketing – Advertising

UNIT 2 (8 Hours)

Pricing strategies: Cost based pricing and limit pricing - Price discrimination – Three different types of price discrimination - Multiple products pricing: Interrelated demand – Interrelated production – Pricing and the product life cycle.

Recommended Textbooks:

1. Slomon J, Wride A, Garratt D, 2018-Economics –10th edition, Pearson.
2. Sloman J, Garratt D, Guest J, Jones E, 2016- Economics for Business –7th edition, Pearson

Recommended References:

1. Parkin, M., & Bade, R. (2007). Foundations of economics. Pearson Addison Wesley.
2. Perman, R. J., & Scouller, J. (2010). Economics of corporate and competitive strategy. Oxford University Press Australia and New Zealand.
3. Chrystal, K. A., & Lipsey, R. G. (1997). Economics for business and management. OUP Catalogue.
4. David Begg, Stanley Fisher and Rudiger Dorn Busch(). Economics, McGraw Hill
5. Samuelson, Paul; Nordhaus, William D (). Economics. McGraw- Hill.
6. Wonnacott, P., & Wonnacott, R. J. (1982). An introduction to microeconomics. New York; Montreal: McGraw-Hill.
7. Koutsoyiannis, A. (1975). Modern microeconomics. Springer

AS010104: SURVIVAL MODELS

Total Credits: 4

Total Hours: 90

Objectives:

- Describe and apply techniques of survival models.
- Describe and calculate central exposed to risk for the given data.
- Describe the concepts of graduation of crude estimates. Describe and apply statistical tests of the comparison of crude estimates with a standard mortality table/a set of graduated estimates. Describe a test for smoothness of a set of graduated estimates.
- Describe the approaches to forecasting of future mortality rates based on extrapolation, explanation and expectation. Describe the Lee-Carter, age-period-cohort, and p-spline regression models for forecasting mortality.

MODULE I

(25 Hours)

UNIT 1

Survival models: A simple model of survival – Future lifetime - Probabilities of death and survival - Force of mortality – Survival probabilities – The probability density function of T_X - Life table functions – Initial and central rate of mortality - Expected future lifetime - Complete expectation of life - Curtate expectation of life – The relationship between the complete and curtate expectations of life – Future lifetimes-variance – Uses of the expectation of life - some important formulae - Simple parametric survival models - The Gompertz and Makeham laws of mortality - Calculating the parameter values – Survival probabilities.

MODULE II

(22 Hours)

UNIT 1

Exposed to risk: Calculating the exposed to risk – Homogeneity – The problem of heterogeneity – The solution - The principle of correspondence - Exact calculation of the central exposed risk -

Working with complete data – Working with incomplete data - Census approximation to the central exposed risk The available data – The census approximation to E_x^c - Death classified using different definition of age – Consistency between census data and death data.

MODULE III

(28 Hours)

UNIT 1

Graduation and statistical tests: Comparison with another experience – Standard tables – Comparison with standard tables – Graduation - Reasons for graduation – The theoretical argument – The practical argument – Limitations - Summary - Desirable features of graduation – Smoothness versus adherence to data – Testing smoothness and adherence to data – Suitability for the purpose in hand – Two examples of graduation - Testing the smoothness of a graduation – What is a smooth graduation? – Smoothness test - Statistics refresher – Statistical tests- Continuity correction - Chi-squared tests – Statistical tests of a mortality experience – Chi-Squared test - Standardized deviation test - Sings tests - Cumulative deviations - Grouping of signs test - Serial correlations test -Testing actual versus expected rates

MODULE IV

(15 Hours)

UNIT 1

Markov chains: An example of a Markov chain - The Chapman-Kolmogorov equations - Time-homogeneous Markov chains–Models - A simple model of a No Claims Discount (NCD) policy - Another model of an NCD policy - Simple random walk on $S = \{... - 2, -1, 0, 1, 2, ... \}$ - Simple random walk on $\{0, 1, 2, ... , b\}$ - a model of accident proneness - The long-term distribution of a Markov chain - The stationary probability distribution - The long-term behaviour of Markov chains - Modelling using Markov chains - Estimating transition probabilities - Assessing the fit – Simulation

Recommended Textbooks:

1. Marubini, E.; Valsecchi, M. G. - John Wiley, 2004. Analysing survival data from clinical trials and observational studies :
2. Benjamin, B.; Pollard, J. H. The analysis of mortality and other actuarial statistics : (3rd ed). - Institute and Faculty of Actuaries, (1993)

Recommended References:

1. Hinde, A. - Routledge, (1998).- Demographic methods.
2. Hickman, J. C. North American Actuarial Journal (1997) - Introduction to actuarial modeling.
3. Macdonald, A.S., Richards, S.J. and Currie, I.D.- Modelling mortality with actuarial applications. - Cambridge University Press, 2018.
4. Scott, W. F. -Mortality studies. - University of Aberdeen, Department of Mathematical Sciences, 2000.
5. Daykin, C. D.; Pentikainen, T.; Pesonen, M. - Chapman & Hall, (1994). - Practical risk theory for actuaries.
6. Elandt-Johnson, R. C.; Johnson, N. L. - John Wiley, (1999). -Survival models and data analysis.
7. Shailaja R Deshmukh.-Actuarial Statistics - An Introduction using R. 3rd ed.

AS010105: ACTUARIAL COMPUTING-I

Total Credits: 3

Total Hours: 90

Objective:

- Provide students with hands on experience of calculating statistical problems using R and problems in annuities and loan schedule using Excel software.

MODULE I

(27 Hours)

Summarize the main features of a data set (exploratory data analysis) -- Summarize a set of data using a table or frequency distribution and display it -- Graphically using a line plot, A box plot, A bar chart, Histogram, Stem and leaf plot or other appropriate elementary device -- Describe the level/location of a set of data using the mean, median and mode, as appropriate.

MODULE II**(18 Hours)**

Describe the spread/variability of a set of data using the standard deviation, Range, Interquartile range as appropriate -- Explain what is meant by symmetry and skewness for the distribution of a set of data -- Generate discrete and continuous random variables using statistical software -- Calculate Pearson's, Spearman's and Kendall's measures of correlation for bivariate data and explain their interpretation and perform statistical inference as appropriate.

MODULE III**(23 Hours)**

Calculation of simple and compound interest rates -- Calculation of present value and accumulated value - Level annuities -- Deferred and increasing annuities -- Compound increasing and decreasing annuities -- Payments made in arrear and payment made in advance -- Continuously payable annuities.

MODULE IV**(22 Hours)**

Loan schedules: Preparation of loan amortization table-calculation of capital outstanding- Calculation of the interest and capital elements.

Recommended References:

1. Guojun Gan, Emiliano Valdez (2018). Actuarial Statistics with R : Theory and Case Studies
2. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R/Andy Field, Jeremy Miles, and Zoë Field.
3. Walkenbach, J. (2007). MICROSOFT EXCEL 2007 BIBLE (With CD). John Wiley & Sons.

SEMESTER II (Total Credits 20)				
Course Code	Title Of The Course	Course Type	Hours / Week	Credits
AS010201	ACTUARIAL STATISTICS-II	Core	5	5
AS010202	FINANCIAL MATHEMATICS-II	Core	5	4
AS010203	BUSINESS ECONOMICS-II	Core	5	4
AS010204	CONTINGENCIES-I	Core	5	4
AS010205	ACTUARIAL COMPUTING-II	Core	5	3

AS010201: ACTUARIAL STATISTICS – II

Total Credits: 5

Total Hours: 90

Objectives:

- Provide grounding in Statistics and its applications such as common probability distributions, asymptotic normal approximations, maximum likelihood inference, interval estimation and hypothesis Testing.
- Understanding of the principles of statistical inference, regression models (including generalized linear models) and the fundamental concepts of Bayesian statistics.
- Provide skills in Statistical analysis using R Language.

MODULE I **(30 Hours)**

UNIT 1 **(5 Hours)**

Introduction of point estimation: Constructing estimators of population parameters using method of moments – Examples

UNIT 2 **(6 Hours)**

Constructing estimators of population parameters using method of maximum likelihood estimator - Examples

UNIT 3 **(4 Hours)**

Un-biasedness means square error of an estimator - Asymptotic distribution of maximum likelihood estimator – Comparing method of moments and MLE

UNIT 4 **(6 Hours)**

Introduction of Confidence Interval: Derivation of confidence interval – Confidence intervals for population mean and population variance – Confidence interval for binomial and Poisson parameters with normal approximation

UNIT 5 **(6 Hours)**

Confidence intervals for difference between population means - Confidence intervals for ratio of population variances – Confidence interval for binomial and Poisson distribution parameters with normal approximation

UNIT 6 **(3 Hours)**

Confidence interval for a difference between two means from paired data.

MODULE II (18 Hours)

UNIT 1 (5 Hours)

Hypothesis Testing: Null and alternative hypothesis – Simple and composite hypothesis - Type I error and type II error – Likelihood ratio -- Level of significance – Probability value and power of test

UNIT 2 (7 Hours)

Basic tests for one sample – Population mean variance and standard deviation - Testing binomial and Poisson parameter -- Basic tests for two sample – Difference between two Population means and Ratio of population variances -- Testing difference between binomial and Poisson parameter

UNIT 3 (6 Hours)

Chi- squared test -- Contingency table – Example problems

MODULE III (14 Hours)

UNIT 1 (5 Hours)

Introduction of Data Analysis: Scatter plots for bi-variate data– Correlation analysis – Sample correlation coefficient – Spearman’s rank correlation coefficient – Inference (only result 1 and result 2 – Multivariate correlation analysis -- Sample correlation coefficient matrixes

UNIT 2 (4 Hours)

Introduction of Linear regression: The simple bivariate linear model – Partitioning the variability of the response – The full normal model and inference – Inferences on the slope parameter

UNIT 3 (5 Hours)

Analysis of variance (One way ANOVA methods and Problems) – Estimating a mean response and predicting an individual response – Checking the model – Multiple linear regression model (Basics)

MODULE IV (28 Hours)

UNIT 1 (9 Hours)

Introduction of Generalized linear models – Exponential families: Normal distribution – Poisson distribution – Binomial distribution – Gamma distribution -- Liner predictor – Interaction between variables – Factors and interaction between factors – Predictors with variable and

factors and interaction - Link functions – Model fitting and comparison – Residuals analysis and assessment of model fit

UNIT 2 **(10 Hours)**

Introduction of Bayesian Statistics: Bayes' theorem -- Prior and posterior distribution: Notation determination for the posterior density – Discrete and continuous prior distribution – Conjugate priors – Improper prior distribution

UNIT 3 **(9 Hours)**

The loss function: Quadratic loss - Absolute error loss- all- or- nothing loss - Examples.

Recommended Textbook:

1. Perna, C., & Sibillo, M. (Eds.). (2012). Mathematical and statistical methods for actuarial sciences and finance. Springer. Mathematical and statistical methods for Actuarial Science and Finance Corazza, Marco, Pizzi

Recommended References:

1. Klugman, S. A., Beckley, J. A., Scahill, P. L., Varitek, M. C., & White, T. A. (2012). Understanding actuarial practice. Society of Actuaries.
2. De Jong, P., & Heller, G. Z. (2008). Generalized linear models for insurance data. Cambridge University Press.
3. Frees, E. W. (2009). Regression modeling with actuarial and financial applications. Cambridge University Press.
4. Denuit, M., Maréchal, X., Pitrebois, S., & Walhin, J. F. (2007). Actuarial modelling of claim counts: Risk classification, credibility and bonus-malus systems. John Wiley & Sons.

AS010202: FINANCIAL MATHEMATICS II

Total Credits: 4

Total Hours: 90

Objectives:

- Develop fine understanding of the working and application of advanced financial products like stocks and derivatives.
- Use of discounted cash flows and equation of value techniques in project appraisal.
- Explain how duration and convexity are used in the (Redington) immunization of a portfolio of liabilities.
- Use the concept of equation of value to solve bond, Equity and Property according to the tax liability.

MODULE I (21 Hours)

UNIT 1 (5 Hours)

Project Appraisal I: Introduction – Estimating cash flows – Fixed interest rates -- Accumulated value, Net present value and internal rate of return

UNIT 2 (4 Hours)

The comparison of two investment projects – Different interest rates for lending and borrowing – Payback period - Other considerations.

UNIT 3 (6 Hours)

Project Appraisal II: Definition of a capital project – Definition of project – Evaluation of cash flows -- Methods of project evaluation – Annual capital charge -- Payback period – Nominal returns – Strategic fit – Opportunity cost -- Hurdle rates

UNIT 4 (6 Hours)

Evaluation of risky projects: Simulation -- Sensitivity analysis – Scenario testing – Monte Carlo stimulation – Probability trees – Certainty equivalents

MODULE II (22 Hours)

UNIT 1 (12 Hours)

Bonds Equity And Property -- Fixed interest securities – Calculating the price-- Allowing for income tax-- Capital gains tax -- Capital gains test -- Calculating yields -- Deferred income tax.

UNIT 2 (5 Hours)

Uncertain income securities: Equities – Property - Real rate of interest.

UNIT 3 (5 Hours)

Inflation adjusted cash flows – Calculating real yield using an inflation index – Calculating real yields given constant inflation assumption – Payments related to the rate of inflation – The effects of inflation –Index-linked bonds.

MODULE III (29 Hours)

UNIT 1 (4 Hours)

Term structure of interest rates: Discrete time – Discrete time spot rates -- Discrete time forward rates.

UNIT 2 (8 Hours)

Continuous time rates -- Continuous time spot rates – Continuing time forward rates – Instantaneous forward rates.

UNIT 3 (7 Hours)

Theories of time-term structure of interest rates – Why interest rates vary over time -- Theories -- Yields to maturity – Par yields.

UNIT 4 (10 Hours)

Duration, convexity and immunization - Interest rate risk-- Effective duration – Duration – Convexity – Immunization

MODULE IV (18 Hours)

UNIT 1 (7 Hours)

Weighted Average Cost Of Capital: Introduction – The importance of the discount rate -- Defining the weighted average cost of capital -- Modigliani and miller -- Their view

UNIT 2 (6 Hours)

CAPM: Cost of equity – CAPM and risk – Systematic risk – Beta as a measure of systematic risk – Measuring beta – Market derived real discount rate.

UNIT 3 (5 Hours)

Cost of debt -- Marginal or average cost -- Determinants – Calculation of WACC.

Recommended Textbook:

1. Bower, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A., & Nesbitt, C. J. (1997). Actuarial Mathematics.

Recommended References:

1. Promislow, S. D. (2014). Fundamentals of Actuarial Mathematics. John Wiley & Sons.
2. Booth, P., Haberman, S., Chadburn, R., James, D., Khorasane, Z., Plumb, R. H., & Rickayzen, B. (2004). Modern actuarial theory and practice. Chapman and Hall/CRC.
3. Harrison, F., & Lock, D. (2017). Advanced project management: a structured approach. Routledge.
4. Ingersoll, J. E. (1987). Theory of Financial decision making (Vol. 3). Rowman & Littlefield.
5. Lessard, D. R., & Paddock, J. L. (1983). Evaluating international projects: weighted-average cost of capital versus valuation by components.

AS010203: BUSINESS ECONOMICS-II

Total Credits: 4

Total Hours: 90

Objectives:

- Provide a general understanding of the macroeconomic concepts, principles and theory to enable students to analyze and interpret the economic environment in making informed judgments.

MODULE I (25 Hours)

UNIT 1 (10 Hours)

Government interventions in market: Efficiency under perfect competition - Objectives of government interventions - Types of market failure – Types of government intervention – The case for less Government intervention

UNIT 2 (5 Hours)

Competition policy: Restrictive policy, Monopoly policy and Merger policy – Policies towards research and development.

UNIT 3 (10 Hours)

Macroeconomic environment: The circular flow of income – The measurement of national income and output -- Macroeconomic objectives: Economic growth – Unemployment: Meaning and measurement of unemployment – Costs of unemployment – Causes of unemployment – Types of unemployment – Unemployment and labour market - Inflation: Inflation rate measure – Causes of inflation – Costs and types of inflation – Inflation and AD-AS Model

MODULE II (25 Hours)

UNIT 1 (5 Hours)

International trade and payments: Globalization – Trading patterns – Advantages of trade – Arguments for restricting trade –Problems with protection – World Trade Organization (WTO).

UNIT 2 (6 Hours)

Balance of Payment and exchange rate: The balance of payment account – Exchange rate – exchange rate and balance of payment – Fixed versus floating exchange rates – Exchange rates in practice

UNIT 3 (8 Hours)

Financial system: Definition, role and evolution – Banking system: Types of banking – Functions of banks – Liquidity and profitability – The central bank -- Money and interest rates: Money market model – Supply of money: Credit creation – Relationship between money supply and interest rate – Demand for money – Equilibrium in money market – Effect of change in the money supply

UNIT 4 (6 Hours)

Monetary policy: Policy setting – Control of money supply over medium and long term – Control of money supply over short term -- Techniques to control the money supply – Techniques to control interest rates -- Difficulties in controlling money supply and interest rates

MODULE III (24 Hours)

UNIT 1 (8 Hours)

Classical and Keynesian theory: Classical analysis of output and employment – Classical analysis of prices and inflation – The Keynesian revolution: Keynes rejection of classical

macroeconomics – Keynesian analysis of employment and inflation - The determination of national income – Keynesian model of unemployment and inflation – Analysis of business cycle

UNIT 2 (8 Hours)

Monetarist and new classical schools and Keynesian responses: Monetarist school – The new classical school – The expectations-augmented Phillips curve – The monetarist perspective on inflation and unemployment – The Keynesian response.

UNIT 3 (8 Hours)

Relationship between the goods and money market: The effect of monetary changes on national income – Monetary effects of changes in the goods market – The IS-LM model – The IS-MP model.

MODULE IV (16 Hours)

UNIT 1 (10 Hours)

Supply side policy: Approaches to supply side policy: new classical – Keynesian – Third way supply side policies – Supply side policies in practice : Market oriented policies – Interventionist policies – Regional and urban policy.

UNIT 2 (6 Hours)

Demand side policy: Fiscal policy and public finances -- Definition and types of fiscal policy – Use of fiscal policy – The policy making environment.

Recommended Textbooks:

1. Slomon J, Wride A, Garratt D, 2018,-Economics –10th edition, Pearson.
2. Sloman J, Garratt D, Guest J, Jones E, 2016-Economics for Business –7th edition, Pearson

Recommended References:

1. Stonecash, R., Gans, J., King, S., &Mankiw, N. G. (2011). Principles of Macroeconomics. Cengage Learning..
2. Parkin, M., & Bade, R. (2007). Foundations of economics. Pearson Addison Wesley.
3. Perman, R. J., &Scouller, J. (2010). Economics of corporate and competitive strategy. Oxford University Press Australia and New Zealand.
4. Chrystal, K. A., &Lipsey, R. G. (1997). Economics for business and management. OUP Catalogue.

5. David Begg, Stanley Fisher and Rudiger Dorn Busch. Economics, McGraw Hill
6. Hoover, K. (1992). The new classical macroeconomics. Edward Elgar Publishing.
7. Snowdon, B., & Vane, H. R. (2002). An encyclopedia of macroeconomics. Edward Elgar Publishing.
8. Ahuja, H. L. (1986). Macro Economics (Theory & Policy). S. Chand.

AS010204: CONTINGENCIES - I

Total Credits: 4

Total Hours: 90

Objectives:

- Understand and use mortality table to calculate the probabilities of death/survival using both ultimate and select mortality.
- Recognize simple assurance and annuity contracts, and develop formulae for the present value of the payments under these contracts and the associated means and variances of these present values.
- Perform calculations of the mean and variance of simple assurance and annuity contracts with standard actuarial functions, using specified mortality table.
- Describe the operation and develop formulae for the means and variances of the payments under conventional with-profits contracts.

MODULE I

(20 Hours)

UNIT 1

The life table: Present values of payments under life insurance and annuity contracts – Equations of value – Allowances for investment income – Other assumptions - The life table- Constructing a life table - the force of mortality – Interpretation – Using the life table – Life random variables – More notation - Life table function at non-integer ages – Method 1 uniform distribution of deaths (UDD) – Method 2 constant force of mortality - Evaluating probabilities without use of the life table - Select mortality – Mortality rates that depend on both age and duration – Displaying select rates – Constructing select and ultimate life tables – Using tabulated select life table functions.

MODULE II

(32 Hours)

UNIT 1

(17 Hours)

Life assurance contracts: Type of contracts - Whole life assurance contracts – Present value random variable – Expected present value – Variance of present value random variable - Term assurance contracts –Present value random variable – Expected present value – Variance of present value random variable - Pure endowment contracts – Present value random variable – Expected present value Variance of the present value variable - Endowment assurance contracts – Present value random variable – Expected present value – Variance of the present value random variable - Deferred assurance benefits – Present value random variable – Expected present value – Variance of the present value random variable - Benefits payable immediately on death – Whole life assurance – Term assurance – Endowment assurance – Other relationships – Claims acceleration approximation – Further approximation - Evaluating means and variances using select mortality.

UNIT 2

(15 Hours)

Life annuity contracts: Whole life annuities payable annually in arrears - Present value random variable – Expected present value – Variance of the present value random variable - Whole life annuities payable annually in advance - Present value random variable – Variance of the present value random variable - Temporary annuities payable annually in arrears - Present value random variable – Expected present value – Variance of the present value random variable - Temporary annuities payable annually in advance - Present value random variable – Expected present value – Variance of the present value random variable - Deferred annuities - Present value random variable – Expected present value – Deferred annuities-due - Guaranteed annuities payable annually in advance - Present value random variable – Expected present value – Variance of the present value random variable - Guaranteed annuities payable annually in arrears - Present value random variable – Expected present value – Variance of the present value random variable - Continuous annuities – Other annuities – Approximations - Continuous annuities - Evaluating means and variance using select mortality.

MODULE III

(18 Hours)

UNIT 1

Evaluation of assurances and annuities: Evaluating assurance benefits - Evaluating annuity benefits - Premium conversion formulae – Discrete version – Continuous version – Variance of benefits - Expected present values of annuity payable ‘m’ times each year - Expected present values under a constant force of mortality.

MODULE IV

(20 Hours)

UNIT 1

Variable benefits and conventional with-profits policies: Variable payments - Payments varying at a constant compound rate - Payment varying by a constant monetary amount – Whole life assurance – Term assurance – Endowment assurance – Decreasing term assurance – Increasing assurances payable immediately on death – Whole life annuity payable in arrears – Whole life annuity payable annually in advance – Temporary annuities – Annuities payable continuously - Conventional with- profit contracts – Types of bonuses.

Recommended Textbooks:

1. Bowers, N. L.; Gerber, H. U.; Hickman, J. C - Actuarial mathematics: 2nd ed. et al. Society of Actuaries,
2. Dickson, D.C.M.; Hardy, M.R.; Waters, H.R.- Actuarial mathematics for life contingent risks: 2nd ed. Cambridge University Press,(2013)

Recommended References:

1. Haberman, S.; Pitacco, E. Chapman & Hall, (1999). - Actuarial models for disability insurance.
2. Benjamin, B.; Pollard, J. H. Institute and Faculty of Actuaries, (1993.)-The analysis of mortality and other actuarial statistics. 3rd ed.
3. Promislow, D. John Wiley, (2015).-Fundamentals of actuarial mathematics. 3rd ed.
4. Scott, W. F. Heriot - Life assurance mathematics. -Watt University, (1999).
5. Neill, A. Heinemann, (1977)-Life contingencies. .

6. Gerber, H. U. Springer -Life insurance mathematics. 3rd ed.; Swiss Association of Actuaries, (1997).
7. Booth, P. M.; Chadburn, R. G.; Haberman, S. et al. Chapman & Hall, (2005). - Modern actuarial theory and practice. 2nd ed.

AS010205: ACTUARIAL COMPUTING -II

Total Credits: 3

Total Hours: 90

Objectives:

- Provide students with hands on experience of calculating statistical problems using R and problems in Financial Mathematics using Excel software.

MODULE I (26 Hours)

Constructing estimators of population parameters -- Calculate confidence intervals for mean, variance and standard deviation and differences between two means -- Ratio of variance from normal data and paired data.

MODULE II (23 Hours)

Testing mean, variance and standard deviation and difference between two means -- Ratio of variance from normal data and paired data -- Fit a simple linear regression model and multiple linear regression models to a data set and interpret the output.

MODULE III (23 Hours)

Methods for project evaluation: Net present value method – Discounted payback period method -
- Accumulated profit method.

MODULE IV (18 Hours)

Weighted average cost of capital – Duration -- Discounted mean term – Convexity –
Immunization -- Asset liability management -- Calculating real yield using an inflation index

Recommended References:

4. GuojunGan, Emiliano Valdez (2018). Actuarial Statistics with R : Theory and Case Studies
5. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R/Andy Field, Jeremy Miles, and Zoë Field.
6. Walkenbach, J. (2007). MICROSOFT EXCEL 2007 BIBLE (With CD). John Wiley & Sons.

SEMESTER III (Total Credits 18)				
Course Code	Title Of The Course	Course Type	Hours /Week	Credits
AS010301	CONTINGENCIES –II	Core	5	4
AS010302	RISK MODELING –I	Core	5	4
AS010303	BUSINESS FINANCE	Core	5	4
AS010304	FINANCIAL ACCOUNTING	Core	5	3
AS80---- AS81----	ELECTIVE FROM GROUP A or B	Elective	5	3

AS010301: CONTIGENCIES - II

Total Credits: 4

Total Hours: 90

Objectives:

- Describe and calculate gross premiums and reserves of assurance and annuity contracts, using gross future loss random variable or using principle of equivalence.
- Describe and calculate reserves under assurance and annuity contracts using prospective and retrospective method of valuation.
- Define and use assurance and annuity functions involving two lives.
- Deal with cash flows and functions dependent upon the death or survival of either or both of two lives, dependent upon a fixed term as well as age.
- Define and calculate death strain at risk, expected death strain, actual death strain and mortality profit, for a single policy or a portfolio of policies.

MODULE I

(18 Hours)

UNIT 1

Gross premiums: The gross premiums -- Gross future loss random variable – Calculating premiums that satisfy probabilities using gross future loss random variable -- Principle of equivalence – Definition – Determining gross premiums using the equivalence principle – The basis – Premium payment structures – Annual premium contracts – Conventional with-profits contracts – Premiums payable m times per year - Calculating gross premiums using simple criteria other than the equivalence principle.

MODULE II

(20 Hours)

UNIT 1

Gross premium reserves: Why hold reserves - Prospective reserves – Calculating gross premium reserves – Calculating prospective reserves that satisfy probabilities – Gross premium prospective reserves for conventional with-profits policies – Reserve conventions - Retrospective reserves - Retrospective accumulations - Gross premium retrospective reserve - Equality of prospective and retrospective reserves – Conditions for equality – Demonstrating the equality of prospective and retrospective reserves - Recursive relationship between reserves for annual

premium contracts - Net premium reserves for conventional without profit contracts – Difference from gross premium reserve – A special result for the net premium reserve for some endowment and whole life assurance contracts

MODULE III (35 Hours)

UNIT 1 (18 Hours)

Joint life and last survivor functions: Random variables to describe joint life functions – Single life functions – Joint life functions – Joint life random variables and joint life table functions – Last survivor lifetime random variables – Evaluating probabilities of death or survival of either or both of two lives – Evaluating last survivor functions – Present value involving two lives – Present values of joint life and last survivor assurances – Calculations, premiums, reserves – Evaluating premiums – Calculating reserves – Future loss random variable.

UNIT 2 (17 Hours)

Contingent and reversionary benefits: Contingent probabilities of death – Contingent assurances – Reversionary annuities – Joint life functions depend on term – Expected present values of joint life assurances and annuities which also depend upon term – Expected present values of last survivor assurances and annuities that also depend upon term – More complex conditions – Expected present values of reversionary annuities that depend upon term – Expected present values of contingent assurances that depend upon term – Expected present value of annuities payable m times a year – Further aspects – Premium conversion relationships – Premium payment term.

MODULE IV (17 Hours)

UNIT 1

Mortality profit : Mortality profit on single policy – Death strain at risk (DSAR) – Expected death strain (EDS) – Actual death strain (ADS) – Mortality profit - Mortality profit on a portfolio of policies - Allowing for death benefits payable immediately - Allowing for survival benefits - Annuities - Allowing for different premium or annuity payment frequencies - Calculation of mortality profit for policies involving two lives.

Recommended Textbooks:

1. Bowers, N. L.; Gerber, H. U.; Hickman, J. C - Actuarial mathematics: 2nd ed. et al. Society of Actuaries,
2. Dickson, D.C.M.; Hardy, M.R.; Waters, H.R.- Actuarial mathematics for life contingent risks: 2nd ed. Cambridge University Press,(2013)

Recommended References:

1. Haberman, S.; Pitacco, E. Chapman & Hall, (1999). - Actuarial models for disability insurance.
2. Benjamin, B.; Pollard, J. H. Institute and Faculty of Actuaries, (1993.)-The analysis of mortality and other actuarial statistics. 3rd Ed.
3. Promislow, D. John Wiley, (2015).-Fundamentals of actuarial mathematics. 3rd ed.
4. Scott, W. F. Heriot - Life assurance mathematics. -Watt University, (1999).
5. Neill, A. Heinemann, (1977)-Life contingencies.
6. Gerber, H. U. Springer -Life insurance mathematics. 3rd ed.; Swiss Association of Actuaries, (1997).
7. Booth, P. M.; Chadburn, R. G.; Haberman, S. et al. Chapman & Hall, (2005). - Modern actuarial theory and practice. 2nd ed.

AS010302: RISK MODELING –I**Total Credits: 4****Total Hours: 90****Objectives:**

- Provide grounding in mathematical and statistical techniques in particular relevance to financial work
- Enable students to understand and apply Actuarial Risk modeling techniques
- Provide understanding of risk modeling in claim forecasting
- Provide understanding of the concept and methods of re-insurance to hedge against risk.

MODULE I (15 Hours)

UNIT 1 (7 Hours)

Loss distributions: Introduction – Simple loss distributions – The exponential distribution – The gamma distribution – The normal distribution – Pareto and Generalized Pareto distribution – lognormal distribution – Wei-bull distribution the burr distribution

UNIT 2 (4 Hours)

Estimation – The method of moment – MLE for gamma and exponential distribution – Method of Percentiles.

UNIT 3 (4 Hours)

Goodness of fit tests – Examples.

MODULE II (25 Hours)

UNIT 1 (8 Hours)

Reinsurance: Introduction – Proportional Reinsurance arrangements – Non-Proportional Reinsurance arrangements – Concepts.

UNIT 2 (6 Hours)

Excess of loss reinsurance for insurer -- Excess of loss reinsurance for reinsurer – Examples -- Proportional Reinsurance Examples

UNIT 3 (5 Hours)

Proportional reinsurance lognormal distribution and examples – Normal distribution and Examples

UNIT 4 (6 Hours)

Inflation – Estimation of Parameters from Censored Data – Policy Excess – Examples

MODULE III (20 Hours)

UNIT 1 (10 Hours)

Risk model 1: The Basic model – Discussion of the simplification in the basic model – Notation and Assumption.

UNIT 2**(10 Hours)**

The collective risk model: The collective risk model distribution function and convolution- Moments of compound distribution – The compound Poisson distribution – The compound binomial distribution – The compound negative binomial distribution – Examples

MODULE IV**(30 Hours)****UNIT 1****(13 Hours)**

Risk model 2: Introduction - Aggregate claim distribution under proportional and individual excess of loss reinsurance -- Proportional reinsurance – Individual excess of loss reinsurance– Examples – Aggregate excess of loss reinsurance

UNIT 2**(17 Hours)**

The Individual risk model -- Parameter variability /uncertainty: Introduction – Variability in a heterogeneous portfolio – Examples -- Variability in a homogeneous portfolio – Examples -- Variability in claim Numbers and claim amounts and parameter uncertainty -- Examples.

Recommended Textbook:

1. Denuit, M., Maréchal, X., Pitrebois, S., & Walhin, J. F. (2007). Actuarial modelling of claim counts: Risk classification, credibility and bonus-malus systems. John Wiley & Sons.

Recommended References:

1. Edward W Frees -Regression Modeling with Actuarial and Financial Applications (International Series on Actuarial Science)
2. Blacker & Yang Actuaries in Micro insurance: Managing Risk for the Underserved ACTEX
3. Miller & Lawton | Stone House-An introduction to statistical modeling – Dobson, Annette J- Chapman & Hall, 1983 viii, 125 pages – ISBN : 0 412 24860 3
4. Hossack,Ian B; Pollard, John H; Zehnwirth, Benjamin -Introductory statistics with applications in general insurance- – 2nd ed. – Cambridge University Press , 1999.
5. Klugman, Stuart A; Panjer, Harry H; Willmot, Gordon E; Venter, Gary G.- John Wiley & Sons -Loss models: from data to decisions. 1998

AS010303: BUSINESS FINANCE

Total Credits: 4

Total Hours: 90

Objectives:

- Provide a basic understanding of corporate finance, including knowledge of the instruments used by companies to raise finance and manage financial risk.
- Equip students with the ability to assess and analyze the financial environment and draw appropriate conclusions for financial outcomes.

MODULE I (26 Hours)

UNIT 1 (8 Hours)

Key principles of finance and corporate governance: Introduction to finance – Finance and real resources of organization -- Finance and the organization objectives -- Responsibilities for financial decisions – The importance of capital budgeting – Financial analysis.

UNIT 2 (7 Hours)

Business objectives – The stakeholders – Conflicting objective provides of finance – Ways of managing conflicts -- Business objectives – A re- statement -- The maximization of shareholders wealth – The goal of the financial managers -- The opportunity cost of capital – The capital markets -- Corporate governance and organization.

UNIT 3 (6 Hours)

Business Ownership: Types of business entity – Sole trader – Partnership limited companies – Limited liability partnerships – Private & public limited companies – Pros & cons of limited companies.

UNIT 4 (5 Hours)

Taxation: Introduction – Personal taxation – Considerations – Taxable income – Tax rates – corporation of- Accounting profits & taxable profits – Rates of tax – Uses of corporation tax system -- Capital gain - Chargeable gains – Indexation allowance – Capital losses – Rates of tax- other taxes – Stamp duty – Inheritance taxes – Property taxes – Sales tax – Custom and excise duties – Double taxation relief.

MODULE II (26 Hours)

UNIT 1 (6 Hours)

Long term finance: Loan capital – Introduction – Debenture stock – Unsecured loan stock - subordinate debt -- Eurobond loan capital – Floating rate notes.

UNIT 2 (3 Hours)

Share capital – Ordinary shares – Preference shares.

UNIT 3 (3 Hours)

Convertibles – Warrants – Options issued by companies – Winding up of a company

UNIT 4 (3 Hours)

Issue of shares: Obtaining stock exchange quotation – Reasons for quotation.

UNIT 5 (5 Hours)

Methods to obtain quotation – Offer for sale at fixed price – Offer for sale by tender – Concessionary methods – Offer for subscription – Placing – Introduction – Role of underwriting.

UNIT 6 (6 Hours)

Issue made by companies already quoted rights issue – Purpose – Impact – Theoretical price – Scrip issue – Purpose – Impact – Scrip dividend.

MODULE III (26 Hours)

UNIT 1 (6 Hours)

Short and Medium Term Finance: Medium Term Company finance – Hire purchase – Credit sale – Leasing – Bank loans.

UNIT 2 (7 Hours)

Short term finance – Bank overdrafts – Trade credit – Factoring - Bills of exchange – Commercial paper

UNIT 3 (4 Hours)

Alternative Sources of Finance: Shadow banking-project finance-Crowd funding microfinance.

UNIT 4 (5 Hours)

Use of derivatives: introduction – Financial futures – Bond futures- Short interest rate future - Work index futures.

UNIT 5**(4 Hours)**

Options – Meaning – Margins & premium – Types – Put option - Call option – Uses of option.
Interests & currency swaps – Pricing – Risk – Uses of swaps.

MODULE IV**(12 Hours)****UNIT 1****(4 Hours)**

Evaluation of working capital: Working capital-management-sources of short term finance-managing cash flow-cash, dividends and dividend sustainability

UNIT 2**(4 Hours)**

Constructing management information-The purpose of forecast and budgets - Examples of forecast and budgets

UNIT 3**(4 Hours)**

Growth and restructuring of companies: Motives for growth-the relationship between profit and growth-the constraints on growth-methods of achieving growth-mergers and acquisitions.

Recommended Textbook:

1. Ross, S. A., Westerfield, R., & Jordan, B. D. (2008). Fundamentals of corporate finance. Tata McGraw-Hill Education

Recommended References:

1. Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2012). Principles of corporate finance. Tata McGraw-Hill Education.
2. Damodaran, A. (1996). Corporate finance. Wiley.
3. Brigham, E. F., & Houston, J. F. (2012). Fundamentals of financial management. Cengage Learning.
4. Davidson, A. (2008). How to Understand the Financial Pages: A Guide to Money and the Jargon. Kogan Page Publishers.
5. Johnson, T. Palgrave Macmillan, 2017. Ethics in quantitative finance.

AS010304: FINANCIAL ACCOUNTING

Total Credits: 3

Total Hours: 90

Objectives:

- The aim of the course is to describe the basic construction of accounts of different types and the principle features of accounts of a company.
- Interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation.
- Show how financial techniques can be used in the assessment of capital investment projects

MODULE I (28 Hours)

UNIT 1 (6 Hours)

Introduction to accounts: The accounting framework – Users -- Sources of regulation statutory requirements – Directors report – Accounting standards – Contents of annual report – Auditor’s report.

UNIT 2 (4 Hours)

Accounting concepts – Cost concepts – Money measurements concepts – Business entity concept – Realization concept – Accrual concept – Dual aspect concept – Materiality – Prudence – Going on concept -- Consistency – Bringing the concepts together.

UNIT 3 (7 Hours)

The main accounts: The balance sheet – Format – Fixed assets – Tangible assets and Intangible assets – Revaluation – Current assets – Liabilities – Long term liabilities – Current liabilities – Provisions and charges – Provisions for taxation and dividends – Pensions – Contingent liability capital.

UNIT 4 (7 Hours)

Profit and loss account – Format – Cost of sales – Expenses – Categories of profit – Taxation – Dividends and retained profits – Earnings per share

UNIT 5 (4 Hours)

Cash flow statement – Format – Purpose of cash flow statement – Notes to accounts.

MODULE II (21 Hours)

UNIT 1 (4 Hours)

Depreciation and reserves – Introduction – Purpose – Methods – Straight-line methods - Reducing balance method.

UNIT 2 (5 Hours)

Capital and reserves – Share capital and share premium –Revaluation reserve –Profit and loss account.

UNIT 3 (6 Hours)

Constructing Accounts: The trial balance – Construction and preparation of financial statement – Profit and loss account and balance sheet – Awkward items in the trial balance – Depreciation – Profit and loss reserve – Stock- Adjustment in the accrual concept

UNIT 4 (6 Hours)

Using the trial balance - Preparation of income statement-balance sheet

MODULE III (28 Hours)

UNIT 1 (5 Hours)

Group accounts and insurance company accounts: Introduction – Consolidated financial statements- Subsidiary companies – Consolidated balance sheet.

UNIT 2 (5 Hours)

Goodwill on consolidation – Minority interest in associated companies – Consolidated balance sheet – Good will on consolidation –Minority interest associated companies.

UNIT 3 (5 Hours)

Insurance companies- Introduction – Estimation of liabilities and timing of profit – profit and loss account – Technical accounts -Non- technical accounts – Balance sheet –Assets – Liabilities – Shareholders fund.

UNIT 4 (5 Hours)

Interpretations of accounts: Introduction –Measuring risk associated with loan capital – Income cover and Income priority percentages – Asset cover and Asset priority percentages – Asset gearing – Income gearing.

UNIT 5 (4 Hours)

Ratios involving share information - Earnings per share -basic and diluted Price earnings ratio- uses-Dividend yield – Dividend cover - EBITDA- net asset value per share – Variations.

UNIT 6 (4 Hours)

Other accounting ratios-Introduction-Profitability ratios – Return on capital employed – Profit margin-Asset utilization ratio- Liquidity ratios – Current ratio- Quick ratio-Efficiency ratios – stock turnover period – Debtor’s turnover period – Creditors turnover period.

MODULE IV (13 Hours)

UNIT 1 (2 Hour)

Limitations of accounts and alternative reporting: Valuation of stock – Depreciation- interest payments – consistency over time.

UNIT 2 (2 Hours)

Limitations in the interpretation of accounts – Subjectivity appropriateness –Inventory- Appropriateness of the figures used- Comparison between firms – Some limitations of ratio analysis -Accuracy of figures. Manipulation of reported figures reporting on environmental, social and economics sustainability-Alternatives to traditional financial reporting

UNIT 3 (3 Hours)

Capital structure and dividend policy: Introduction – Capital structure – Components of capital structure-The aims of financial manager – Asset and their financing needs-changing the capital structure-Theoretical background of gearing decision-Factors affecting gearing decision in practice.

UNIT 4 (3 Hours)

The market and capital structure – High growth company that is highly geared – Cyclical industry – An industry facing decline - “ people ” businesses – Company in high growth but high risk industries – Taxation and capital structure.

UNIT 5 (3 Hours)

Dividends-shareholder’s reward – Fundamentals of dividend policy – Factors influencing dividend policy – Other methods of reward – Scrip and stock dividends – Effects on companies and shareholders – Share buyback – The market and dividends.

Recommended Textbooks:

1. Scott, W. R. (2003). Financial accounting theory.
2. Beaver, W. H. (1998). Financial reporting: an accounting revolution (Vol. 1). Upper Saddle River, NJ: Prentice Hall

Recommended References:

1. Sloman, J., Garratt, D., Guest, J., & Jones, E. (2016). Economics for business. Pearson Education.
2. Brigham, E. F., & Houston, J. F. (2012). Fundamentals of financial management. CengageLearning.A
3. Davidson, A -How to understand the financial pages. 2nd ed. Kogan Page, 2008. .
4. Bushman, R. M., & Smith, A. J. (2001). Financial accounting information and corporate governance.

SEMESTER IV (Total Credits 22)				
AS010401	PRICING & RESERVING OF LIFE ASSURANCES & ANNUITIES	Core	5	4
AS010402	RISK MODELING –II	Core	5	4
AS010403	ACTUARIAL COMPUTING –III	Core	5	3
AS80---- AS81----	ELECTIVE FROM GROUP A or B	Elective	5	3
AS80---- AS81----	ELECTIVE FROM GROUP A or B	Elective	5	3
AS010405	PROJECT WORK AND REPORT			3
AS010406	VIVA – VOCE			2

AS010401: PRICING & RESERVING OF LIFE ASSURANCES & ANNUITIES

Total Credits: 4

Total Hours: 90

Objectives:

- Describe the construction and use of multiple decrement tables. Define a multiple decrement model as a special case of a multiple state Markov model.
- Describe the operation of conventional, unit-linked and accumulating with-profits contracts.
- Profit test of whole life, endowment and term assurances, annuities, unit-linked contracts, and conventional/unitized with-profits contracts. Show how a profit test can be used to price a product.
- Project expected future cash flows for the above listed contracts, and hence to show it can be used to calculate gross premium reserves. Show how, for unit-linked contracts, non-unit reserves can be established to eliminate ('zeroise') future negative cash flows, using a profit test model.

MODULE I

(20 Hours)

UNIT 1

Competing risks: Health insurance contract -- Multiple state models – Notation – Valuing continuous cash flows using multiple state models – Designing the multiple state model – Multiple decrement models – A simple example – Multiple decrement probabilities – Deriving probabilities from transition intensities - Multiple decrement tables – Associated single decrement tables – Relationships between single and multiple decrement tables – Constructing a multiple decrement table – Obtaining dependent probabilities – Integral formulae for multiple decrement probabilities - Using multiple decrement tables to evaluate expected present values of cash flows.

MODULE II

(18 Hours)

UNIT 1

Unit-linked and accumulating with-profits contracts: Unit-linked contracts – Unit funds and non-unit funds - Accumulating with-profits contracts – Definition – Unitized (accumulating) with-profits contracts – Charges and benefits under UWP – Comparison between UWP and the simple AWP designs.

MODULE III

(30 Hours)

UNIT 1

Profit testing: Evaluating expected cashflows for various contract types – Example 1: Conventional whole life assurance – Example 2: Conventional endowment assurance – Example 3: Unit-linked endowment assurance – Example 4: Single premium unitized with-profits contract -- Profit test for annual premium contracts – Summary measures of profit – Profit testing using the present value random variable -- Pricing using profit test – Profit criterion.

MODULE IV

(22 Hours)

UNIT1

Reserving aspects of profit testing: Pricing and reserving bases -- Calculating reserves for Unit -- linked contracts – Reserves revisited – Calculating reserves for unit-linked contracts -- Calculating reserves for conventional contracts using the profit test -- Effect of pricing and reserving bases on a profit test -- Setting out the calculations.

Recommended Textbooks:

1. Bowers, N. L.; Gerber, H. U.; Hickman, J. C - Actuarial mathematics: 2nd ed. et al. Society of Actuaries,
2. Dickson, D.C.M.; Hardy, M.R.; Waters, H.R.(2013)- Actuarial mathematics for life contingent risks: 2nd ed. Cambridge University Press

Recommended References:

1. Haberman, S.; Pitacco, E. Chapman & Hall, (1999). - Actuarial models for disability insurance.
2. Benjamin, B.; Pollard, J. H. Institute and Faculty of Actuaries, (1993.)-The analysis of mortality and other actuarial statistics. 3rd ed.
3. Promislow, D. John Wiley, (2015).-Fundamentals of actuarial mathematics. 3rd ed.
4. Scott, W. F. Heriot - Life assurance mathematics. -Watt University, (1999).
5. Neill, A. Heinemann, (1977)-Life contingencies. .
6. Gerber, H. U. Springer -Life insurance mathematics. 3rd ed.; Swiss Association of Actuaries, (1997).
7. Booth, P. M.; Chadburn, R. G.; Haberman, S. et al. Chapman & Hall, (2005). - Modern actuarial theory and practice. 2nd ed.

AS010402: RISK MODELING –II

Total Credits: 4

Total Hours: 90

Objectives:

- Provide a sound grounding in mathematical and statistical techniques of particular relevance to financial work.
- Enable students to understand and apply Actuarial Risk modeling techniques.
- Provide students with understanding of use of risk modeling technique in claim forecasting.
- Understand the concept and methods of re-insurance to hedge against risk.

MODULE I

(30 Hours)

UNIT 1

(7 Hours)

Time series: Introduction – Properties of a uni-variate time series – Auto Covariance function – Auto Correlation function – Correlograms -- Partial Auto Covariance function – Partial Auto Correlation function

UNIT 2 (5 Hours)

Stationary random series main linear model of time series: Introduction -- Backwards shift operator 'B' and difference operator ' Δ ' -- Examples

UNIT 3 (15 Hours)

Main linear models of time series: The first order autoregressive model AR (1), The autoregressive model AR (P), The first-Order moving average model MA (1), The moving average MA (q) and The autoregressive moving average process ARMA (p, q)

UNIT 4 (3 Hours)

Modeling non stationary processes: The ARIMA model – Examples – Basics of Markov Property

MODULE II (15 Hours)

UNIT 1 (5 Hours)

Ruin Theory: Introduction -- Basis concepts and notation -- The surplus process -- Equations

UNIT 2 (4 Hours)

The probability of ruin in discrete and continues time –The Poisson and compound poisson processes – Probability of ruin in the short term -- Premium security loadings

UNIT 3 (6 Hours)

Reinsurance and ruin – Introduction – Proportional reinsurance – Excess of loss reinsurance – Examples.

MODULE III (25 Hours)

UNIT 1 (5 Hours)

Run-off triangles: Introduction – The origins of run-off triangles – Types of reserves – Presentations of claims data – Estimating future claims – Other ways of recording data

UNIT 2 (8 Hours)

Projections using development factors: Run-off Patterns – The statistical model for run-off triangles -- The chain ladder method – Model checking – Other methods of deriving development factors -- Assumptions underlying the method.

UNIT 3 **(12 Hours)**

Adjusting for inflation: The inflation adjusted chain ladder method: Dealing with Past and Future Inflation and Assumptions underlying the method -- The average cost per claim method: Description and Application of the method, Assumptions underlying the method and Loss ratios - The Bornhuetter-Ferguson method: Concept of Bornhuetter-Ferguson method, Description of the method, Application of the method and Assumptions underlying the method – Grossing up factors versus development factors.

MODULE IV **(20 Hours)**

UNIT 1 **(5 Hours)**

Machine Learning: An overview of machine learning – Concepts in machine learning – The loss function – Model evaluation – Examples

UNIT 2 **(7 Hours)**

Generalization error and model validation – Train validation test – Validation and over-fitting – Regularization – Branches of machine learning – Supervised Learning - Unsupervised Learning – Semi-supervised Learning -- Reinforcement Learning

UNIT 3 **(8 Hours)**

Stages of analysis in machine learning – Collecting data – Types of data -- Exploring and Preparing Data – Splitting the table into the training and validation sets

Recommended Textbook:

1. Dobson, Annette J Chapman & Hall -An introduction to statistical modeling, 1983

Recommended References:

1. Hossack, Ian B. Pollard, John H; Zehnwirth, Benjamin-Introductory statistics with applications in general insurance – 2nd ed.- Cambridge University Press , 1999 xi, 282 pages – ISBN :0 521 65534 X
2. Klugman , Stuart A; Panjer, Harry H;Willmot Gordon E; Venter, Gary G- John Wiley & Sons -Loss models : from data to decisions -, 1998 – xiii, 644 pages ISBN 0471 23884 8

3. Michel Denuit ,Xavier Marechal ,Sandra Pitrebois ,Jean-Francois Walhin -Actuarial Modelling of Claim Counts: Risk Classification, Credibility and Bonus-Malus Systems 1st Edition
4. Maginn& Tuttle | John Wiley & Sons-Managing Investment Portfolios WORKBOOK: A Dynamic Process, 3rd ed. 2007
5. Klugman et al Understanding Actuarial Practice, 2012
6. Alex Panlilio, Steven Perkins Practical application of machine learning within Actuarial Work, by modeling, analytics, and insights in data working party

AS010403: ACTUARIAL COMPUTING – III

Total Credits: 3

Total Hours: 90

Objective:

- Provide students with hands on experience of calculating problems in contingency using Excel software.

MODULE I (22 Hours)

Competing risk: Multiple decrement probabilities – Constructing multiple decrement tables – Evaluate expected present value of cash flows.

MODULE II (22 Hours)

Unit linked and accumulating with profit contracts: Accumulating with profits contract

MODULE III (23 Hours)

Profit Testing: Calculating expected cash flows for various contract types – Profit test for annual premium contracts – Pricing using profit test.

MODULE IV (23 Hours)

Reserving aspects of profit testing: Pricing and reserving –Calculating reserves for unit-linked contracts –Calculating reserves for conventional contracts using profit test.

Recommended References:

1. Walkenbach, J. (2007). MICROSOFT EXCEL 2007 BIBLE (With CD). John Wiley & Sons.

AS80-ELECTIVES – GROUP A	
AS80--	Elective I-Risk Management
AS80--	Elective II- Insurance and Retirement Benefits
AS80--	Elective III-Business Management

AS800---: ELECTIVE I- RISK MANAGEMENT

Total Credits: 3

Total Hours: 90

Objectives:

- Describe and discuss the factors that determine designing of a contract
- Discuss the actuarial techniques used in the assessment of capital investment projects and cost-benefit analysis
- Describe the principles and objectives of investment management and the asset-liability matching requirements

MODULE I (26 Hours)

UNIT 1 (5 Hours)

Cashflows of simple products: - Introduction to cash flows: Cashflow matching and Cashflow process -- Cashflow scenarios: Annuity, Term assurance, Endowment assurance, An interest-only loan, Repayment loan (mortgage) and Motor insurance

UNIT 2 (9 Hours)

Contract design: Introduction – Parties involved in contract design: Customer needs and interests and Characteristics of other stakeholders involved in contract design – Deciding on the benefits to offer: The level and form of benefits, Option and guarantees, Discretionary benefits, Benefits taken early/ discontinuance terms and Contract conditions - Commercial considerations: Profitability, Marketability and Competitiveness and Statutory/ regulatory requirements

UNIT 3 (12 Hours)

Financing considerations: Financing requirements, Method of financing the benefits to be provided and risk characteristics – Premiums, contributions and charges: Premium/ Contribution pattern, Charges vs. expenses, Extent of cross-subsidies and Consistency with other contracts- Administrative and accounting issues: Administration system and Accounting implications

MODULE II (22 Hours)

UNIT 1 (11 Hours)

Project management: - Participating in a successful project: Introduction, Characteristics of well-run projects, written strategy documents and Project management team - Capital project appraisal: Definition of a capital project and Key stages in capital project - Initial appraisal – Detailed appraisal: Definition of project and Evaluation of cash flows

UNIT 2 (11 Hours)

Choice of risk discount rate: General considerations, Systematic risk and specific risk, Choosing the discount rate for projects with a normal degree of systematic risk, Choosing the discount rate for projects with a higher than normal degree of systematic risk and Other factors -- Risk identification – Analysis of risks – Risk mitigation

MODULE III (27 Hours)

UNIT 1 (10 Hours)

Relationship between return and asset classes - Expected and required returns: Required returns, Expected return, Requires vs. expected return and Determining whether an asset seems cheap - Analyzing historical returns: Introduction, Equities, Conventional bonds, Index-linked bonds, Cash and Earnings

UNIT 2 (10 Hours)

Valuation of asset classes and portfolios - Analysis of expected returns from different assets: Introduction, Two definitions, The analysis, Conventional government bonds, Corporate loan, Stocks, Equities and Property - Comparisons between investment sectors: Yield gap and reverse yield gap, Dividend yields vs. real yields, Property vs. other sectors, Corporate bonds vs. government bonds and Overseas investments - Other methods: Yields “norms”- index levels and price charts - Yield ratios

UNIT 3 (7 Hours)

Relationship between the assets and liabilities: Consistency of valuation - Consistency of method - Consistency of bases- Allowing for the variability of the asset prices – Notional portfolios: Method - Choosing the notional portfolio

MODULE IV

(15 Hours)

UNIT 1

(7 Hours)

Developing investment strategy : The principles of investment – Asset-Liability matching requirements of liabilities -- Nature of liabilities, Benefit payments, Expense outgo and Premium / contribution income – Asset-liability matching requirements of assets: Selecting assets appropriate to the liabilities, Guaranteed in money terms, Guaranteed in terms of the prices index or similar, Discretionary benefits and Investment-linked - Other considerations: Currency, Free assets / surplus and Regulatory framework

UNIT 2

(8 Hours)

Active and passive investment management - Measuring risk, Risk budgeting and Matching -- Actuarial techniques for determining investment strategy – Asset-liability models -- Non-actuarial techniques for determining investment strategy -- Liability hedging – Immunization

Recommended References:

1. Booth, P., Haberman, S., Chadburn, R., James, D., Khorasane, Z., Plumb, R. H., & Rickayzen, B. (2004). Modern actuarial theory and practice. Chapman and Hall/CRC.
2. Daykin, C. D., Pentikainen, T., & Pesonen, M. (1993). Practical risk theory for actuaries. Chapman and Hall/CRC.

AS800-- ELECTIVE II- INSURANCE & RETIREMENT BENEFITS

Total Credits: 3

Total Hours: 90

Objectives:

- The course aims at equipping students with the understanding of principles of insurance and different superannuation schemes under insurance
- Provide understanding of tax treatment of retirement benefits and the international accounting standards.

MODULE I

(25 Hours)

UNIT 1

Concept of Insurance and its origin: History – Principles and concept in insurance -- liberalization of Indian insurance -- Underwriting in insurance –Types of insurance products: Life, General and Health -- Micro insurance -- Social security schemes: Objective and Schemes in India -- Changes in the field of insurance industry -- Challenges facing insurance industry -- Issues in insurance industry- IRDA – Regulations.

MODULE II

(15 Hours)

UNIT 1

Superannuation Schemes: Objectives - Development of scheme pension as retirement benefit -- Defined benefit and defined contribution -- Optional pensions -- Commutation of pension -- Pension in other contingencies -- Methods of costing pension -- Costing of past service pension: Definite, indefinite and controlled funding -- National pension scheme.

MODULE III

(35 Hours)

UNIT 1

(20 Hours)

Group Insurance: Objective and Development of scheme - Comparison between individual and group insurance - Conditions of eligibility - Eligible groups -- Contributory and non-contributory schemes - Group selection - Rate making in group insurance -- Group insurance in lieu of EDLI – Group creditor insurance -- Weaker section scheme and rural scheme -- Group saving linked insurance scheme

UNIT 2

(15 Hours)

Provident fund and employee's family pension and deposit linked insurance scheme -- Gratuity scheme: Payment of gratuity act 1972 -- Objective of gratuity scheme -- Ways of meeting gratuity liability -- Group gratuity scheme.

MODULE IV

(15 Hours)

UNIT 1

Accounting Standards – Indian AS-15, US GAAP and International Accounting Standards – Actuarial Valuation of Retirement benefits-- Taxation Aspects

Recommended References:

1. Rosenbloom, J. S., & Hallman, G. V. (1991). Employee benefits planning. Prentice Hall.
2. Baranoff, E. Z., & Baranoff, E. Z. (2004). Risk management and insurance (pp. 48-52). Danvers: Wiley.
3. Baker, T., & Simon, J. (Eds.). (2010). embracing risk: The changing culture of insurance and responsibility. University of Chicago Press.
4. Jones, H. E., & Long, D. L. (2005). Principles of Insurance: Life, Health, and Annuities. LOMA.
5. Dreze, J., Hills, J., & Sen, A. (1991). Social security in developing countries. E. Ahmad (Ed.). Oxford: Clarendon.
6. Walton, P., Haller, A., & Raffournier, B. (Eds.). (2003). International accounting. Cengage Learning EMEA.
7. IC 83 Group Insurance and Retirement Benefit Schemes (2016). Insurance Institute of India

AS800--: BUSINESS MANAGEMENT

Total Credit: 3

Total Hours: 90

Objectives:

- Make students aware of the internal and external environment in which business operates
- Equip students with competencies that would enable them to identify business problem and apply related analytical tools to evaluate the constantly changing business environment
- Encourage team work and appreciate the diversity of a group setting.
- Develop leadership and management skills to be able to embrace changes in the organization

MODULE I (30 Hours)

UNIT 1 (15 Hours)

External Business Environment: Nature and Types of competitive environments – Impact and influence of external environment on organizations – Corporate social responsibility – Organizational development – Features and types of organizational culture

UNIT 2 (15 Hours)

Organizational Behaviour: Features of organizational behaviour – Changing nature of work in workplaces– Organization and management – Impact of globalization on organizations – Impact and influence of internal environment on the organization’s strategy

MODULE II (30 Hours)

UNIT 1 (15 Hours)

Strategic Management: Concepts in strategic management — Different levels of strategies in organization -- Organizational goals, objectives and policies – Organizational structure – Value chain analysis

UNIT 2 (15 Hours)

Impact of internal and external environment on organizations: PESTEL analysis -- SWOT analysis -- Porter’s five force model - Porter’s diamond -- Stakeholder mapping – Qualitative and quantitative tools of competitor’s analysis – Scorecards

MODULE III (20 Hours)

UNIT 1 (12 Hours)

Managing Change: Nature of organizational change – Reasons for resistance to change – Human and social factors of change – Tools and methods for implementation of change – Risk associated with change

UNIT 2 (8 Hours)

Leadership: Importance in organizations -- Styles and forms of leadership -- Values and behavior of leaders -- Exercising leadership power – Effective leadership

MODULE IV

(10 Hours)

UNIT 1

Team work: Types of member team roles –Professional and personal qualities -- Understanding group dynamics – Project management -- Nature and causes of conflicts – Management of conflict – Building effective teams.

Recommended Textbooks:

1. Parikh, M., & Gupta, R. (2010). Organizational Behaviour Tata McGraw Hill. Education Private Limited: New Delhi
2. Aswathappa, K., & Reddy, G. S. (2009). Organizational behaviour (Vol. 20). Himalaya Publishing House

Recommended References:

1. Sherlekar, S. A., & Sherlekar, V. S. (2007). Himalaya Publishing House. Modern Business Organisation and Management: Systems-based Contingency Approach to the Organisation and Management of Business.
2. Robbins, S. P. (2001). Organisational Behaviour: Concepts, Controversies and Applications Australia and New Zealand. Prentice Hall.
3. Kotter, J. P. (2012). Leading change. Harvard business press.
4. Chance, P.L., & Chance, E.W. (2002). Introduction to educational leadership and organizational behavior: Theory into practice. Larchmont, NY: Eye on Education.

AS81-ELECTIVES – GROUP B	
AS810--	Elective I-Actuarial Risk Management
AS810--	Elective II-Research Methodology
AS810--	Elective III-Marketing of Services

AS810 --: ELECTIVE I-ACTUARIAL RISK MANAGEMENT

Total Credits: 3

Total Hours: 90

Objectives:

- Understand strategic concepts in managing business activities of financial institutions and management of the various types of risk faced by the organizations.
- Analyze the issues and formulate, justify and present plausible and appropriate solutions to business problems.

MODULE I

(30 Hours)

UNIT 1

(12 Hours)

Introduction to financial products and customer needs: Insurance contracts, Pension schemes, investment schemes, Derivatives and Reinsurances contracts - Bringing together customer needs and financial products: Logical or emotional needs, Current or future needs and Designing products to meet the need– Pension schemes : Defined benefit pension schemes, Defined contribution scheme and Hybrid schemes

UNIT 2

(11 Hours)

Risk and uncertainties: Risks to the beneficiary, Risk to the sponsor and Risk to the state – Benefit risks: Benefit risks in defined benefit schemes, Benefits risks in defined contribution schemes, Benefit risks in both defined benefit and defined contribution schemes – Contribution / premium risks: Contribution /premium risks in a defined contribution scheme, Contribution /premium risks in a defined benefit scheme, Contribution risks in both defined benefit and defined contribution schemes – Investment risks: Income, Capital proceeds, Reinvestment, Default, Tax and expenses, Appreciation of benefits by recipients and Opportunity cost of the capital -Overall security risks in benefits schemes: Security and Strength of the sponsor / provider promise

UNIT 3

(7 Hours)

Risks in insurance: Categories of risk – Financial risks: Market risks, Credit risks and Business risk -- Non-financial risks: Operational risk and External risk - Risk classification

MODULE II (30 Hours)

UNIT 1 (11 Hours)

The risk management process: Introduction the risk faced: Risk identification, Risk measurement, Risk control, Risk financing and Risk monitoring - Adoption of control measures: Introduction, Reducing the total cost of a risk, Reducing the probability of catastrophic loss, Ensuring survival while minimizing the cost of risk management - Risk as an opportunity not a constraint

UNIT 2 (11 Hours)

Risk management tools – I: Issues surrounding the management of risk –Tools that can be used to aid the management of risks – Reinsurance terminology- Reinsurance contracts: Facultative reinsurance and Treaty reinsurance - Types of reinsurance: Proportional reinsurance and Non-proportional reinsurance - Proportional reinsurance: Quota share, Surplus, Reinsurance premiums under proportional arrangements

UNIT 3 (8 Hours)

Non- proportional reinsurance: Excess of loss reinsurance, Risk excess of loss, Aggregate excess of loss , Catastrophe excess of loss, Stop loss and Use of non- proportional reinsurance -- Financial reinsurance -- Reinsurance as a risk management tool: The benefits of reinsurance, The cost of reinsurance, Cost vs. benefits and The effectiveness of reinsurance

MODULE III (10 Hours)

UNIT 1 (10 Hours)

Risk management Tools 2: Introduction – Diversification – Underwriting: what is underwriting, Under writing as a risk management tools and Life insurance underwriting - Alternative risk transfer: Discounted covers, Integrated risk covers, Securitization, Post loss funding, Insurance derivate, Swaps and Summary of art -- Management control systems – Managing the risk associated with options and guarantees

MODULE IV (20 Hours)

UNIT 1 (10 Hours)

Capital and capital management: - Introduction of capital: Types of capital, The regulatory environment and Modeling capital requirements -- Capital needs: Individuals, Companies, Providers of financial services products, Banks and The state -- Sources of capital: Proprietary companies, Mutual companies, Sponsors of benefit schemes and The state

UNIT 2 (10 Hours)

Capital management tools: Reinsurance, Financial reinsurance, Securitization, Subordinated debt, Banking products, Derivatives , Equity capital, Internal sources of capital - Insolvency and Closure - Insurance companies – Sponsored benefit schemes: Level of benefits and Provision of benefits

Recommended References:

1. Booth, P., Haberman, S., Chadburn, R., James, D., Khorasane, Z., Plumb, R. H., & Rickayzen, B. (2004). Modern actuarial theory and practice. Chapman and Hall/CRC.
2. Daykin, C. D., Pentikainen, T., & Pesonen, M. (1993). Practical risk theory for actuaries. Chapman and Hall/CRC.

AS810 --: ELECTIVE II-RESEARCH METHODOLOGY

Total Credits: 3

Total Hours: 90

Objectives:

- Enable students to identify, explain and apply the basic concepts of research, such as sampling techniques, issues of reliability and validity in research.
- Enable to create research questions and hypotheses, identify and analyze the appropriate method and variables needed for research questions.
- Recognize the ethical issues involved in research and practice ethical research standards.

MODULE I (20 Hours)

UNIT 1 (10 Hours)

Business Research: Introduction – Characteristics and motivations in research – Types of research – Research approaches – Significance of research – Research methods vs. methodology – Research and scientific methods – Research process – Criteria of good research

UNIT 2 (10 Hours)

Defining the research problem: What is research problem? - Selecting the problem - Necessity of and techniques in defining the problem – Research design: Concept, Meaning and Need -- Features of good design and types – Basic principles of experimental and quasi-experimental research design – Evaluative criteria for developing a good research design.

MODULE II (20 Hours)

UNIT 1 (10 Hours)

Sampling Design: Census and sample surveys -- Criteria for selecting a sample procedure - Characteristics of a good sample procedure – Types of sample design – Techniques of selecting a random sample and non-random sample – Complex random sampling design – Sampling and non-sampling errors – Appropriate sample size determination based on i) Precision rate and confidence level ii) Bayesian statistics – Advantages and limitations of sampling.

UNIT 2 (10 Hours)

Hypothesis Formulation: Concept, Meaning and Types -- Testing of hypothesis -- Procedures of hypothesis testing – Flow diagram for hypothesis testing – Parametric and non-parametric tests for testing hypothesis – Limitations of tests of hypothesis – Types of errors and their implications.

MODULE III (25 Hours)

UNIT 1 (15 Hours)

Measurement and Scaling Techniques: Measurement in research - Measurement scales -- Sources of errors in measurement -- Tests of second measurement -- Technique of developing measurement tools -- Criteria for good measurement -- Meaning of scaling -- Scale classification bases -- Important scaling techniques and scale construction techniques – Attitude Measurement:

Likert scale, Semantic differential scale, Thurston scale, Equal appearing interval scale and Multi-dimensional scaling.

UNIT 2

(10 Hours)

Methods of data collection: Collection of primary data: Observation method, Interview method and Collection of data through questionnaire and schedules – Collection of secondary data – Selection of appropriate method for data collection – Guidelines for developing questionnaire -- Successful interviewing – Survey Vs. Experiment – Reliability and validation of measurement – Pre-testing of questionnaire.

MODULE IV

(25 Hours)

UNIT 1

(15 Hours)

Processing and data analysis: Editing, Coding, Classification - Tabulation of data and Data validation – Methods of data presentation – Types of data analysis: Quantitative and Qualitative – Statistics in research: Descriptive and inferential statistics – Descriptive statistics: Measures of Central Tendency, Dispersion, Asymmetry and Cross-tabulations (Problem Only).

UNIT 2

(10 Hours)

Research Report Writing: Purpose – Types – Steps - Format of Research Report and Criteria of good research report – Pre-Writing considerations – Final presentation of the research report – Idea of referencing: Bibliography, Footnotes and End Notes – Formats of publications in research journals – Areas of scientific dishonesty and ethical issues related to copyright – Scientific misconduct.

Recommended References:

1. Singh, Y. K. (2006). Fundamental of research methodology and statistics. New Age International.
2. Walter, M., & Andersen, C. (2013). Indigenous statistics: A quantitative research methodology. Left Coast Press.
3. Tavakoli, H. (2012). A dictionary of research methodology and statistics in applied linguistics. Rahnama press.
4. Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International.

5. Morse, J. M., & Field, P. A. (1995). Qualitative research methods for health professionals (Vol. 2). Thousand Oaks, CA: SAGE publications.
6. Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. Issues in educational research, 16(2), 193-205

AS810 -- ELECTIVE III - MARKETING OF SERVICES

Total Credits: 3

Total Hours: 90

Objectives:

- Enable students to understand the differences between services and products, the elements of marketing mix, challenges and issues in marketing services.
- To provide an in-depth appreciation and understanding of the unique challenges inherent in managing and delivering quality services.
- Identify the key elements that marketers must integrate to sustain service excellence and provide customer value.

MODULE I (30 Hours)

UNIT 1

Services—characteristics & categories – Major differences between services & goods classification of different types of services – Contribution of service sector to the economy-consumer behavior - Evaluation of service Alternatives – Customer satisfaction.

MODULE II (30 Hours)

UNIT 1 (15 Hours)

Marketing mix elements for services – Targeting, segmentation & positioning – Problem areas of segmentation– Importance of pricing

UNIT 2 (15 Hours)

Advertising & sales promotion in services - Role of distribution in services

MODULE III (20 Hours)

UNIT 1 (10 Hours)

Role of people in services marketing: Services provider employee and Services recipient customer - Service quality: Measurement and delivery of service quality

UNIT 2 (10 Hours)

Management of services – Performance measurement – Enhancement & control

MODULE IV (10 Hours)

UNIT 1

Customer encounters management - Obligation & duties of service provider - Marketing strategies for service firms – Marketing of health care service – Customer relationship management – New service opportunities

Recommended References:

1. Apte, G. (2004). Services marketing. Oxford University Press, USA.
2. Kapoor, D. C. (2004). Marketing & Sales Management. S. Chand.
3. Shajahan, S. (2006). Relationship marketing: text and cases. Tata McGraw-Hill Education.
4. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Services marketing: Integrating customer focus across the firm (No. 2nd Eu). McGraw Hill.
5. Jauhari, V., & Dutta, K. (2009). Services: Marketing, operations, and management. Oxford university press.
6. Shanker, R. (2002). Services marketing. Excel Books India.

MODEL QUESTION PAPERS

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010101 – ACTUARIAL STATISTICS- I
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Give the types of data.
2. Define Probability.
3. Define Random variable.
4. List out any five continuous distribution.
5. Define Probability Generating Function.
6. Obtain the probability function for the marginal distribution of M from 0; where

$$P(M = m, N = n) = \frac{m}{35 \times 2^{n-2}}, \text{ where } m = 1, 2, 3, 4 \text{ and } n = 1, 2, 3$$

7. Define Compound Distribution.
8. Briefly give the equation and definition of Central Limit Theorem.
9. Calculate three commonly used statistics that provide a measure of spread, and are expressed in terms of the original unit of measure, for the following set of ten observations : 5.1, 2.6, 7.3, 4.4, 4.6, 2.9, 3.4, 3.2, 4.4, 5.0
10. Define a simple random sample? (8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Draw Stem and Leaf diagram of following Data :
243 306 271 396 287 399 466 269 295 330
425 324 228 113 226 176 320 230 404 487
127 74 523 164 366 343 330 436 141 388

12. A box of chocolates contains 8 milk chocolates and 4 plain chocolates. A chocoholic eats three chocolates. Calculate the probability that:
- all three are milk chocolates
 - exactly one is a plain chocolate.
13. A continuous random variable has the probability density function
- $$f_X(x) = ke^{-2x} \quad \text{for } x > 0. \text{ Find } k \text{ and } P(X < 5.27).$$
14. If $X \sim N(25, 36)$, find:
- $P(X < 28)$
 - $P(X > 30)$
 - $P(X < 20)$
 - $P(|X - 25| < 4)$
15. Find the CGF of X where $X \sim \text{Gamma}(\alpha, \lambda)$, and hence find its mean and variance.
16. If the number of minutes it takes for a mechanic to check a tyre is a random variable having an exponential distribution with mean 5, what is the probability that the mechanic will take:
- more than eight minutes to check two tyres ?
 - at least fifteen minutes to check three tyres?
17. Let X and Y have joint density function given by: $f(x, y) = \frac{3}{5} x(x+y)$, $0 < x < 1$, $0 < y < 2$, Determine the conditional expectation $E[Y|X = x]$.
18. The number of claims arising in a month under a home insurance policy, follows a Poisson distribution with mean 0.075. Calculate the approximate probability that at least 50 claims in total arise in a month under a group of 500 independent such policies. (6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. (i) State and Prove Bayes theorem
- (ii) The punctuality of trains has been investigated by considering a number of train journeys. In the sample, 60% of trains had a destination of Manchester, 20% Birmingham and 20% Edinburgh. The probabilities of a train arriving late in Manchester, Edinburgh or Birmingham are 30%, 20% and 25% respectively. If a late

train is picked at random from the group under consideration, what is the Probability that it terminated in Manchester?

20. U and V have the joint distribution given by $f(u, v) = (2u+v)/3000$,

Where $10 < u < 20, -5 < v < 5$ Find $E(U)$ and $E(V)$:

(i) using $f(u, v)$

(ii) using marginal distribution $f(u)$ and $f(v)$

21. Calculate $P(X < 8)$ if:

(i) X is the number of claims reported in a year by 20 policyholders. Each policyholder makes claims at the rate of 0.2 per year independently of the other policyholders.

(ii) X is the number of claims examined up to and including the fourth claim that exceeds £20,000. The probability that any claim received exceeds £20,000 is 0.3 independently of any other claim.

(iii) X is the number of deaths amongst a group of 500 policyholders. Each policyholder has a 0.01 probability of dying independently of any other policyholder.

(iv) X is the number of phone calls made before an agent makes the first sale. The probability that any phone call leads to a sale is 0.01 independently of any other call.

22. Find $P(X < 8)$ if:

(i) $X \sim U(5, 10)$

(ii) $X \sim N(10, 5)$

(iii) $X \sim \text{Exp}(0.5)$

(iv) $X \sim \text{Chi-Square}$ with degrees of freedom 5

(v) $X \sim \text{Gamma}(8, 2)$

(vi) $X \sim \text{log N}(2, 5)$

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010102 – FINANCIAL MATHEMATICS - I
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Express i in terms of d
2. Define Nominal rate of return and Force of interest.
3. find the effective annual interest rate that is equivalent to a simple interest rate of 3%pa over 4 years.
4. Explain principle of consistency
5. Define Deferred Annuity.
6. State the Linear Interpolation formula which is used to find yield in Equation of Value.
7. Briefly explain the retrospective and prospective methods
8. Calculate the accumulated value of 6.34 ,assuming a force of interest of 9%after
1)3months 2)3 years and 3)7 years and 5 days
9. Define mortgage
10. Find $i^{(4)}$ if $i=4\%$ (8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. The force of interest is given by:

$$\delta(t) = \begin{cases} 0.04 + 0.002t & 0 \leq t < 10 \\ 0.015t - 0.08 & 10 \leq t < 12 \\ 0.07 & t \geq 12 \end{cases}$$

Find an expression for the accumulation factor from time 0 to t .

12. Explain Call Deposit and Equity with examples.
13. Find n , if $P=78.92, I=5, R=125$ and $i=10\%$
14. Find the present value as at 1 June 2004 of payments of £1,000 payable on the first day of each month from July 2004 to December 2004 inclusive, assuming a rate of interest of 8% per annum convertible quarterly.
15. Rent on a property is payable continuously for 5 years. The rent in the first year is £3,000, thereafter the annual rent increases by £500 pa. Calculate the present value of the rent at the start of the 5 years, using an annual effective rate of interest of 6%.
16. A company has just bought an office block for £5m, which it will rent out to a number of small businesses. The total rent for the first year will be £100,000, increasing by 4% pa compound in each future year. It will be sold after 20 years for £7.5m. Assuming that rent is paid in the middle of each year, calculate the yield the company will obtain on this investment. Ignore tax.
17. A loan of \$50,000 is repayable by equal annual payments at the end of each of the next 5 years. Interest is 8% pa for the first three years and 12% pa thereafter. Calculate the loan outstanding immediately after the second repayment.
18. Explain any five different kinds of annuity type financial products with time line
(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. The force of interest is given by:

$$\delta(t) = \begin{cases} 0.08 - 0.001t & 0 \leq t < 3 \\ 0.025t - 0.04 & 3 \leq t < 5 \\ 0.03 & t \geq 5 \end{cases}$$

Calculate the present value at time 2 of a payment of £1,000 at time 10.

20. The force of interest at any time t (measured in years) is given by:

$$\delta(t) = \begin{cases} 0.04 & 0 < t \leq 1 \\ 0.05t - 0.01 & 1 < t \leq 5 \\ 0.24 & t > 5 \end{cases}$$

What is the total accumulated value at any time t (>0) of investments of 1 at times 0, 4 & 6?

21. A man makes payments into an investment account of \$200 at time 5, \$190 at time 6, \$180 at time 7, and so on until a payment of \$100 at time 15. Assuming an annual effective rate of interest of 3.5%, calculate:

(i) the present value of the payments at time 4

(ii) the present value of the payments at time 0

(iii) the accumulated value of the payments at time 15

22. A loan of £16,000 is repayable by ten equal annual payments. The annual effective rate of interest is 4%. Calculate:

(i) the interest element of the 4th payment

(ii) the capital element of the 7th payment

(iii) the capital repaid in the last five years of the loan

(iv) the total interest paid over the whole loan.

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010103- BUSINESS ECONOMICS- I
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define opportunity cost with example
2. Differentiate micro economics and macroeconomics
3. What is mean by mixed economy?
4. State the law of demand
5. Define Income elasticity of demand for a good
6. Define marginal utility
7. What is sunk cost?
8. Define product differentiation
9. What is a cartel?
10. Define price discrimination

(8 × 1 =8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. What is natural level of unemployment? What are its causes? What policies do you suggest to deal with this problem?
12. Distinguish between dominant equilibrium and Nash equilibrium
13. Discuss Limit pricing with the help of a diagram
14. The demand equation for a good is $Q_d=25-4P$ and its supply equation is $Q_s=1+2P$, where P is the price. Find the range of values of P at which there will be surplus of supply over demand.

15. A risk averse magician is planning to organize his first ever foreign show. On successful completion of show he will earn \$40,000. He would earn nothing if the show is disrupted. The probability of disruption is 0.2%. His utility function is $U(w)=10+w^{0.5}$.
- Calculate the maximum premium the magician will be prepared to pay to insure against the risk of disruption of his show.
16. Describe with the aid of a diagram the intended effect of advertising on a product's demand curve and explain how advertising achieves this effect.
17. What are the four stages of lifecycle of a product? How will the consumer demand, competition and the other factors affecting the pricing decision generally vary between these stages?
18. With help of a diagram, explain how a monopolist firm can employ perfect price discrimination to increase its profits.

(6 × 2 =12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Discuss the determinants of supply and demand
20. Compare and contrast oligopoly, monopolistic competition and perfect competition in terms of:
- The product that they offer
 - Their ability to affect the prices that they charge
 - The level of profits that they make
21. Explain why and how the problems of adverse selection and moral hazard can affect insurance companies and how these problems can be dealt with.
22. Explain the different pricing strategies adopted by companies through the product life cycle.

(2 × 5 =10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science
AS010104- SURVIVAL MODELS

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Explain what $S_{29}(36)$ AND $F_{30}(20)$ represents.
2. A graduation covers 20 age groups and has resulted in 6 positive and 14 negative deviations.
Carry out a signs test on these data values.
3. Suppose the last year for which we have data is 2017. The estimated value of k_{2017} from the model is 0.93, and the estimate of μ is -0.007 .
Calculate the predicted value of k_{2025} .
4. Explain the importance of dividing the data for a mortality investigation into homogeneous classes.
5. Explain which of ${}_5p_{34}$ and ${}_7p_{33}$ is larger.
6. Explain why it is necessary to graduate crude rates of mortality for practical use.
7. Write down a formula for q_x in terms of l_x , d_x , with verbally description.
8. State the characteristics of a good graduation.
9. Carry out the serial correlation test at lag 1 on Graduation X.
For Graduation X you are given that: with $m = 20$
 $\sum (x - \bar{x}) = -5.10$, $\sum x^2 = 9.36$
10. Principle of correspondence (8 × 1 = 8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. (i) Show algebraically that $e_x = p_x (1 + e_{x+1})$
- (ii) Using ELT15 (Males) mortality, approximate the curtate expectation of life for:
- (a) a new-born baby
 - (b) a 21-year-old actuarial student
 - (c) a 70-year-old pensioner

12 Explain three methods of graduation.

13 A mortality table, which obeys Gompertz' Law for older ages, has:

$$\mu_{70} = 0.025330 \text{ and } \mu_{90} = 0.126255$$

Calculate the probability that a life aged 60 will survive for 20 years.

14 Show how the Gompertz model just defined relates to the Gompertz law.

15 In a certain population, the force of mortality is given by:

	μ_x
$60 < x \leq 70$	0.01
$70 < x \leq 80$	0.015
$x > 80$	0.025

Calculate the probability that a life aged exactly 65 will die between exact ages 80 and 83.

16 Carry out the smoothness test on the following set of graduated rates:

X	
55	0.00429
56	0.00478
57	0.00535
58	0.00596
59	0.00667
60	0.00754
61	0.00867

17. (i). The mortality rate for the base year of a mortality projection has been estimated to be:

$m_{60,0}=0.006$.It is believed that the minimum possible mortality rate for lives aged 60 is 0.0012. It is also believed that 30% of the maximum possible reduction in mortality at this age will have occurred by ten years' time. Using an appropriate reduction factor, calculate the projected mortality rate for lives aged 60 in 20 years' time.

- (ii). Describe the advantages and disadvantages of using an expectation-based approach to mortality projections

18

- a. A mortality investigation was held between 1 January 2016 and 1 January 2018. The following information was collected. The figures in the table below are the numbers of lives on each census date with the specified age labels. During the investigation there were 42 deaths at age 49 nearest birthday. Estimate μ_{49} stating any assumptions that you make.

	Date		
Age last birthday	1.1.16	1.1.17	1.1.18
48	3,486	3,384	3,420
49	3,450	3,507	3,435
50	3,510	3,595	3,540

(6 × 2 =12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. The mortality of a certain species of furry animal has been studied. It is known that at ages over five years the force of mortality μ is constant, but the variation in mortality with age below five years of age is not understood. Let the proportion of furry animals that survive to exact age five years be ${}_5p_0$.

(i). Show that, for furry animals that die at ages over five years, the average age at death in years is—

(ii) Obtain an expression, in terms of μ and ${}_5p_0$, for the proportion of all furry animals that die between exact ages 10 and 15 years. A new investigation of this species of furry animal revealed that 30 per cent of those born survived to exact age 10 years and 20 per cent of those born survived to exact age 15 years.

(iii) Calculate μ and ${}_5p_0$.

20. You have been given the following census counts for a population (covering all ages):

P_{2016} = Number in population on 1 January 2016 = 20,000

P_{2017} = Number in population on 1 January 2017 = 40,000

P_{2018} = Number in population on 1 January 2018 = 30,000

Estimate the central exposed to risk (all ages) for this population over each of the following periods, given only the census counts P_{2016} , P_{2017} and P_{2018} . In each case, state any assumptions you have made.

(i) Period: 1 January 2016 to 31 December 2017

(ii) Period: 1 July 2016 to 30 June 2017

(iii) Period: 1 January 2018 to 31 December 2018

(iv) Period: 1 April 2017 to 31 March 2018

21. Explain any 5 graduation tests with formula and test statistics.

22

Age x	α_x	$f_{20,x}$
60	0.13	0.55
70	0.304	0.498
80	0.478	0.446
90	0.652	0.394
100	0.826	0.342
110	1	0.29

i) Using the values of α and f given above, calculate the reduction factors and hence the projected mortality rates for the blank boxes in the table below.

Age	Year					
	1992		1997		2002	
	R	q	R	q	R	q
60	1	0.005914	0.843	0.004983		
80	1	0.075464			0.867	0.065392

ii) Use the values in the completed table to describe the view that was taken, about the expected future progression of mortality rates, when these projections were made.

(2 × 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010105 – ACTUARIAL COMPUTING - I
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

(Answer any **Three** questions. Each question carries a weight of 10)

1. Write R code for following questions,
 - a) Simulating a random sample from the discrete uniform distribution, Generate a vector for sample space $S = \{1, 2, 3, \dots, 20\}$
 - b) Simulating a random sample of 100 values from the binomial distribution with $n = 20$ and $p = 0.3$
 - c) Calculate $P(X \leq 5) = 0.9432683$ for $\lambda = 2.7$, consider x following poisson distribution.
 - d) Simulating 100 values from a $U(0,3)$ distribution and calculate $P(X \leq 1.8) = 0.6$
 - e) Simulating a random sample of 100 values from the gamma distribution with $\alpha = 2$ and $\lambda = 0.25$
2. Sample of 100 claims for damage due to water leakage on an insurance company's household contents policies might be as follows:

243 306 271 396 287 399 466 269 295 330

425 324 228 113 226 176 320 230 404 487

127 74 523 164 366 343 330 436 141 388

293 464 200 392 265 403 372 259 426 262

221 355 324 374 347 261 278 113 135 291

176 342 443 239 302 483 231 292 373 346

293 236 223 371 287 400 314 468 337 308

359 352 273 267 277 184 286 214 351 270

330 238 248 419 330 319 440 427 343 414

291 299 265 318 415 372 238 323 411 494

- a) Summaries these data using frequency with any graphical method
 - b) Plot the value and give explanation
 - c) Draw stem and leaf diagram
 - d) Calculate mean, median and mode
3. A life insurance company examines the ages of the last 100 policyholders to take out endowment assurance with them. The results are shown below:

Age (years)	0 – 14	15 – 19	20 – 24	25 – 34	35 – 54	55 – 79
Frequency	9	28	21	16	14	12

- (i) Draw a histogram for these data and use it to comment on the shape of the distribution
 - (ii) Estimate the mean age for these policyholders.
 - (iii) Estimate the median age for these policyholders.
 - (iv) How do the result of parts (ii) and (iii) confirm your observations in part (i)?
4. A bank lends a company £250000 at a fixed rate of interest of 10% *pa*. The loan is to be repaid by level monthly payments in arrears for 5 years. Construct a Loan schedule for the above transaction and Calculate
- a) The capital and interest element in the 49th installment
 - b) The capital outstanding immediately after the 14th installment
 - c) The capital repaid in the last 5 installments
 - d) The total interest paid over the whole loan
 - e) The interest paid in the 3rd year
- At the end of the fourth year the company decides to make further improvements in their operations and wants to borrow another £4, 00000 at that stage. If the total balance is to be repaid over 3 years by level monthly payments and there is no alteration to the interest rate, calculate
- f) The monthly installment
 - g) The total interest paid over this 3 years

5.

a. An investor wishes to find the present value of a stream of property income payments. She proposes to make the following assumptions.

- The level of current payments is £20,000 per annum, paid quarterly in advance.
- Payments will remain fixed for 5-year periods. At the end of each 5-year period the payments will rise in line with total inflationary growth over the previous five years.
- Inflation is assumed to be constant at 3% per annum.
- The interest rate for the calculation is 12% per annum effective.

Find the present value of the income stream assuming that the payments continue for 50 years.

b. A man makes payments into an investment account of \$200 at time 5, \$190 at time 6, \$180 at time 7, and so on until a payment of \$100 at time 15. Assuming an annual effective rate of interest of 3.5%, calculate:

- i. The present value of the payments at time 4
- ii. The present value of the payments at time 0
- iii. The accumulated value of the payments at time 15

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010201 – ACTUARIAL STATISTICS- II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Distinguish between the terms 'estimate' and 'estimator'?
2. Explain confidence interval estimation?
3. Explain Type-I & Type-II errors in hypothesis testing?
4. Distinguish between correlation and regression?
5. Explain the principle of maximum likelihood estimation.
6. What is ANOVA? What are the assumptions made?
7. Define degrees of freedom?
8. Define Hypothesis and its types?
9. What is the general formula for calculating the treatment effect?
10. Write down the key components of Generalized Linear Model

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. In the context of generalized linear models, explain what you understand by the following terms: Covariate, Linear predictor and Link function
12. Find the MLEs of μ and σ for a sample of n IID observations from $N(\mu, \sigma^2)$ distribution.
13. In a one year mortality investigation, 45 of the 250 ninety year olds present at the start of the investigation died before the end of the year. Assuming that the number of deaths has a binomial distribution with parameters $n= 250$ and q , find a symmetrical 90% confidence interval for the unknown mortality rate q .
14. The annual rainfall in cm at a certain weather station over the last ten years has been as follows: 17.2 28.1 25.3 26.2 30.7 19.2 23.4 27.5 29.5 31.6

Scientists at the weather station wish to test whether the average annual rainfall has increased from its former long term value of 22 cm. Test this hypothesis at the 5% level, stating any assumptions that you make.

15. A new computerized ultrasound scanning technique has enabled doctors to monitor the weights of unborn babies. The table below shows the estimated weights for one particular foetal at fortnightly intervals during the pregnancy.

Calculate S_{xx} , S_{yy} , S_{xy} and find correlation.

Gestation period (weeks)	30	32	34	36	38	40
Estimated foetal weight (kg)	1.6	1.7	2.5	2.8	3.2	3.5

16. A schoolteacher is investigating the claim that class size does not affect GCSE results.

His observations of nine GCSE classes are as follows:

Class	X_1	X_2	X_3	X_4	Y_1	Y_2	Y_3	Y_4	Y_5
Students in class (c)	35	32	27	21	34	30	28	24	17
Average GCSE point score for class (p)	5.9	4.1	2.4	1.7	6.3	5.3	3.5	2.6	1.6

Obtain the fitted regression line of p on c .

17. Consider the following data on sales, accounts and administration in a company.

Sales	72	81	96	75	69	88	74	102
Accounts	65	73	78	66				
Admin	61	79	67	74	65			

- Find the overall mean μ .
- Find the treatment means, μ_i .
- Hence, find the treatment effects.

18. (a). A random sample (X_1, \dots, X_n) is taken. Derive from first principles the maximum likelihood estimators for:

- λ from an $\text{Exp}(\lambda)$ distribution
- p from a $\text{Bin}(m, p)$ distribution.

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. A university wishes to analyze the performance of its students on a particular degree course. It records the scores obtained by a sample of 12 students at entry to the course, and the scores obtained in their final examinations by the same students. The results are as follows:

Student	A	B	C	D	E	F	G	H	I	J	K	L
Entrance exam score x (%)	86	53	71	60	62	79	66	84	90	55	58	72
Finals paper score y (%)	75	60	74	68	70	75	78	90	85	60	62	70

- (i) Obtain the linear regression equation of y on x .
- (ii) Assuming the full normal model, calculate an estimate of the error variance σ^2 and obtain a 90% confidence interval for σ^2 .
20. Find a 95% confidence interval for the average height of 10 year old children, assuming that heights have a $N(\mu, \sigma^2)$ distribution (where μ and σ^2 are unknown), based on a random sample of 5 children whose heights are:
124cm, 122cm, 130cm, 125cm and 132cm.
21. In a one year investigation of claim frequencies for a particular category of motorists, the total number of claims made under 5,000 policies was 800. Assuming that the number of claims made by individual motorists has a $Poi(\lambda)$ distribution, find a symmetrical 90% confidence interval for the unknown average claim frequency λ .
22. An analysis using the simple linear regression model based on 19 data points gave the following sum of squares and products: $S_{xx}= 12.2, S_{yy}= 10.6, S_{xy}= 8.1$
- (i) Calculate $\hat{\beta}$ and test whether β is significantly different from zero.
- (ii) Calculate the correlation coefficient r and test whether it is significant.

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010202 – FINANCIAL MATHEMATICS - II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Write a note on project appraisal methods
2. Define Capital gain tax.
3. Distinguish between time spot and forward rates
4. Describe yield to maturity
5. Define hurdle rate
6. State Redington's condition.
7. Uses of WACC
8. An investor purchases a 100 zero coupon bond for 90. calculate the yield obtained If the bond is redeemed after a) 5 years and b) 10 years.
9. Explain with examples the terms convexity.
10. What random factors may effect interest rates (8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. A speculator borrows £50,000 at an effective interest rate of 8% per annum to finance a project that is expected to generate £7,500 at the end of each year for the next 15 years. Find the discounted payback period for this investment.
12. A loan of 1,000 bears interest of 6% per annum payable yearly and will be redeemed at par after ten years. An investor, liable to income tax and capital gains tax at the

rates of 40% and 30% respectively ,buys the loan for 800.what is his net effective annual yield?

13. An investor liable to income tax at 25% and capital gain tax at 20% purchases 10,000 nominal of a newly issued 5 year fixed interest bond which is redeemable at par and pays coupons of 8%pa half yearly in arrears calculate the price the investor should pay to obtain a yield of 10%pa.

14. Traditional view on WACC

15. A French investor who is taxed at 35%on income has just purchased 500 shares in a small education company ex-dividend. Dividends are paid annually and the next dividend is due in one month's time. the last dividend was 8 per share and dividends are expected to rise by 4%pa.calculate the price paid by the investor if the expected yield 12%pa effective.

16.16.

The cashflows C_t (where the time t is measured in years and the amounts are in £000) for two business ventures are as follows:

$$\text{Venture 1: } C_0 = -100, C_1 = -40, C_2 = +50, C_3 = +120$$

$$\text{Venture 2: } C_1 = -45, C_3 = +25, C_4 = +25, C_5 = +25$$

Calculate the accumulated profit at time 5 and the net present value for each of these ventures using a risk discount rate of 15% per annum.

17.17.

The 3, 5 and 7-year spot rates are 6%, 5.7% and 5% *pa* respectively. The 3-year forward rate from time 4 is 5.2% *pa*. Calculate:

- (i) f_3
- (ii) $f_{5,2}$
- (iii) y_4
- (iv) $f_{3,4}$

18.18.

A fund must make payments of £50,000 at the end of the sixth and eighth years. Show that, if interest rates are currently 7% *pa* at all durations, immunisation to small changes in interest rates can be achieved by holding an appropriately chosen combination of a 5-year zero-coupon bond and a 10-year zero-coupon bond.

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. An investor is planning to make an investment in one or both of two projects. The cash flows associated with the projects are as follows. The unit of time is years.
- Project A: Initial payments of £2 million at time zero and £4 million at time 2 are made. In return a sum of £900,000 per annum is paid continuously from time 5 to time 25.
- Project B: Regular payments of £100,000 are made at the start of each year for 10 years. In return, amounts of X , $2X$, $3X$ and so on are made annually for 10 years, the first payment being made at time 11.
- (i) Find the net present value of Project A at an effective annual interest rate of 10%.
 - (ii) Find the value of X if the internal rate of return for Project B is the same as that for Project A.
 - (iii) Find the value of X if both projects are to have the same net present value at 10% *pa*.
20. An investor purchases a bond 3 months after issue. The bond will be redeemed at par 10 years after issue and pays coupons of 6% *pa* annually in arrears. The investor pays tax of 25% on both income and capital gains (with no relief for indexation).
- (i) Calculate the purchase price of the bond per £100 nominal to provide the investor with a rate of return 8% *pa* effective.
 - (ii) The real rate of return expected by the investor from the bond is 3% *pa* effective. Calculate the annual rate of inflation expected by the investor.

21. An index takes the following values:

1/1/05	121.2	1/1/06	123.9	1/1/07	125.2
1/4/05	122.8	1/4/06	124.2	1/4/07	126.0
1/7/05	123.1	1/7/06	124.4		
1/10/05	123.6	1/10/06	124.9		

An index-linked bond is purchased on 1/4/05 (when the remaining term is two years) for a price of £101 per £100 nominal. The bond is due to be redeemed at par. All coupon and redemption payments are linked to the inflation index three months prior to the payment date. The coupons on the bond are of nominal amount of 4% pa payable half-yearly in arrears on 1st April and October every year. Calculate the real yield obtained by the investor. You may ignore tax.

22. A fund must make payments of 50000 at the end of the sixth and eighth years. Show that ,if interest rates are currently 7% pa at all durations ,immunization to small changes in interest rates can be achieved by holding an appropriately chosen combination of a 5year zero coupon bond and 10 year zero coupon bond

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010203- BUSINESS ECONOMICS- II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define consumer surplus.
2. Explain Frictional Unemployment.
3. What are public goods?
4. What is a patent?
5. Define terms of trade
6. What is meant by absolute advantage
7. Explain multiplier effect
8. Define disposable income
9. What do you mean by privatization?
10. Define international liquidity

(8 × 1=8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. What is meant by “Economic Growth”? What are the key factors that may lead to Economic Growth
12. What are the three categories of withdrawals from and injections into the circular flow of income? Describe briefly
13. Explain briefly the reasons when international trade may occur even though there is no comparative advantage?

14. Consider the following data of an economy of a given year. All data are in rupees. GDP = 1000, GNP = 1200, personal disposable income = 1000, personal saving = 200, investment = 80, undistributed profit of corporations = 0, net foreign transfers = 0 and government expenditure = 20.
- Find out the values of net factor income from abroad, aggregate consumption expenditure, total taxes net of transfers and trade balance.
15. Discuss who gains and who loses as markets become continually more globalised.
16. Explain why Government tries to avoid fluctuations in price of its domestic currency. How the Government can maintain its value in short and long term?
17. What is the difference between cost-push inflation and demand-pull inflation?
18. What are the possible motives for growth via vertical integration? What are the problems associated with vertical integration?

(6×2=12)

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Discuss the effectiveness of monetary and fiscal policy with fixed and floating exchange rates.
20. 20.
- a) Explain why Governments may wish to avoid fluctuations in the value of a country's currency and how they can maintain its value in the short and long term.
 - b) Explain the problems associated with restriction on foreign exchange trading and other methods of restricting the outflow of money.
21. An economy is characterized by following equations:
- $$C = 100 + cY_d = 100 + 0.75Y_d,$$
- $$I = 45,$$
- $$G = 80,$$
- $$T = 20 + 0.20Y,$$
- $$R = 40,$$
- $$X = 40,$$
- $$M = 30 + 0.10Y,$$

where C is consumption function, c is marginal propensity to consume, Y_d is Disposable income ($Y - T + R$), I is autonomous investment, G is autonomous government purchases, T is tax function, Y is level of income, R is autonomous transfer payments by the government, X is autonomous exports, M is import function.

- a) Find out equilibrium national income.
 - b) What will be the size of Government Purchases multiplier?
 - c) Other things remaining same, by what amount the government purchases should increase in order to raise the equilibrium national income by 20%?
22. Government of a country ABC is worried about very high inflation and wants to control it through reducing money supply. List out and explain the ways by which the money supply can be reduced. Explain how each method help reducing money supply.

(2×5=10)

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS010204: CONTINGENCIES - I

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Explain UDD assumption and derive ${}_{t-s}q_{x+s} = \frac{()}{}$
2. Differentiate between temporary immediate annuity in arrear and in advance?
3. Find (i) $\ddot{a}_{30:10|}$ (AM92 at 4%)
(ii) \ddot{a}_{75} (PMA92 C20 at 4%)
4. Calculate the expected present value of a payment of £2,000 made 6 months after the death of a life now aged exactly 60, assuming AM92 Select mortality and 6% *pa* interest.
5. Explain concept of select mortality and ultimate mortality.
6. Obtain an approximate expression for $(I\ddot{a})_{x:\overline{n}|}$ in terms of discrete (\ddot{a}) annuity functions.
7. A population is subject to a constant force of mortality of 0.015 *pa*. Calculate:
(i) The probability that a life aged exactly 20 dies before age 21.25.
(ii) The probability that a life aged exactly 22.5 dies between the ages of 25 and 27
(iii) The complete expectation of life for a life aged exactly 28.
8. Verify that $A_{65} = 1 - d\ddot{a}_{65}$ using AM92 mortality and 4% *pa* interest.
9. Calculate the value of $(Ia)_{50}$ assuming AM92 mortality and 4% *pa* interest.
10. Prove that $\ddot{a}_{x:n|} = v p_x \ddot{a}_{x+1:n|}$

(8 × 1 =8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Calculate ${}_3p_{62.5}$ based on PFA92C20 mortality using: (i) The CFM assumption

- (ii) The UDD assumption
12. A life is subject to a constant force of mortality of 0.008 pa at all ages above 50. The constant force of interest of $4\% \text{ pa}$. Calculate the exact values of:
- (i) \bar{A}_{50}
- (ii) A_{50}
13. Derive EPV and variance of endowment assurance contract.
14. A 50-year-old woman purchases a deferred annuity to provide herself with an income of $\pounds 15,000 \text{ pa}$, paid annually in advance from age 70 until death. Calculate the expected present value of the benefits from this deferred annuity, using PFA92C2 Mortality, and an interest rate of $4\% \text{ pa}$ effective.
15. (i) Explain types of bonuses
- (ii) For the three alternative bonus allocation methods specified above, and given an initial guaranteed sum assured of $\pounds 10,000$ in each case, calculate the sum assured (including bonuses) as at the end of Years 1, 2 and 3.
16. Prove that $\ddot{a}_{x:\overline{n}|} = \ddot{a}_{\overline{n}|} + n|\ddot{a}_x$
17. Prove $\text{var}\left(\bar{a}_{T_x}\right) = \frac{1}{\delta^2} \left[{}^2\bar{A}_x - (\bar{A}_x)^2 \right]$
18. Using AM92 mortality and $4\% \text{ pa}$ interest, calculate:
- (i) $\ddot{a}_{60}^{(2)}$
- (ii) $a_{60}^{(12)}$
- (iii) $\ddot{a}_{50:\overline{15}|}^{(4)}$

(6 × 2 = 12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. A whole life assurance policy pays 20,000 on death in Year 1, 20,100 on death in Year 2, and so on increasing by 100 each year. The payment is made immediately on death of a life currently aged 35 exact.

- (i) Write down an expression for the present value random variable of this payment, in terms of the curtate future lifetime K_x , and/or the complete future lifetime T_x .
- (ii) Calculate the expected present value of these benefits, assuming:
 - (a) AM92 Select mortality and 6% pa interest
 - (b) a constant force of mortality of 0.015 pa and force of interest 0.03 pa .

20. Explain different types of life annuity contracts.

21. EPV and Variance of Temporary annuities payable annually in advance.

22. (i) Explain UDD assumption and constant force of mortality.

(ii) Calculate the value of ${}_{1.75}p_{45.5}$ using AM92 Ultimate mortality and assuming that:

- (a) Deaths are uniformly distributed between integer ages.
- (b) The force of mortality is constant between integer ages.

(2 × 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010205 – ACTUARIAL COMPUTING - II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

(Answer any **Three** questions. Each question carries a weight of 10)

1. Calculate a 95% confidence interval for the average height of 10-year-old children, assuming that heights have a $N(\mu, \sigma^2)$ distribution (where μ and σ are unknown), based on a random sample of 5 children whose heights are: 124cm, 122cm, 130cm, 125cm and 132cm. Write R function for a symmetrical 95% confidence interval for the mean with unknown variance.

Obtained a value of 1 from the binomial distribution with parameters $n = 20$ and θ ,

Construct a 95% symmetrical confidence interval for θ using R code

2. A car manufacturer runs tests to investigate the fuel consumption of cars using a newly developed fuel additive. Sixteen cars of the same make and age are used, eight with the new additive and eight as controls. The results, in miles per gallon over a test track under regulated conditions, are as follows:

Control	27.0	32.2	30.4	28.0	26.5	25.5	29.6	27.2
Additive	31.4	29.9	33.2	34.4	32.0	28.7	26.1	30.3

If μ_C is the mean number of miles per gallon achieved by cars in the control group, and μ_A is the mean number of miles per gallon achieved by cars in the group with fuel additive, test:

(i) $H_0: \mu_A - \mu_C = 0$ vs $H_1: \mu_A - \mu_C > 0$

(ii) $H_0: \mu_A - \mu_C = 6$ vs $H_1: \mu_A - \mu_C \neq 6$

3. Calculate Spearman's rank correlation coefficient for the claims settlement data

Claim (£100's)	x	2.10	2.40	2.50	3.20	3.60	3.80	4.10	4.20	4.50	5.00
Payment (£100's)	y	2.18	2.06	2.54	2.61	3.67	3.25	4.02	3.71	4.38	4.45

Calculate Kendall's rank correlation coefficient for the original borrowing rate data

Leverage ratio, x 0.1 0.4 0.5 0.8 1.0 1.8 2.0 2.5 2.8 3.0

Interest rate (%), y 2.8 3.4 3.5 3.6 4.6 6.3 10.2 19.7 31.3 42.9

- 4 A property developer has bought some land for £25,000,000 on which a block of apartments will be built. These apartments will be built over a period of five years starting immediately. Each apartment will take one month to build and will cost £160,000 to build. It is assumed that these building costs will be incurred at the beginning of each month. The number of apartments built each month is 10. It is further assumed that the apartments will each be sold for £250,000 three months after they have been built so that e.g. the first apartments are sold after four months.

The developer assumes a risk discount rate of 10% per annum effective.

(i) Calculate

- (a) The present value of the land and building costs of the project
- (b) The present value of the sale proceeds

(ii) Calculate

- (a) The accumulated value of the project at the time that the final apartments are sold.
- (b) The discounted payback period of the project
- (c) The internal rate of return for the project.

5.

- a) Evaluate the discounted mean term of a bond redeemable at par in 10 years' time with annual coupons of 8% at interest rates of 5%, 10% and 15%. Hence sketch a graph of the discounted mean term as a function of the interest rate over the range 5% to 15%.
- b) Evaluate the DMT of a level 10-year annuity of 150 *pa* payable annually in arrears at interest rates of 5%, 10% and 15%. And sketch a graph of the DMT as a function of the interest rate.
- c) Rent on a property is payable continuously for 5 years. The rent in the first year is £3,000, thereafter the annual rent increases by £500 *pa*. Calculate the Convexity of this investment using an annual effective rate of interest of 6%.

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science
AS010301: CONTIGENCIES -II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. What is gross premium? State the equivalence principle?
2. Define joint and last survival function?
3. Give an expression for the present value of reversionary annuities?
4. Define DSAR?
5. Why hold reserves?
6. Define ${}_t p_{xy}$?
7. What is mortality profit?
8. What is direct expense and overhead expense?
9. Define the term T_{xy} ?
10. Define contingent assurance?

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Net premium reserve
12. Prove the result ${}_n q_{xy}^2 = {}_n q_{xy}^1 - {}_n p_x {}_n q_y$
13. Calculate the gross premium retrospective reserve at the end of the second policy year for a 5-year single premium endowment assurance with sum assured £30,000 payable on maturity or at the end of the year of earlier death, issued to a 48-year old. Assume AM92

Select mortality, interest of 4% *pa* effective, initial expenses of £360 and renewal expenses of £45 at the start of each year excluding the first.

14. Show the equality of prospective and retrospective gross premium reserve in whole life assurance?
15. Describe briefly about survivor function and prove the relation $L = S+S-J$ through function.
16. Prove _____, Then prove $f_{T_{xy}}(t) =$
17. Define DSAR? With EDS and ADS for single policy?
18. Using PA92C20 mortality and 4% *pa* interest, calculate _____, assuming that one life is male and the other is female.

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Simple annuities and insurance involving 2 lives
20. (i) Prove ${}_nq_x = {}_nq_{xy}^1 + {}_nq_{xy}^2$, Express the result verbally
(ii)
Simplify the sum ${}_nq_{xy}^2 + {}_nq_{xy}^2$, and use the result to prove that ${}_nq_{xx}^2 = \frac{1}{2} {}_nq_{xx}$
(iii)

a)	${}_5q_{40:40}^1$
b)	${}_5q_{40:40}^2$
21. Calculate the net premium reserve after exactly 10 years for a 15-year endowment assurance issued to a life aged exactly 50 at entry, with a sum assured of 10,000 paid at the end of the term or at the end of the year of death if earlier:
 - (I) Where premiums are paid annually.
 - (ii) Where premiums are paid monthly.

Basis: AM92 Ultimate mortality and 4% *pa* interest.

22. A male and a female, aged 60 and 64 respectively, take out a policy under which the benefits are:

- A lump sum of £50,000 payable at the end of the year of the first death provided this occurs within 10 years.
- An annuity payable annually in advance with the first payment due to be made 10 Years from the date of issue. The annuity payments will be £10,000 *pa* for as long as both lives are still alive or £5,000 while only one of them is alive.

Level premiums are payable annually in advance for at most 10 years and will cease on the first death if this occurs earlier.

Calculate the amount of the annual premium on the following basis:

Interest: 4% *pa*

Mortality: PMA92C20 for the male life and PFA92C20 for the female life

Expenses: Initial : £750

Renewal : 3% of each premium excluding the first

(2 X 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science
AS010302 – RISK MODELING- I
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Show that if $\gamma = \frac{1}{2}$, the Weibull distribution will always have a standard deviation that exceeds the mean, whereas if $\gamma = 2$ the opposite will be true.
2. If X has a Pareto distribution with parameters $\lambda = 400$ and $\alpha = 3$, and N has a Poisson (50) distribution, find the expected value of S .
3. What is the variance of S , the aggregate claim amount before reinsurance? Why is it not true that $\text{var}(S_I) + \text{var}(S_R) = \text{var}(S)$?
4. Define risk model?
5. If claims from a portfolio have a $N(500, 400)$ distribution, and there is a retention limit of $M = 550$, find the mean amount paid by the reinsurer on all claims.
6. Define Reinsurance and its types?
7. Losses arising from a portfolio follow a Pareto distribution with parameters $\alpha = 3$ and $\lambda = 2,000$. Calculate the probability that a randomly chosen loss amount exceeds the mean loss amount.
8. Suppose that $N \sim \text{Poisson}(\lambda)$, $M \sim \text{Poisson}(\mu)$, and N and M are independent. Use a convolution approach to derive the probability function of $N + M$.
9. Determine an expression for the MGF of the aggregate claim amount random variable if the number of claims has a $\text{Bin}(100, 0.01)$ distribution and individual claim sizes have a $\text{Gamma}(10, 0.2)$ distribution.
10. State the two conditions that must hold for a risk to be insurable. (8 × 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. The probability of a claim arising on any given policy in a portfolio of 1,000 one year term assurance policies are 0.004. Claim amounts have a $\text{Gamma}(5, 0.002)$ distribution. Find the mean and variance of the aggregate claim amount.

12. The aggregate claims from a risk have a compound Poisson distribution with parameter μ . Individual claim amounts (in pounds) have a Pareto distribution with parameters $\alpha = 3$ and $\lambda = 1,000$. The insurer of this risk calculates the premium using a premium loading factor of 0.2 (ie it charges 20% in excess of the risk premium). The insurer is considering effecting excess of loss reinsurance with retention limit £1,000. The reinsurance premium would be calculated using a premium loading factor of 0.3. The insurer's profit is defined to be the premium charged by the insurer less the reinsurance premium and less the claims paid by the insurer, net of reinsurance.
- Show that the insurer's expected profit before reinsurance is 100μ .
 - Calculate the insurer's expected profit after effecting the reinsurance, and hence find the percentage reduction in the insurer's expected profit.
13. Suppose that the Poisson parameters of policies in a portfolio are not known but are equally likely to be 0.1 or 0.3.
- Find the mean and variance (in terms of m_1 and m_2) of the aggregate claims from a policy chosen at random from the portfolio.
 - Find the mean and variance (in terms of m_1 , m_2 and n) of the aggregate claims from the whole portfolio.
14. Consists of the following values, in units of thousands of pounds:
4.6, 6.8, 22.9, 1.4, 3.8, 10.2, 19.4, 32.1
- If the original claim amounts are modelled using a *Gamma* (α, λ) distribution, and the retained proportion is 80%, find the distribution of the reinsurer's claims and hence estimate the parameters α and λ using a method of moments approach.
15. Derive a formula for the average claim amount. If individual claim amounts X follow a lognormal distribution with PDF:

$$f(x) = \frac{1}{\sqrt{x}} \exp\left(-\frac{1}{2} \left(\ln \frac{x}{\mu}\right)^2\right)$$

16. The annual aggregate claims from a risk have a compound Poisson distribution with parameter 250. Individual claim amounts have a Pareto distribution with parameters $\alpha = 4$ and $\lambda = 900$. The insurer effects proportional reinsurance with a retained proportion of 75%. Calculate the variances of the total amounts paid by the insurer and by the reinsurer.

17. The random variable S has a compound Poisson distribution with Poisson parameter 4. The individual claim amounts are either 1, with probability 0.3, or 3, with probability 0.7. Calculate the probability that $S = 4$.
18. An insurer arranges excess of loss reinsurance with retention limit of Rs. 10,000. The reinsurer suspects that the original claims (including the claims settled entirely by the direct insurer) are independent and have a Pareto distribution. Recent claim amounts paid by the reinsurer in respect of this risk happen to be Rs. 4,253, Rs. 22,320, Rs. 9,724, Rs. 3,692 and Rs. 85,035. The reinsurer wants to estimate the proportion of claims that are settled directly by the insurer. Use the method of moments to obtain an estimate of this proportion.

(6 × 2 = 12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Let N be the number of claims on a risk in one year. Suppose claims $[X_1, X_2, \dots]$ are independent, identically distributed random variables, independent of N . Let S be the total amount claimed in one year.
- Derive $E(S)$ and $\text{var}(S)$ in terms of the mean and variance of N and X_1 .
 - Derive an expression for the moment generating function $M_S(t)$ of S in terms of the moment generating functions $M_X(t)$ and $M_N(t)$ of X_1 and N respectively.
 - If N has a Poisson distribution with mean λ show that:

$$M_S(t) = \exp(\lambda (M_X(t) - 1))$$
 - If N has a binomial distribution with parameters m and q , determine the moment generating function of S in terms of m , q and $M_X(t)$.
20. Claims from a portfolio are believed to have a *Pareto* (α, λ) distribution. In Year 0, $\alpha=6$ and $\lambda=1000$. An excess of loss reinsurance arrangement is in force, with a retention limit of 500. Inflation is a constant 10% *pa*.
- Find the distribution of the insurer's claim payments in Years 1 and 2 before reinsurance.
 - Find the percentage increase in the insurer's mean net claims payout in each year.

21. The annual aggregate claim amount from a risk has a compound Poisson distribution with Poisson parameter 10. Individual claim amounts are uniformly distributed on (0, 2000). The insurer of this risk has affected excess of loss reinsurance with retention level 1600. Calculate the mean, variance of both the insurer's and reinsurer's aggregate claims under this reinsurance arrangement.

22. Claim amounts from a portfolio have the distribution with PDF $f(x) = 2cx \exp(-cx^2)$, $x \geq 0$. An individual excess of loss reinsurance arrangement with retention limit $M = 3$ is in force. A sample of the reinsurer's payment amounts gives the following values:

$$n = 10 \quad \Sigma y_i = 8.7 \quad \Sigma y_i^2 = 92.3$$

where the units are millions of pounds. Find the maximum likelihood estimate of c .

(2 × 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010303- BUSINESS FINANCE
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define Agency Theory
2. What is meaning of Credit Sale and Leasing
3. What are the main methods by which a company can obtain a listing on the Stock Exchange
4. What is the meaning of Eurobonds and Conversion Premium
5. Define Double taxation relief
6. What are the categories of Future contract
7. Briefly explain Mergers and Acquisitions.
8. Sources of Short term finance
9. Types of Factoring
10. What is Subordinate debt (1x8=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. What are the objectives of shareholders and give an example
12. Explain the different type of Short Term Company finance
13. Explain Role of underwriting
14. Define Preference Shares and list of possible varieties of Preference Shares
15. What are the principles of Personal taxation
16. Define Options and explain the types of Options
17. Write a note on purpose and examples of forecast budgets
18. Pros and cons of limited companies (2x6=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Explain the different type of Business entity

20.

a. Ordinary Shares are the most risky form of investment so a prudent investor should avoid investing in them – Discuss

b. List of Possible varieties of Ordinary Shares

21. What is meaning of Swap and explain its Types & Uses of Swap

22.

a. How is taxable Income calculated?

b. Assume that the personal allowance is 5000, and that the marginal tax rates are 20% for the first 40,000 and 40% for taxable income above this. Assuming there are no adjustments to total income, how much tax will a single person earning 50,000 pay? What proportion of total income is paid in tax?

(2x5=10)

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS010304 – FINANCIAL ACCOUNTING

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Write main users of accounting information?
2. Write formula for cost of sales in income statement?
3. Define Revaluation reserve?
4. Define share capital and share premium?
5. Give a definition of Good will?
6. Write two special features of insurance company accounts?
7. What is the use of gross dividend yield?
8. A UK company made £5m pre-tax profit last year. It paid a dividend for the year of £0.02 per share. It has 100m shares in issue currently priced at £1.
assuming corporation tax is charged at 30%, calculate
i) earnings per share ii) dividend cover iii) gross dividend yield iv) PE ratio
9. Define dividend policy
10. Give the statement of cash flow (8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Write – Contents of an auditor's Report?
12. The following data was taken from the records of ABC plc and relates to the values of the company's assets, liabilities and capital at 31st December 2007. Organize the items to form the company's balance sheet as at 31st December 2007.

	<i>£000s</i>
Inventories	135
Trade payables	65
Machinery (cost)	347
Machinery (accumulated depreciation)	132
Cash	56
Long-term loans	289
Ordinary share capital	200
Trade receivables	195
Tax provision	67
Dividend provision	45
Retained earnings	185
Land	350
Other reserves	100

13. Explain awkward items in the trial balance?

14. Consider the following non-current assets:

- factory, initial cost £250,000, estimated useful life 25 years, no residual value
- two vans, initial cost £15,000 each, estimated useful life 6 years, no residual value
- machinery, initial cost £122,000, estimated useful life 11 years, estimate residual value £13,750.

The factory was bought 7 years ago. The vans and the machinery were all bought at the beginning of 2007.

The factory and the vans are depreciated using the straight line method. Depreciation on the machinery is worked out using the reducing balance method.

Calculate the company's total depreciation charge for 2007?

15. Define the following items:

- i) Holding company ii) subsidiary company
- iii) Associated undertaking iv) minority interest

16. What are the difference between subsidiary companies and associated companies?

17. Explain income cover and income priority percentages?

18. Explain - i) EPS ii) EBITDA per share

- iii) PE ratio (using net earnings) iv) gross dividend yield (6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Explain the types of accounting concepts?
20. You are examining a company's balance sheets for two years in order to understand what has happened to the non-current assets over the period. Given the selected items from the balance sheets and additional data, calculate the amount received from the sale of non-current assets.

Non-Current Asset	31.07.07 in (000's)	31.07.06 in (000's)
Cost	3976	3465
Depreciation	1245	1033
	2731	2432

Additional information:

- During the year, the company paid £900,000 for new equipment.
 - The depreciation allowance for the year is £432,000.
 - The company made a loss on the disposal of non-current assets of £50,000.
21. Balance sheets (in £s) for Company A and Company B are shown below. Shares in Company A have a par value of 50p, and those in Company B a par value of 25p.

	A	B
Non Current assets	200	100
Current assets	600	440
Share Capital	300	160
Reserves	400	80
Current Liabilities	100	300

Calculate the goodwill cost of control assuming that Company A's shares are priced at par, and that B's shareholders are offered 1 share in A for every 1 share in B when A acquires:(i) 100% of Company B and (ii) 75% of Company B.

22. Explain Gearing & Asset gearing and income gearing? (2x5=10)

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS010401: PRICING & RESERVING OF LIFE ASSURANCES & ANNUITIES

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Using the multiple decrement table in the preceding question, calculate ${}_1q$, and state what this probability means in words.
2. Define profit vector
3. A man pays a premium of £7,000 at the start of each year under an accumulating with-profits contract. Calculate the fund value of the policy after 3 years if the insurer declares annual bonus interest rates as follows:
year 1: 2.3%
year 2: 2.6%
year 3: 2.5%
4. Define summery measure of profit?
5. Define dependent and independent probabilities in multiple decrement table?
6. Define unit linked contract ?
7. Define profit signature?
8. State two other transitions that, in real life, might affect the expected present value of the sickness benefits for a new policyholder who is currently healthy. Assume that the policyholder is to pay regular premiums.
9. For a typical unit-linked contract, state:
 - (a) The different charges that might be used in the product, and
 - (b) The different non-unit cash outgoes that the company might have to pay.

10. A population is subject to two causes of decrement, death (d) and withdrawal (w). Explain whether the value of q_x would be larger or smaller than the value of q_x^* .

(8 X 1 = 8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. In a certain population, forces of decrement are assumed to be constant over individual years of age. The following independent forces of decrement will be assumed for this population between the exact ages of 50 and 52: Force of decrement for year of age commencing from exact age x

Age x	due to mortality	due to sickness
50	0.011	0.075
51	0.012	0.081

Construct a double decrement table including the two decrements of mortality a sickness, for this population between exact ages 50 and 52, assuming a radix of $(al)_{50} = 100,000$.

12. How to calculate reserve for conventional contract using profit test.
13. Comparison between unitized with profit contract and accumulating with profit contract.
14. consider the following 3 state model

We wish to construct a double decrement table for mortality and sickness only.

The independent force of sickness for the year of age from 50 to 51 is 0.075 and the independent force of mortality for the same year of age is 80% of the force of mortality according to the ELT15 (Males) mortality table.

Assuming that all forces of decrement are constant over individual years of age, calculate the first line of this double decrement table, using a radix of $(al)_{50} = 100,000$.

15. Describe unit funds and non-unit funds
16. Describe integral formula for multiple decrement probabilities.
17. Active members of a pension scheme are subject to the following probabilities of decrement at the given ages (where r and d stand for retirement and death, respectively)

Age x		
60	0.1	0.03
61	0.2	0.04

Calculate the following probabilities, all relating to an active member who is currently exactly aged 60.

- (i) The probability of retiring during the year of age 61 to 62.
- (ii) The probability of dying as an active member before age 62 (*ie* without retiring first).
- (iii) The probability of still being an active member at age 62.

18. The company's expenses in respect of this policy in the first month were 55% of the annual premium plus £178, and on average the mortality experience of all such policyholders was 58% of AM92 Ultimate. Death claim payments are made at the end of the month, after all charges have been deducted. Calculate the profit or loss to the company for the first month (ignoring any interest in the non-unit fund and assuming that the proportion of policyholders dying during the first month is one-twelfth of the annual proportion). (6 X 2 =12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Suppose a life insurance company sells a 5-year regular-premium endowment assurance policy to a 55-year old male. The sum insured is £10,000 payable at the end of year of death. Initial expenses are 50% of annual premium, renewal expenses are 5% of subsequent premiums. Premiums are payable annually in advance.

There is a surrender benefit payable equal to a return of premiums paid, with no interest. This is paid at the end of the year of withdrawal.

The company is required to hold net premium reserves, calculated ignoring surrenders. We shall now calculate the projected yearly cashflows per policy in force at the start of each year, using the following bases.

For pricing: AM92 Ultimate mortality, 4% *pa* interest, expenses as above and ignoring surrenders, using the equivalence principle

For reserving: Interest and mortality as per pricing

For future cash flow projection: Interest and expenses as per pricing, dependent surrender and mortality probabilities as in the table below.

Age x	$(aq)_x^d$	$(aq)_x^w$
55	0.005	0.1
56	0.006	0.05
57	0.007	0.05
58	0.008	0.01
59	0.009	0

20. The in-force expected non-unit cashflows for a five-year unit-linked contract taken out by a person aged exactly 50 are (-10, -20, 5, -15, 40). Calculate the non-unit reserves required to zeroise any negative cashflows other than those occurring in the first policy year. Assume AM92Ultimate mortality and 6% *pa* interest.
21. A man currently aged exactly 42 wishes to provide himself with a pension of around £25,000 *pa* on his retirement at age 67. He intends to purchase an accumulating with-profits endowment policy that will mature on his 67th birthday, and which he hopes will provide enough funds at retirement to purchase the required pension.
- Calculate the annual premium that would provide the required expected amount of pension based on the following assumptions:
- premiums are level and are paid at the start of each year throughout the duration of the AWP contract, which has no explicit charges
 - the insurance company declares an annual bonus interest rate of 3.5% *pa* throughout the duration of the AWP contract
 - terminal bonus is ignored
 - the annuity is to be paid monthly in advance for the whole of life from age 67, without Guarantee
 - the insurance company projects that it will use the following annuity basis to convert cash into annuity payments at the time of retirement:

Interest: 4% *pa*

Mortality: PMA92C20 with a 7-year deduction from the age

Expenses: Ignored

22. (i). Evaluating effect of pricing and reserving bases on a profit test?

(ii). A life insurance company issues a number of 3-year term assurance contracts to lives aged exactly 60. The sum assured under each contract is £200,000, payable immediately on death. Premiums are payable annually in advance for the term of the policy, ceasing on earlier death. The company carries out profit tests for these contracts using the following assumptions:

Initial expenses: £200 plus 35% of the first year's premium

Renewal expenses: £25 plus 3% of the annual premium, incurred at the beginning of the second and subsequent years

Mortality: AM92 Ultimate

Investment return: 7% per annum

Risk discount rate: 15% per annum

Reserves: One year's office premium

Show that the office premium, to the nearest pound, is £2,610, if the net present value of the profit is 25% of the office premium.

(2 x 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010402 – RISK MODELING- II
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Give an expression for $2X_t - 5X_{t-1} + 4X_{t-2} - X_{t-3}$ in terms of second order differences.
2. Define: IBNR claims, Development factor
3. Write surplus process $U(t)$ equation?
4. List the tests that could be applied to the residuals to test the model for goodness of fit.
5. State the three main stages in the Box-Jenkins approach to fitting an ARIMA time series model.
6. Describe how 'Bornhuetter-Ferguson' method improves the use of loss ratio as compared to basic chain ladder method.
7. Explain what is meant by a 'delay triangle'.
8. Explain the term Cointegrated time series
9. Give two examples of non-linear time series models, while clearly specifying their functional forms.
10. Explain in words the assumptions underlying the Chain Ladder Technique for completing the delay triangle? (8 × 1 = 8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. The table below shows the numbers of household insurance claims reported in each development year for accident years from 2005 to 2008. Use the basic chain ladder method to estimate the total ultimate number of claims arising from accidents occurring between 1 January 2005 and 31 December 2008.

Number of claims reported		Development year			
		0	1	2	3
Accident Year	2005	17500	5000	2250	750
	2006	21000	6200	2750	
	2007	18800	5500		
	2008	21300			

12. Show that the moving average process $X_n = 3 + e_n - e_{n-1} + 0.25 e_{n-2}$ is weakly stationary, where e_n is a white noise process with mean 0 and variance 1.
13. Explain the following terms relating to machine learning:
 - (a) hyper-parameters
 - (b) CART
 - (c) greedy splitting
 - (d) clustering.
14. Explain the branches of machine learning
15. Let Y_t be a sequence of independent and identically distributed, standard normal random variables. Which of the following processes are stationary time series, as defined above?
 - (i) $X_t = \sin(w_t + U)$, where U is uniformly distributed on $[0, 2\pi]$
 - (ii) $X_t = \sin(w_t + Y_t)$
 - (iii) $X_t = X_{t-1} + Y_t$
 - (iv) $X_t = Y_{t-1} + Y_t$
 - (v) $X_t = 2 + 3t + 0.5X_{t-1} + Y_t + 0.3Y_{t-1}$
16. Estimate the expected outstanding claims reserve for the data in the table below, using the Bornhuetter-Ferguson method. Assume an expected loss ratio of 85%, and that the total claims paid are £1,942,000.

Claims incurred (in1000)		Earned Premium	Development year			
			0	1	2	3
Accident Year	1997	860	473	620	690	715
	1998	940	512	660	750	
	1999	980	611	700		
	2000	1020	647			

17. A general insurance company is planning to set up a new class of travel insurance. It plans to start the business with £2 million and expects claims to occur according to a Poisson process with parameter 50. Individual claims are thought to have a gamma distribution with parameters $\alpha = 150$ and $\lambda = \frac{1}{4}$. A premium loading factor of 30% is applied.

Explain how each the following change to the company's model will affect the probability of *ultimate* ruin:

- (i) A 28% premium loading factor is applied instead.
- (ii) Individual claims are found to have a gamma distribution with parameters $\alpha = 150$ and $\lambda = \frac{1}{2}$
- (iii) The Poisson parameter is now believed to be 60.

18.

- a) The autocorrelation function of a time series shows coefficients significantly different from zero at lags 1 through 4. The partial autocorrelation function shows one spike and monotonically increases to zero as lags length increases. If the time series is model by ARMA (p,q) then state values of p and q.
- b) State the definitions of four non-linear time series models.
- c) If X_t follows MA(1) and $Y_t = 0.6 + 0.3t + X_t$ then prove that the standard deviation of first difference of Y_t will be higher than that of X_t .

(6 × 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. The aggregate claims arising during each year from a particular type of annual insurance policy are assumed to follow a normal distribution with mean $0.7P$ and standard deviation $0.2P$ where P is the annual premium. Claims are assumed to arise independently. Insurers are required to assess their solvency position at the end of each year. A small insurer with an initial surplus of £0.1m for this type of insurance expects to sell 100 policies at the beginning of the coming year in respect of identical risks for an annual premium of £5,000. The insurer will incur expenses of $0.2P$ at the time of writing each policy. Calculate the probability that the insurer will prove to be insolvent for this portfolio at the end of the coming year. Ignore interest.

20. The table below shows the claim payments made by a general insurer in each year for a particular type of insurance.

Claim payments made during year (£000s)		Development Year			
		0	1	2	3
Accident Year	2003	10	50	50	30
	2004	50	70	30	
	2005	40	30		
	2006	90			

- (i) What was the total amount paid during the 2006 calendar year?
(ii) Find development factors for Development Year 2 for the 2003 and 2004 Accident years.
21. Write down an equation defining the statistical model assumed by each of the following methods of projecting the payments for outstanding claims:
- (i) Basic chain ladder method
(ii) Inflation adjusted chain ladder method

Define each symbol and indicate whether the value of each quantity is assumed at the outset or is estimated by the model.

22. Classify the process $2X_t = 7X_{t-1} - 9X_{t-2} + 5X_{t-3} - X_{t-4} + e_t - e_{t-2}$

(2 × 5 = 10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS010403 ACTUARIAL COMPUTING - III
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

(Answer any **Three** questions. Each question carries a weight of 10)

1. Use the question spreadsheet to answer the following question. Use the mortality functions on the 'Life Table' tab where appropriate.

An endowment assurance with an 18-year term will pay a sum assured of 75,000 at the end of the term, or at the end of the year of death of a life currently aged exactly 37, if earlier. Level annual premiums are payable at the start of each year while the policy is in force. The insurance company uses the following basis for the calculation of gross premiums:

Mortality: AM92 Ultimate

Interest: 3% *pa* effective

Expenses

Initial: 0.5% of the sum assured

Renewal: 38 *pa* payable at the start of each year except the first

Claim: 350 paid at the time of claim (either on death or maturity)

Commission

Initial: 20% of the first annual premium

Renewal: 2.5% of each subsequent annual premium (*ie* paid at the start of each year except the first)

- (i) Calculate the gross annual premium for the contract.

Hint: make the interest rate and the premium input variables in your spreadsheet.

- a. Recalculate the premium assuming the effective interest rate is (a) 2% *pa* and (b) 4% *pa*.
Give a brief explanation of the results obtained.

2. Use the question spreadsheet to answer the following question.
- (i) On the 'Life Table' tab, in the relevant column calculate AM92 Select $l_{[x-1]+1}$ values for ages $x = 18, 19, \dots, 91$, using the given Ultimate l_x values and the relevant mortality probabilities from the 'Mortality rates' tab.
 - (ii) Using the $l_{[x-1]+1}$ and l_x values, in the relevant column calculate the associated values of $d_{[x-1]+1}$.
 - (iii) Calculate AM92 Select $l_{[x]}$ and $d_{[x]}$ values in a similar way to parts (i) and (ii), for age $x = 17, 19, \dots, 90$.

Use the select life table constructed in part (i) to calculate the probabilities of the following events:

- (a) a select life currently aged exactly 64 is still alive five years later
 - (b) a life who was selected one year ago when aged exactly 45, dies within the next 18 years
 - (c) a life aged exactly 41, who was selected one year ago, is still alive in 9 years' time but is dead by age 57
 - (d) a select life who is currently aged exactly 63 dies in the coming year
 - (e) a select life who is currently aged exactly 63 dies between exact ages 64 and 65
 - (f) a select life who is currently aged exactly 63 dies between exact ages 65 and 66.
3. Use the question spreadsheet to answer the following question. Use the mortality functions on the 'Life Table' tab where appropriate.
- (i) On a new tab, calculate the expected present value (EPV) of a 15-year level term assurance, paying 100,000 at the end of the year of death of a life currently aged exactly 47.
- As part of your calculation, create three columns showing:
- (1) the amount of payment made in year t
 - (2) the amount by which that payment is discounted
 - (3) the probability of the payment being made.
- Basis: AM92 Select Interest: 2% *pa* effective

- (ii) Copy the spreadsheet from part (i) as required, and adapt it to calculate the EPV of each of the following term assurances (all with payments at the end of the year of death of a select life, currently aged 47 exact, within a term of 15 years), and using the same mortality and interest basis:
- (a) 150,000 on death in the first year, decreasing by a level amount of 10,000 each year (so the benefit on death in the final year is 10,000)
 - (b) first payment of 75,000, increasing by 3% *pa* compound
 - (c) the amount on death is equal to the amount of capital outstanding at the start of the year of death, on a 15-year mortgage of 150,000 serviced by level annual repayments (made in arrear) at a mortgage interest rate of 4% *pa* effective.

4. Eighteen years ago, a life insurer sold 1,000 identical endowment assurance policies to lives then aged exactly 37. The policy term has just ended. Each policy had a sum assured of £75,000 payable on maturity or immediately on earlier death.

Reserves were calculated using AM92 Ultimate mortality and interest of 3% *pa* effective. These are given in the question spreadsheet, along with an extract from the AM92 life table and the observed number of deaths in each policy year.

Calculate the mortality profit for each policy year assuming that the effective annual rate of interest is 3%.

5. Use the question spreadsheet to answer the following question. Use the mortality functions provided.

The insurance company uses the following basis to calculate retrospective accumulations:

Mortality: PMA92C20

Interest: 3% *pa* effective

A man aged exactly 65 is considering taking out some kind of life insurance policy.

- i. Under one type of policy, premiums of 1,000 *pa* will be paid for 15 years or until the man's death, if this occurs sooner.

On tab (i) calculate the retrospective accumulation of these premiums at the end of the policy term.

- ii. The man is considering taking out a term assurance policy, under which a benefit of 10,000 will be paid immediately on his death, if this occurs within the next 15 years only.

Calculate the retrospective accumulation of these benefit payments at the end of the policy term.

- iii. The man is also considering whether to take out a full endowment assurance, which will pay 10,000 at the end of the 15 year term or immediately on earlier death. Calculate the retrospective accumulation of these benefit payments at the end of the policy term.

- iv. Recalculate part (i) assuming an interest rate of 4% *pa*, and explain the answer you obtain.

MODEL QUESTION PAPERS
ELECTIVE GROUP A

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS800-- – ELECTIVE I –RISK MANAGEMENT

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define the term annuity.
2. Determine any three factors for contract design.
3. Bring out the significance in written strategy documents.
4. What is the purpose of initial appraisal?
5. When assets are fairly priced?
6. State yield ratio?
7. State principle of Investment.
8. Define Risk Budgeting.
9. What is the big risk with allowing cross-subsidies?
10. What is meant by convexity and duration ?

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Discuss the following commercial considerations associated with a contract design
 - i) Profitability.
 - ii) Marketability quoting the other aspects of the contract design that will make the contract marketable.
12. Give any 6 factors that need to be considered when determining the suitability of a proposed contract design.
13. Explain analysis of risk in capital project appraisal.
14. List the characteristics of well-run projects.
15. Give the relation between return on asset classes

16. In connection with relationship between assets and liabilities and in the context of principles of investment, Discuss the asset – liability matching requirements of assets
- i) Guaranteed in money terms
 - ii) Discretionary benefits
17. Explain the role financial manager in financial sector
18. In connection with relationship between assets and liabilities and in the context of principles of investment, Discuss the asset – liability matching requirements of liabilities
- i) Nature of liabilities
 - ii) Expense outgo
 - iii) Premium / Contribution Income

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Describe the positive and negative cash flow of provider of the following types of benefits and also discuss, in each case, the various characteristics of the cash flows such as amount of positive/negative cash flows known in advance or not and timing of positive/negative cash flows know in advance or not etc.,
- i) An Annuity
 - ii) Term Assurance
 - iii) Endowment Assurance
 - iv) An Interest only loan
 - v) A Repayment loan
20. Give a detailed account on
- i) The ways of mitigating the risks.
 - ii) Financial consequences of risk mitigation
21. Derive an expression that can be used to compare the relative levels of the equity and property markets, and use this expression to explain the factors underlying a narrowing in the yield gap between rental yields and dividend yields.
22. Discuss the following in Asset Management on Risk budgeting and Liability Hedging

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS800----- ELECTIVE II - INSURANCE & RETIREMENT BENEFITS
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. What do you mean by Insurance?
2. Define the term Premium.
3. Define “Non Contributory Scheme”.
4. Distinguish between EDLI and Non- EDLI.
5. Enumerate the main advantages of control funding method.
6. Give a note on any two Optional Pensions.
7. What is Micro Insurance Scheme?
8. Write about Poultry Insurance in rural Scheme.
9. Define the term Beneficiary.
10. What is Retirement Benefit? (8×1 = 8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. What are the conditions to be fulfilled by Payment of Gratuity Act 1972?
12. Discuss how ‘Definite funding Method’ operates.
13. Describe the fixed cover schemes on lives of employees.
14. Explain what is meant by creditor and debtor groups.
15. Give a detailed discussion on Weaker Insurance Scheme.

16. Briefly describe about Unit Linked Insurance Scheme.
17. How is International Accounting Standards worked out?
18. State the benefits which are tax free?

(6×2 = 12)

Section C

(Answer any **Two** questions. Each question carries a weight of 2)

19. What is insurance? Classify different types of insurance and explain how do insurance companies spread their risk.
20. Explain in detail about the Group Savings Linked Insurance Scheme.
21. Give an account on the rural schemes.
22. Bring out the significance of taxation under Group Insurance Scheme.

(2×5 = 10)

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS800- ELECTIVE III-BUSINESS MANAGEMENT

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define Organizational behavior.
2. Define Organizational Diagnosis
3. What is leadership?
4. What is BCG matrix?
5. What is group cohesion?
6. What is reactive change?
7. What do you mean by contingency leader?
8. What is emotional intelligence?
9. What do you understand by resistance to change?
10. Differentiate organizational culture and climate (8 × 1=8)

SECTION –B

(Answer any **six** questions. Each question carries a weight of 2)

11. Distinguish between the Functional and Product organization and Line & Staff organization.
List the merits and demerits with examples.
12. Analyze the major methods applied in conflict management and how they help to address conflicts cycles. Give examples
13. Explain transactional theory of leadership with help of illustrations
14. Why is 'Business Ethics' assuming greater importance in today's business world? Identify and briefly discuss in various functions of management.
15. Discuss the key roles for managing change in organizations and their limitations.

16. Discuss the importance of differentiation strategy in the present competitive environment.

Explain the advantages and disadvantages

17. Define strategic management. Explain its characteristics

18. What is a mission statement? Explain the elements in developing mission statement

(6 × 2=12)

SECTION-C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Explain the importance of social and organizational culture in bringing about change.

Discuss what creates a proactive approach in bringing about change in organizational culture.

20. What are the different leadership styles? What is the most effective leadership style? Justify your explanation with examples.

21. What do you understand by group dynamics? What are the different stages of group dynamics? Identify the reasons which play an influential role in the formation of a group and why. Explain with suitable examples.

22. Write short notes on any three of the following:

a) Socio-Technical approach to work design

b) Mechanistic vs. Organic systems

c) Role Analysis Technique

d) Sensitivity training

(5 × 2= 10)

MODEL QUESTION PAPERS
ELECTIVE GROUP B

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS810 -- – ELECTIVE I – ACTUARIAL RISK MANAGEMENT

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Define defined benefit scheme and defined contribution scheme?
2. Write categories of risk
3. Write three aspects of the management of risk by an organization?
4. Define systemic and diversifiable risk?
5. What are the disadvantages of quota share reinsurance relative to other forms of reinsurance?
6. Write three main types of Excess of loss reinsurance?
7. An individual has both income and expenditure, why might they also need capital?
8. Outline the nature of debt and equity capital?
9. Briefly explain alternative risk transfer
10. What are the risks of offering preferential annuity rates to smokers?

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Explain the types of financial products?
12. List the investment risks associated with a benefit scheme?
13. Advantages and disadvantages of Excess of loss reinsurance?
14. What are the main claim risks to General & Life Insurance Company?
15. What are the main benefits of reinsurance to an insurance company?
16. Can you think of any disadvantages to the insurer of integrated risk covers?

17. Discuss the capital needs of following,
i) individuals ii) Companies iii) Providers of financial service products iv) the state

18. Discuss the following in connection with risk in benefit scheme,

i) Benefit risks in defined benefit scheme

ii) Benefit risks in both defined benefit scheme and defined contribution scheme

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Explain the major types of risk faced by a financial organization?

20. Briefly explain the tools come under the Alternative Risk Transfer (ART)?

21. Explain– Diversification and its risk, in connection with risk Management tools and discuss underwriting as a risk management tools?

22. Discuss any eight capital management tools

(2x5=10)

Model Question Paper

M.Sc. DEGREE (C.S.S) EXAMINATION.....

M.Sc. Actuarial Science

AS810--- – Elective II - Research Methodology

(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Explain the meaning of research
2. What is the necessity of defining a research problem?
3. What are the objectives of research?
4. What are the limitations of secondary data collection?
5. What are the features of a research design?
6. List down the advantages of observation method of data collection.
7. What are the guiding considerations in the construction of questionnaire? Explain
8. Why tabulation is considered essential in a research study?
9. What are the precautions to be taken while writing a research report
10. Explain the technique and importance of oral presentation of research findings

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. Write short notes of the following: (a) Editing of data (b) Generalizations of findings
(c) Interpretation of analyzed data (d) Selection of a research problem
12. Explain the need, meaning and essentials of interpretation
13. Explain methods of Generalization and Guidelines for Developing Questionnaire
14. Explain the difference between Correlation and Regression with suitable examples.
15. What are the different types of diagrams used to present the data?

16. Explain simple hypothesis and composite hypothesis with suitable examples.
17. Explain Format of Research Report
18. Discuss the major issues in construction of Index Numbers.

(6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. Discuss – process of data implies editing, coding, classification and tabulation?
20. What are the different stages in preparing a research report?
21. a) One ticket is drawn at random from a bag containing 30 tickets, numbered from 1 to 30. Find the probability that it is a multiple of 5 or 7.
b) 2% of the electric toys produced in a manufacturing process turnout to be defective. Find the probability that a shipment of 200 toys will contain 5 defectives?
[e = 2.7183 constant]
22. Calculate the two lines of regression from the following data:
Find the value of Y when X = 66.

X	57	58	59	59	60	61	62	64
Y	67	68	65	68	72	72	69	71

(2x5=10)

Model Question Paper
M.Sc. DEGREE (C.S.S) EXAMINATION.....
M.Sc. Actuarial Science
AS810.... – Elective III – MARKETING OF SERVICES
(2019 Admission Onwards)

Time: 3 Hours

Maximum Weight: 30

Section A

(Answer any **Eight** questions. Each question carries a weight of 1)

1. Distinguish between goods and services
2. What do you mean by evoked set of alternatives?
3. What are the four modes of service delivery?
4. Enumerate reasons for growth in service sector.
5. Give the Positioning alternatives for a Hospital.
6. What do you mean by evoked set of alternatives?
7. What in internal marketing?
8. What do you mean by yield management?
9. Define service quality?
10. What are benefits of good service guarantee?

(8x1=8)

Section B

(Answer any **Six** questions. Each question carries a weight of 2)

11. What is a service? How do services differ from products? Explain why services tend to be more difficult to evaluate than goods.
12. Explain the need for the extended mix of marketing in services.
13. Differentiate between core, facilitating and supporting services, giving suitable examples.
14. Why do consumers of services perceive higher levels of risks associated with their purchases? Discuss with the help of examples

15. In what ways the buying process differs between individual buyer and the organizational buyer?
16. Discuss the problems areas of segmentation in services.
17. Differentiate between search, experience and credence qualities and discuss their implications for service marketer.
18. Discuss how relationship marketing or retention marketing is different from traditional emphasis in marketing. (6x2=12)

Section C

(Answer any **Two** questions. Each question carries a weight of 5)

19. What guidelines you would follow for developing an advertising campaign for a service organization? Discuss by taking the example of a commercial bank or an insurance company.
20. Explain the significance of determining the demand patterns. Describe the strategies for matching supply and demand giving suitable examples.
21. Briefly explain 'GAP model of service quality' identify causes of the gaps. What strategies you would suggest for reducing these gaps. Discuss with the help of suitable examples.
22. 'Pricing strategy includes much more than determining what to charge'. Examine the statement with regards to pricing of health services.

(2x5=10)