



Autonomous (2016-17)

Malad Kandivli Education Society's  
**NAGINDAS KHANDWALA COLLEGE**  
OF COMMERCE, ARTS & MANAGEMENT STUDIES  
AND SHANTABEN NAGINDAS KHANDWALA COLLEGE OF SCIENCE  
(Re-accredited (3<sup>rd</sup> cycle) by NAAC with 'A' Grade)  
ISO 9001 : 2015 Certified  
Educational Excellence Award By Indus Foundation, U.S.A.  
IMC Ramkrishna Bajaj National Quality Commendation Certificate

## Highlighted Syllabus

  
DR. (MRS.) ANCY JOSE  
PRINCIPAL





**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester I**

**4. Actuarial Accounting 1 (Theory)**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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NAGINDAS KHANDWALA COLLEGE OF COMMERCE  
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## Syllabus: Actuarial Accounting 1

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AC1	1914UCHAAC	Actuarial Accounting 1	DSE	3

### Course Objective

The aim of this course is to

- provide a basic understanding of corporate finance
- provide knowledge of the instruments used by companies to raise finance

### Course Outcome

On successful completion of this course, student should be able to

- CO1: understand how companies are governed and structured (Level: Understand)
- CO2: suggest appropriate ways to finance a company (Level: Analyse)
- CO3: understand how to calculate company's taxable income (Level: Understand)
- CO4: evaluate projects (Level: Evaluate)

## Syllabus: Actuarial Accounting 1(Theory) Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Corporate Governance, Corporate Organization and Business Types</b>	15
Module2	<b>Financing of Corporates and Taxation:</b>	15
Module3	<b>Issue of Shares, Reward Policy for Shareholders, Mergers and Acquisition</b>	15
Module4	<b>Project Evaluation</b>	15
	Total	60

  
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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p><b>Corporate Governance, Corporate Organisation and Business Types (Employability, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• purpose and process of regulating the financial reporting information of incorporated entities</li> <li>• key principles of corporate governance and the regulation of companies</li> <li>• relationship between finance and the real resources and objectives of an organisation</li> <li>• relationship between the stakeholders in an organisation(including lenders and investors)</li> <li>• role and effects of the capital markets</li> <li>• maximisation of shareholder wealth as the main goal of financial management in a company</li> <li>• problems relating to the maximisation of shareholder wealth in practice: social responsibility concerns, agency problems and divergent objectives</li> <li>• the strategies employed by managers to maximize shareholder wealth</li> <li>• determinants of value and the actions managers can take to influence value</li> <li>• the distinctive characteristics of different types of business structures: sole traders, partnerships, limited companies and limited liability partnerships as business entities</li> <li>• different types of loan and share capital</li> <li>• authorised and issued share capital</li> <li>• economic advantages and disadvantages of a limited company as a business entity</li> <li>• the main differences between a private and public company</li> </ul>	15
2	<p><b>Financing of Corporates and Taxation (Employability, Entrepreneurship, Skill Development)</b></p>	15

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 Page 3 | 7

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	<ul style="list-style-type: none"> <li>• Types of medium term company finance: <ul style="list-style-type: none"> <li>○ hire purchase</li> <li>○ credit sale</li> <li>○ leasing</li> <li>○ bank loans</li> </ul> </li> <li>• Types of short term company finance: <ul style="list-style-type: none"> <li>○ bank overdrafts</li> <li>○ trade credit</li> <li>○ factoring</li> <li>○ bills of exchange</li> <li>○ commercial paper</li> </ul> </li> <li>• Alternative methods of raising finance outside the regular banking system including <ul style="list-style-type: none"> <li>○ shadow banking</li> <li>○ direct project financing</li> <li>○ crowd-funding</li> <li>○ micro-finance</li> </ul> </li> <li>• Basic principles of personal taxation of income and capital gains</li> <li>• Basic principles of corporate taxation</li> <li>• Different systems of company taxation from the points of view of an individual shareholder and the company</li> <li>• Basic principles of double taxation relief</li> <li>• Understanding of the characteristics of the principal forms of financial instrument issued or used by companies and the ways in which they may be issued.</li> <li>• Reasons a company might have for seeking a quotation on the stock exchange</li> <li>• The characteristics of <ul style="list-style-type: none"> <li>○ debenture stocks</li> <li>○ unsecured loan stocks</li> <li>○ Eurobonds</li> <li>○ preference shares</li> <li>○ ordinary shares</li> <li>○ convertible unsecured loan stocks</li> <li>○ convertible preference shares</li> <li>○ warrants</li> <li>○ floating rate notes</li> <li>○ subordinated debt</li> <li>○ options issued by companies</li> </ul> </li> <li>• The characteristics and possible uses by a non-financial company of: <ul style="list-style-type: none"> <li>○ financial futures</li> <li>○ options</li> <li>○ interest rate and currency swaps</li> </ul> </li> </ul>	
3	<b>Issue of Shares, Reward Policy for Shareholders, Mergers and Acquisition: (Employability, Skill Development)</b>	15

	<ul style="list-style-type: none"> <li>• Methods of obtaining a quotation for securities: <ul style="list-style-type: none"> <li>○ introduction</li> <li>○ placing</li> <li>○ offer for sale</li> <li>○ offer for sale by tender</li> <li>○ offer for subscription</li> </ul> </li> <li>• New issues to existing shareholders: <ul style="list-style-type: none"> <li>○ scrip issue</li> <li>○ rights issue</li> </ul> </li> <li>• Role of underwriting in the issue of securities.</li> <li>• Factors to be considered by a company when deciding on its capital structure</li> <li>• Effect of the capital structure of a company on the market valuation of the company</li> <li>• Effect of taxation on the capital structure used by a company</li> <li>• Principal factors that a company should consider in setting dividend policy</li> <li>• Alternative ways of distributing profits, such as buybacks</li> <li>• Effect of the dividend policy on the market valuation of a company</li> <li>• Companies growth with the different ways of company restructuring</li> <li>• Relationship between growth and profitability</li> <li>• Constraints on a firm's growth</li> <li>• Motives for mergers and acquisitions <ul style="list-style-type: none"> <li>○ Characteristics of a merger</li> <li>○ Methods of evaluating a target company</li> <li>○ Steps that a buyer will usually take in a leveraged buyout</li> </ul> </li> <li>• Cost of Capital of a company <ul style="list-style-type: none"> <li>○ Concept</li> <li>○ Impact of nature of investment projects</li> </ul> </li> <li>• Weighted average cost of capital of a company</li> </ul>	
4	<b>Project Evaluation (Employability, Entrepreneurship, Skill Development)</b>	15

	<ul style="list-style-type: none"> <li>• Methods to determine the viability of a capital project</li> <li>• Cash flow projections and techniques to estimate cashflows</li> <li>• Methods commonly used to evaluate risky investments including simulation and certainty equivalents</li> <li>• Issues in establishing the required rate of return for a capital project</li> <li>• Factors underlying the choice of discount rate within project assessment including: <ul style="list-style-type: none"> <li>○ the assumptions and limitations in the use of the weighted average cost of capital</li> <li>○ the allowance for leverage</li> <li>○ the allowance for risk</li> </ul> </li> <li>• Methods for identifying the risks that may be present for different types of project</li> <li>• Techniques for ascertaining the probability of occurrence of different risks over varying timescales and the financial impact of occurrence</li> <li>• Techniques for ascertaining the distribution of the possible financial outcomes of a capital project</li> </ul>	
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**Reference Books:**

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT2	2018	Actuarial Education Co. acted@bpp.com
2.	Accounting and financial fundamentals for nonfinancial executives by Robert Rachlin & Allen Sweeny.	1996	AMACOM, New York
3.	Accounting Fundamentals by William Ruland		0324023618 South-Western College Pub.

**Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

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Page 6 | 7  
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- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.



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**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Patter Of

**First Year Semester - I**

**3. Actuarial Statistics 1B [Theory]**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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## Syllabus: Actuarial Statistics 1B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS1B	1913UCHAAS	Actuarial Statistics 1B (Theory and Practical)	CC	4+2

### Course Objective

The aim of this course is to provide a grounding in mathematical and statistical techniques leading to inferences that are of particular relevance to actuarial work.

### Course Outcome

On successful completion of this subject, a student will be able to:

**CO1:** describe and apply the principles of statistical inference (Level: Understand, Apply)

**CO2:** calculate point estimates and interval estimates of parameters under different distribution environments (Level: Evaluate)

**CO3:** calculate test statistic and perform a test of significance for various parameters under appropriate distributional environments (Level: Evaluate, Analyse)

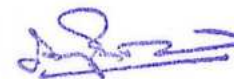
**CO4:** describe, apply and interpret the results of the linear regression model and generalised linear models. (Level: Understand, Apply, Analyse)

**CO5:** explain the fundamental concepts of Bayesian statistics and use them to compute Bayesian estimators. (Level: Understand, Apply)

## Syllabus: Actuarial Statistics 1 B

### Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	Point and Interval Estimation	15
Module2	Hypothesis Testing and Tests of Significance	15
Module3	Regression Theory and Its Applications	15
Module4	Bayesian Statistics	15
	Total	60



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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p><b>Point and Interval Estimation (Employability, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Define Population, Sample, Parameter, Statistic, Estimator, Estimate, Bias, Mean Square Error, Unbiased Estimator, Efficiency, Sufficiency, Consistency</li> <li>• Methods of Point Estimation: Method of Moments, Method of Percentiles, Method of Maximum Likelihood Estimation, Method of Least Squares, Method of Minimum Chi-square</li> <li>• Properties of M.L.E., Cramer Rao Lower Bound for Variance of an Unbiased Estimator</li> <li>• Bootstrap Method to estimate properties of an estimator</li> <li>• Concept of Confidence Interval, Confidence interval for an unknown parameter using a given sampling distribution</li> <li>• Confidence Interval for Mean, Proportion, Poisson Mean, Difference between means, Variance, Ratio of Variances, Coefficient of Correlation</li> </ul>	15
2	<p><b>Hypothesis Testing and Tests of Significance (Employability, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Concepts of Statistical Hypothesis, Null and Alternative Hypothesis, Simple and Composite Hypothesis, Type I and Type II Errors, Test Statistic, Critical Region, Level of Significance, Power of a test, Test of Significance</li> <li>• Probability-value of a test, Likelihood ratio test</li> <li>• Large Sample Tests as Applications of Normal Distribution: Tests for One/Two Population Mean(s)/Proportion(s)</li> <li>• Large Sample Tests for Population Correlation Coefficient(s) using Fisher's z-transformation</li> <li>• Chi-square Test for (i) one population variance, (ii) goodness of fit, (iii) independence of attributes</li> <li>• t-tests for Mean(s) of One/Two Normal Population Mean(s), Paired t- test, t-test for Significance of Bivariate Normal Population Correlation Coefficient and Regression Coefficient</li> <li>• F-test for (i) comparison of two population variances, (ii) simultaneous equality between several population means (ANOVA)</li> </ul>	15

3	<b>Regression Theory and Its Applications (Employability, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Concepts of response variables, explanatory variables</li> <li>• Simple linear regression model with single explanatory variable : derivation of least squares estimates of slope and intercept parameters and their interpretation</li> <li>• Multiple linear regression model with several explanatory variables: derivation of least squares estimates of parameters and their interpretation</li> <li>• Use measures of model fit to select an appropriate set of explanatory variables.</li> <li>• Generalised Linear Model (GLM: Definition of an exponential family of distributions, Its Mean, Variance, Variance Function, Scale Parameter, Link function, Canonical link function of various distributions of the family</li> <li>• GLM: Concept of a variable, a factor taking categorical values and an interaction term. Definition of the linear predictor, illustration of its form for simple models, including polynomial models and models involving factors.</li> <li>• Definition of the deviance and scaled deviance, Estimation of the parameters of a GLM, Choice of a suitable model by using an analysis of deviance and by examining the significance of the parameters, Pearson and Deviance residuals and their use</li> <li>• Apply statistical tests to determine the acceptability of a fitted model: Pearson's Chi-square test and the Likelihood ratio test</li> </ul>	

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4	<b>Bayesian Statistics &amp; Data Analysis (Employability, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• concepts of prior probability and posterior probability</li> <li>• use of Bayes' Theorem to calculate simple conditional probabilities</li> <li>• concepts of prior distribution, posterior distribution and conjugate prior distribution</li> <li>• derivation of posterior distribution for a parameter in simple cases</li> <li>• concept of a loss function</li> <li>• derivation of Bayesian estimates of parameters using simple loss functions</li> <li>• Explain what is meant by the credibility premium formula and describe the role played by the credibility factor</li> <li>• Explain the Bayesian approach to credibility theory and use it to derive credibility premiums in simple cases</li> <li>• Explain the empirical Bayes' approach to credibility theory and use it to derive credibility premiums in simple cases</li> <li>• Explain the differences between the two approaches and state the assumptions underlying each of them</li> </ul>	

**Reference Books:**

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT3	2018	Actuarial Education Company acted@bpp.com
2.	ActEd Study Material Subject CT6	2018	Actuarial Education Company acted@bpp.com
3.	John Freund's Mathematical Statistics with Applications by Miller, Miller	2003	131427067 Prentice Hall India
4.	Elementary Statistics by Mario Triola	2006	9780321369185 Prentice Hall
5.	Introduction to Mathematical Statistics by Hogg, McKean and Craig		ISBN-13: 978-0321795434 Pearson
6.	Statistical Methods by R. J. Shah	2010	Sheth Publishers
7.	Statistics by M.G. Diwan and R. Ramkrishnan	2003	Insurance Institute of India

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Page 5 | 8  
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**Theory Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

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Page 6 | 8

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**Nagindas Khandwala College (Autonomous)**

Syllabus And Question Paper Pattern Of

**First Year Semester I**

***3. Actuarial Statistics 1B [Practical]***  
Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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Page 7 | 8

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**Syllabus: Actuarial Statistics 1B [Practical] No of Lectures - 30**

**Topics are same as in Theory.**

**Course Outcome**

On successful completion of this course, student should be able to use scientific calculator, spreadsheet software (if required) to

**CO1:** calculate point estimate band interval estimates of parameters under different distribution environments (**Apply**)

**CO2:** calculate test statistic and perform a test of significance for various parameters under appropriate distributional environments (**Evaluate, Analyse**)

**CO3:** interpret the results of the linear regression model and generalised linear models (**Analyse**)

**CO4:** fit a linear regression model to a data set and interpret the output (**Understand, Apply**)

**CO5:** fit a generalised linear model to a data set and interpret the output (**Understand, Apply, Analyse**)

**CO6:** compute Bayesian estimators (**Evaluate**)

A student should carry out practical exercises to achieve the above mentioned competence.

**Practical Examination: Total Marks 50**

- Continuous Internal examination shall carry 25% weight. It would involve a written test under no supervision carrying 20% weight and Class participation carrying 5% weight.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination, a candidate is permitted to use a designated, non-programmable scientific calculator, a computer with Excel, R software and a specified Actuarial Tables Book.

*Theory and Practical marks scored by a student shall then be merged in the ratio of 2:1 to convert to a total of 100 marks.*

*The Passing criteria will apply after the merger of theory and practical marks. A student shall be considered to have PASSED if he/she obtains at least 40% marks in each of CIE and EE component.*

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Syllabus and Question Paper Pattern Of  
**First Year Semester I**

**2. Actuarial Statistics 1A (Theory)**

Under Academic Autonomy and Credit, Grading and  
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With effect from Academic Year 2019- 20

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**PRINCIPAL** Page 1 | 7

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## Syllabus: Actuarial Statistics 1A

Course Abbreviation	Course Code	Full Course Name	Type of Course
AS1A	1912UCHAAS	Actuarial Statistics 1A (Theory and Practical)	CC

### Course Objective

The aim of this course is to provide a grounding in mathematical and statistical techniques that are of particular relevance to actuarial work.

### Course Outcome

On successful completion of this course, student should be able to

- CO1: Calculate various statistical measures and interpret them (Level: Apply)
- CO2: Summarise data using appropriate statistical and graphical presentation (Level: Analyse, Apply)
- CO3: Calculate probabilities of simple and compound events (Level: Evaluate)
- CO4: Define random variables and determine their distributions in various actuarial applications (Level: Analyse)
- CO5: Describe the essential features of statistical distributions (Level: Understand)
- CO6: Determine generating functions (Level: Apply)
- CO7: Calculate probabilities and other measures from standard discrete and standard continuous distributions (Level: Evaluate)

## Syllabus Actuarial Statistics 1A

### Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Summary Statistics and Probability</b>	15
Module2	<b>Discrete Random Variables and Discrete Distributions</b>	15
Module3	<b>Continuous Random Variables and Continuous Distributions</b>	15
Module4	<b>Data Analysis</b>	15
	Total	60

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**PRINCIPAL** page 2 | 7

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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<b>Summary Statistics and Probability (Employability, Skill development)</b> <ul style="list-style-type: none"> <li>• Data types and Presentation: Frequency distribution, tabular, graphical and diagrammatic presentation</li> <li>• Data interpretation</li> <li>• Summary Measures: Measures of central tendency, location, dispersion, skewness, kurtosis and moments</li> <li>• Probability using Classical approach, Empirical approach and Axiomatic approach</li> <li>• Probability of compound events using Addition theorem, Multiplication theorem and Bayes' theorem</li> </ul>	15
2	<b>Discrete Random Variables and Discrete Distributions (Employability, Skill development)</b> <ul style="list-style-type: none"> <li>• Discrete random variable, probability mass function, cumulative distribution function, calculation of probability</li> <li>• Expectation, variance, median, mode, moments and other measures. Properties of Expectation and Variance</li> <li>• Standard Discrete Distributions: Discrete Uniform, Bernoulli's, Binomial, Poisson, Geometric Type I and Type II, Negative Binomial Type I and Type II, Hypergeometric. Their Key characteristics and Calculation of Probability (Using Actuarial Tables and otherwise)</li> <li>• Generating Functions: Probability Generating Function, Moment Generating Function and Cumulant Generating Function. Their key properties, determination of these functions and their use in finding various other measures</li> <li>• Joint Discrete Probability Distribution: Joint, Marginal and Conditional Probability functions, Joint CDF, Covariance and Correlation Coefficient, Joint Moment Generating Function</li> </ul>	15

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 Page 3 | 7  
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3	<b>Continuous Random Variables and Continuous Distributions (Employability, Skill development)</b>	15
	<ul style="list-style-type: none"> <li>• Continuous random variable, probability density function, cumulative distribution function, survival function, calculation of probability</li> <li>• Expectation, variance, median, mode, moments and other measures</li> <li>• Standard Continuous Distributions: Rectangular, Exponential, Gamma, Beta I, Beta II, Normal, Log Normal, Chi-square, t, F, Pareto, Weibul, Burr. Their Key characteristics and Calculation of Probability, Percentiles (Using Actuarial Tables and otherwise), Generating functions</li> <li>• Central Limit theorem and its applications</li> <li>• Joint Discrete Probability Distribution: Joint, Marginal and Conditional Probability functions, Joint CDF, Covariance and Correlation Coefficient, Joint Moment Generating Function</li> <li>• Conditional Expectation, Conditional Variance and their key result</li> </ul>	
4	<b>Data Analysis (Employability, Skill development)</b>	15
	<ul style="list-style-type: none"> <li>• Exploratory Data Analysis involving calculation of summary statistics and data visualization</li> <li>• Pearson's, Spearman's and Kendall's measures of correlation for bivariate data</li> <li>• Principal Component Analysis</li> <li>• Random sampling and sampling distributions of sample mean, sample variance, sample proportion</li> <li>• Fisher-Cochran's theorem, Student's t and Snedecor's F statistics and their distributions</li> </ul>	

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**PRINCIPAL** Page 4 | 7

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**Reference Books:**

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT3	2018	Actuarial Education Company acted@bpp.com
2.	John Freund's Mathematical Statistics with Applications by Miller, Miller	2003	131427067 Prentice Hall India
3.	Elementary Statistics by Mario Triola	2006	9780321369185 Prentice Hall
4.	Descriptive Statistics by R. J. Shah	2010	Sheth Publishers
5.	Statistical Methods by R. J. Shah	2010	Sheth Publishers
6.	Statistics by M.G. Diwan and R. Ramkrishnan	2003	Insurance institute of India

**Theory Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

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**PRINCIPAL** Page 5 | 7

NAGINDAS KHANDWALA COLLEGE OF COMMERCE  
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NAGRE - 5 BISKROMBI, VADODRA DISTRICT OF GUJARAT  
VADODRA - 390 004



**Nagindas Khandwala College (Autonomous)**

Syllabus and Question Paper Pattern of

**First Year Semester I**

**2. Actuarial Statistics 1A (Practical)**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

*Nagindas Khandwala College*

**PRINCIPAL** Page 6 | 7

NAGINDAS KHANDWALA COLLEGE OF COMMERCE  
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NAGINDAS KHANDWALA COLLEGE OF SCIENCE  
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MALSI WADI, AMBARNATI - 400 064

## Topics are same as in theory

### Course Outcome

On successful completion of this course, student should be able to use scientific calculator, spreadsheet software to

- Calculate various statistical measures and Interpret them (Level: Evaluate, Apply, Analyse)
- Summarise data using appropriate statistical analysis, descriptive statistics and graphical presentation. (Level: Evaluate, Apply, Analyse)
- Calculate probabilities of simple and compound events (Level: Evaluate)
- Calculate probabilities and other measures from standard discrete and standard continuous distributions (Level: Evaluate)
- Perform data analysis including principal component analysis A student should carry out practical exercises to achieve the above mentioned competence. (Level: Evaluate, Apply, Analyse)

### Examination: Total Marks 50

- Continuous Internal examination shall carry 25% weight. It would involve a written test under no supervision carrying 20% weight and Class participation carrying 5% weight.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination, a candidate is permitted to use a designated, non-programmable scientific calculator, a computer with Excel, R software and a specified Actuarial Tables Book.

*Theory and Practical marks scored by a student shall then be merged in the ratio of 2:1 to convert to a total of 100 marks.*

*The Passing criteria will apply after the merger of theory and practical marks. A student shall be considered to have PASSED if he/she obtains at least 40% marks in each of CIE and EE component.*

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NAGINDAS KHANDWALA COLLEGE OF COMMERCE  
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**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus and Question Paper Pattern Of

**First Year Semester I**

**1. Foundation Course**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

*Nagindas Khandwala College*

  
PRINCIPAL Page 1 | 5

NAGINDAS KHANDWALA COLLEGE OF COMMERCE  
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## Syllabus: Foundation Course

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
FC	1911UCHAFC	Foundation Course	AECC	3

### Course Objective

To make a student aware of

- Composition of Indian society from many facets and impact of globalization
- Impact of Politics and power changes on social and economic growth
- Actuarial profession and role of actuary, Constitution and Role of Institute of Actuaries of India
- Impact of Several Influential People (Indian and International)

### Course Outcome

On successful completion of this course, student should be able to

**CO1:** describe composition of Indian society (Level: Remember)

**CO2:** describe impact of globalization (Level: Understand)

**CO3:** explain impact of Politics and power changes on social and economic growth (Level: Understand)

**CO4:** state constitution and role of Institute of Actuaries of India (Level: Remember)

**CO5:** describe role of actuary (Level: Understand)

**CO6:** describe achievements of some famous people, analyse their strengths and describe the impact of their deeds on our lives (Level: Remember, Analyse)

## Syllabus: Foundation Course

### Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Indian Society and Globalization</b>	10
Module2	<b>Impact of Politics and Power Changes</b>	10
Module3	<b>Actuarial Profession</b>	10
Module4	<b>How some influential people have impacted our lives?</b>	15
	<b>Total</b>	<b>45</b>

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### Detailed Syllabus

Module	Topics	No. of Lectures
<b>1</b>	<b>Indian Society and Globalisation</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, gender, geographical location and level of education</li> <li>• Concepts of liberalization, privatization and globalization</li> <li>• Growth of information technology and communication and its impact manifested in everyday life</li> <li>• Impact of globalization on industry: changes in employment and increasing migration</li> <li>• Effect of Globalization on economic and financial growth</li> <li>• Changes in agrarian sector due to globalization</li> </ul>	
<b>2</b>	<b>Impact of Politics and Power Changes</b>	<b>10</b>
	Impact of Uncertainties about the ruling party and their policies on <ul style="list-style-type: none"> <li>• Financial markets</li> <li>• Agriculture sector</li> <li>• Subsidies and taxation</li> <li>• Growth plans of companies</li> <li>• Social Welfare Schemes</li> </ul>	
<b>3</b>	<b>Actuarial Profession (Employability)</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• What is actuarial science</li> <li>• Who is an actuary</li> <li>• Role of an actuary</li> <li>• What is needed to become a good student of actuarial science</li> <li>• Applications of Actuarial science in various fields</li> <li>• Future scope for an actuary</li> <li>• History of Actuarial profession in India</li> <li>• Institute of Actuaries of India – Structure, Role, Responsibilities</li> <li>• Ethics for Actuary</li> </ul>	
<b>4</b>	<b>How some influential people have impacted our lives?</b>	<b>15</b>

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	<p>The lives of people to include (but not limited to)</p> <ul style="list-style-type: none"> <li>• Gautam Buddha</li> <li>• Mahatma Gandhi</li> <li>• Swami Vivekanand</li> <li>• Dhirubhai Ambani</li> <li>• J R D Tata</li> <li>• Kautilya</li> <li>• S Ramanujan</li> <li>• Rabindranath Tagore</li> <li>• Mother Teresa</li> <li>• Warren Buffet</li> <li>• Bill Gates</li> <li>• Albert Einstein</li> <li>• Isaac Newton</li> <li>• Leonardo Da Vinci</li> </ul> <p>The students are expected to learn suitable Software and make Presentations of different personalities. (Skill Development)</p>	
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**Reference Books andArticles:**

Sr. No.	Title Author	ISBN Publisher
1.	<p><b>Foundation Course Study Material of University of Mumbai</b>  <a href="http://archive.mu.ac.in/myweb_test/F.Y.B.A.%20&amp;%20B.Com%20-%20Foudation%20Course%20%28Eng%29.pdf">http://archive.mu.ac.in/myweb_test/F.Y.B.A.%20&amp;%20B.Com%20-%20Foudation%20Course%20%28Eng%29.pdf</a></p>	University of Mumbai
2.	<p>Politics, Power and Change: What is Next for ASEAN?            by KPMG  <a href="https://assets.kpmg.com/content/dam/kpmg/sg/pdf/2017/05/politics-power-and-change-what-next-for-asean.pdf">https://assets.kpmg.com/content/dam/kpmg/sg/pdf/2017/05/politics-power-and-change-what-next-for-asean.pdf</a></p>	KPMG
3.	<p>Study Material on Actuaries Act and Actuarial Profession of Institute of Actuaries of India</p>	Institute of Actuaries of India
4.	<p>Incarnations: India in 50 Lives by Sunil Khilnani,</p>	Penguin Random House India, ISBN: 9780143429333, 0143429337

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**Examination: Total Marks 100**

- Internal examination shall carry 25% weight. It would involve a Power Point Presentation (10% weight), a written test under no supervision carrying 10% weight and Class participation carrying 5% weight.
- External examination shall carry 75% weight. It shall have 5 questions each with 15% weight. Internal options may be present.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.

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**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester I**

**4. *Mathematics for Actuaries (Theory)-1***  
Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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Page 1 | 4

## Syllabus: Mathematics for Actuaries 1

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
MA1	1914UCHAMA	Mathematics for Actuaries 1	DSE	3

### Course Objective

The aim of this course is to

- provide a basic understanding of mathematical concepts needed for studying actuarial science

### Course Outcome

On successful completion of this course, student should be able to

- CO1: use numerical methods to understand accuracies of calculations (Level: Understand, Apply)
- CO2: apply matrix and determinants for solving equations (Level: Apply)
- CO3: understand the basics of calculus to build on further (Level: Understand)
- CO4: use basic algebraic concepts in actuarial modeling (Level: Apply)
- CO5: apply finite differences and difference equations in actuarial applications (Level: Apply)

## Syllabus: Mathematics for Actuaries 1

### Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Numerical methods</b>	10
Module2	<b>Matrices, Determinants and Elementary Calculus</b>	12
Module3	<b>Algebra</b>	13
Module4	<b>Finite Differences and their Applications</b>	10
	Total	45



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### Detailed Syllabus

Module	Topics	No. of Lectures
<b>1</b>	<b>Numerical methods (Skill Development)</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Measures of Absolute and Relative Changes</li> <li>• Measures of Absolute and Relative Errors</li> <li>• Linearly interpolating an intermediate value of a function based on two given values</li> <li>• Simple iterative methods to solve a non-linear equation</li> </ul>	
<b>2</b>	<b>Matrices, Determinants and Elementary Calculus (Skill Development)</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Vector algebra with simple operations                             <ul style="list-style-type: none"> <li>➤ Matrix operations</li> </ul> </li> <li>• Determinants and their applications</li> <li>• Mathematical constants &amp; standard functions:                             <ul style="list-style-type: none"> <li>➤ Functions: <math>x^n</math>, <math>a^x</math>, <math>e^x</math>, <math>\ln x</math>. Definition, basic properties, graphs. Absolute values, Minimum and maximum values. Concepts of limit and continuity</li> </ul> </li> </ul>	
<b>3</b>	<b>Algebra (Skill Development)</b>	<b>13</b>
	<ul style="list-style-type: none"> <li>• Solution of simple equations, including simultaneous equations (not necessarily linear)</li> <li>• Use of Matrix Algebra and Determinants in solving Linear Equations</li> <li>• Solution of quadratic equations</li> <li>• Solution of inequalities</li> <li>• Summation of terms (<math>\Sigma</math>) and Product of terms (<math>\pi</math>).</li> <li>• Summation of terms in Arithmetic Progression and Geometric Progression</li> <li>• <math>\Sigma r</math> and <math>\Sigma r^2</math> where <math>r</math> represents a natural number ranging from 1 to <math>n</math>.</li> <li>• Binomial expansions of <math>(a + b)^n</math> where <math>n</math> is a positive integer and <math>(1 + x)^p</math> where <math>p</math> is a real number with condition for convergence.</li> </ul>	
<b>4</b>	<b>Finite Differences and their Applications (Skill Development)</b>	<b>10</b>



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	<ul style="list-style-type: none"> <li>• Operators: E, <math>\Delta</math>, B.</li> <li>• Finite differences and their tables</li> <li>• Applications to estimation of missing number.</li> <li>• Newton's and Lagrange's Formulae</li> <li>• Applications to interpolation and extrapolations</li> <li>• Solution of Simple Difference equations</li> <li>• Their applications in Markov Chain and other problems</li> </ul>	
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Sr. No.	Title Author	ISBN Publisher
1.	Higher Algebra Hall and Knight ISBN 9781402179655	Macmillan and Co., London
2.	College Algebra T G Kulkarni and Kelkar	Macmillan
3.	Calculus: Early Transcendentals James Stewart ISBN-13: 9780534393212	Brooks/Cole Pub Company.
4.	Calculus James Stewart ISBN-13: 9780534393397	Thompson Learning

**Reference Books:**

**Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.

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Page 4 | 4

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**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester I**

**5. R Programming and Analytics (Practical)**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

*Nagindas Khandwala College*

 Page 1 | 4

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## Syllabus: R Programming and Analytics

Course Abbreviation	Course Code	Full Course Name	Type of Course
RP	1915UCHARP	R Programming and Analytics (Practical)	SEC

### Course Objective

- Gain a foundational understanding of business analytics using R programming
- Master the R programming and understand how various statements are executed in R

**Course Outcome:** On successful completion of this course, a student shall be able to

**CO1:** Gain an in-depth understanding of data structure used in R and learn to import/export data in R (Level: Understand)

**CO2:** Define, understand and use the various apply functions and DPLYR functions (Level: Apply)

**CO3:** Understand and use the various graphics in R for data visualization (Level: Apply)

**CO4:** Gain understanding of use of R for calculating statistical measures and interpret them (Level: Understand)

**CO5:** Apply hypothesis testing methods and regression models using R (Level: Apply)

**CO6:** Learn and use clustering methods including K-means, DBSCAN, and hierarchical clustering – all using R (Level: Apply)

### Syllabus: R Programming and Analytics (Practical)

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Introduction</b>	15
Module2	<b>Getting Deeper in R</b>	15
Module3	<b>Advanced Concepts</b>	15
Module4	<b>Applications to various tools</b>	15
	Total	60

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 Page 2 | 4

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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<b>Introduction (Employability, Entrepreneurship, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Big Data and Data Mining</li> <li>• Technology and Tools for Big Data mining, A framework for tackling Big Data Analytics Project</li> <li>• Introduction to Business Analytics</li> <li>• Introduction to R Programming</li> </ul>	
2	<b>Getting Deeper in R (Employability, Entrepreneurship, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• R Data Structure</li> <li>• Apply Functions</li> <li>• Data Visualization</li> <li>• Data mining</li> <li>• Big Data Processing and Storage Systems, their integration with R</li> </ul>	
3	<b>Advanced Concepts (Employability, Entrepreneurship, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Classification</li> <li>• Clustering</li> <li>• Association</li> <li>• Predictive Modeling</li> <li>• Data Science and unstructured data analysis.</li> </ul>	
4	<b>Applications to various tools including (but not limited to) (Employability, Entrepreneurship, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Descriptive measures in Statistics</li> <li>• Estimation</li> <li>• Hypothesis Testing</li> <li>• Regression Analysis</li> <li>• Time Series Forecasting</li> </ul>	

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Page 3 | 4

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### Reference Books:

Sr. No.	Title and Author	Edition Year	ISBN Publisher
1.	Beginning R : The Statistical Programming Language by Dr. Mark Gardener	2013	
2.	Statistics Using R by Purohit, Gore and Deshmukh	2008	Narosa Publications
3.	Actuarial Statistics- An Introduction Using R by Shailaja R Deshmukh	1st 2009	9788173716904 Universities Press
4.	Essential R For Data Analysis: Data manipulation and visualization using R for beginning and intermediate users	1st	PBR Books
5.	R for Data Science by Hadley Wickham		

### Examination: Total Marks 100

- Continuous Internal examination shall carry 25% weight. It would involve a written test under no supervision carrying 20% weight and Class participation carrying 5% weight.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination a candidate is permitted to use a designated a computer with facility to run R programming codes and a specified Actuarial Tables Book.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.

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 Page 4 | 4

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**1.1.3**  
**Employability**  
**B. Com (Hons.) Actuarial**  
**Studies**  
**2019-20**  
**Syllabus**



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**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester II**

**4. Actuarial Accounting 2**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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## Syllabus: Actuarial Accounting 2

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AC2	1924UCHAAC	Actuarial Accounting 2	DSE	3

### Course Objective

The aim of this course is to

- provide a basic understanding of accounting principles
- provide the ability to interpret the accounts and financial statements of companies and financial institutions
- provide an understanding of how to manage financial risk

### Course Outcome

On successful completion of this course, student should be able to

**CO1:** construct statement of income, balance sheet and cashflow statement (Level: Create)

**CO2:** analyse published accounts (Level: Analyse)

**CO3:** produce management information (Level: Create)

## Syllabus: Actuarial Accounting 2

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Basic Concepts of Accounting</b>	15
Module2	<b>Construction of Accounting Statements, Insurance Company Accounts and Group Accounts</b>	15
Module3	<b>Measures of Comparison of Accounts</b>	15
Module4	<b>Constructing management information and evaluating working</b>	15
	Total	60

  
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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p><b>Basic Concepts of Accounting (Employability, Entrepreneurship, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Why companies are required to produce annual reports and accounts</li> <li>• Value of financial reporting on environmental, social and economic sustainability</li> <li>• Fundamental accounting concepts which should be adopted in the drawing up of company accounts</li> <li>• Basic accounting items and their classification</li> <li>• Purpose of a:                             <ul style="list-style-type: none"> <li>○ statement of financial position</li> <li>○ statement of comprehensive income</li> <li>○ cash flow statement</li> <li>○ notes to the accounts</li> </ul> </li> <li>• Depreciation                             <ul style="list-style-type: none"> <li>○ Purpose</li> <li>○ Methods of Calculation</li> </ul> </li> <li>• Reserves                             <ul style="list-style-type: none"> <li>○ types : Retained earnings, Revaluation reserve and Share Premium reserve</li> <li>○ how do they arise and how they may be used</li> </ul> </li> </ul>	15
2	<p><b>Construction of Accounting Statements, Insurance Company Accounts and Group Accounts (Employability, Entrepreneurship, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Trial balance</li> <li>• Construction of                             <ul style="list-style-type: none"> <li>○ statements of financial position</li> <li>○ statements of profit or loss</li> <li>○ cash flow statements</li> </ul> </li> <li>• Insurance company accounts:                             <ul style="list-style-type: none"> <li>○ how different from other companies' account</li> <li>○ structure and content</li> </ul> </li> <li>• Concepts of holding company, subsidiary company and associated company</li> <li>• Purpose of consolidated accounts</li> <li>• Goodwill arising on consolidation of group accounts</li> <li>• Minority interest</li> </ul>	15

  
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3	<b>Measures of Comparison of Accounts (Employability, Entrepreneurship, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Measures useful to lenders: <ul style="list-style-type: none"> <li>○ priority percentages and gearing</li> <li>○ interest cover and asset cover for loan capital</li> </ul> </li> <li>• Measures useful to owners/investors: <ul style="list-style-type: none"> <li>○ price earnings ratio</li> <li>○ dividend yield</li> <li>○ dividend cover</li> <li>○ EBITDA</li> <li>○ (Net) earnings per share</li> </ul> </li> <li>• Understanding the possible effects of interest rate movements on a highly geared company.</li> <li>• Accounting ratios which indicate: <ul style="list-style-type: none"> <li>○ profitability</li> <li>○ liquidity</li> <li>○ efficiency</li> </ul> </li> <li>• Shortcomings of historical cost accounting</li> <li>• Limitations in the interpretation of company accounts</li> <li>• How reported figures can be manipulated to create a false impression of a company's financial position</li> </ul>	
4	<p><b>Constructing management information and evaluating working capital (Employability, Entrepreneurship, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Working capital position of a company <ul style="list-style-type: none"> <li>○ Analysis of accounts receivables, accounts payables and inventory ratios</li> <li>○ Evaluate policies for working capital management, including its individual elements</li> <li>○ Methods for financing working capital</li> <li>○ Analysis of the short term cash position of a company</li> <li>○ Measures to manage the short term cash position of a company</li> <li>○ Dividend sustainability</li> </ul> </li> <li>• Forecasts and budgets as sources of management information. <ul style="list-style-type: none"> <li>○ Their <ul style="list-style-type: none"> <li>○ Functions</li> <li>○ Purpose</li> <li>○ Basic examples</li> </ul> </li> </ul> </li> </ul>	15

  
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**Reference Books:**

Sr. No.	Title Author	Edition Year	ISBN Publisher
1	ActEd Study Material Subject CT2	2018	Actuarial Education Co. acted@bpp.com
2	Accounting and financial fundamentals for nonfinancial executives by Robert Rachlin & Allen Sweeny.	1996	AMACOM, New York
3	Accounting Fundamentals by William Ruland		0324023618 South-Western College Pub.
4	Principles of Corporate Finance by Richard Brealey and Stewart Myers	2017	McGraw Hill

**Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.



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**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester - II**

**2. Actuarial Statistics 2A [Theory]**

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2019- 20

  
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## Syllabus: Actuarial Statistics 2A

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS2A	1922UCHAAS	Actuarial Statistics 2A (Theory and Practical)	CC	4+2

### Course Objective

The aim of this subject is to provide a strong background of mathematical and statistical modeling techniques that are of particular relevance to actuarial work, including time series analysis and its applications

### Course Outcome

On successful completion of this subject, a student will be able to:

**CO1:** describe and use statistical distributions for risk modeling (**Knowledge, Apply**)

**CO2:** describe the main concepts underlying the analysis of time series models  
(**Understand**)

**CO3:** describe and apply basic principles of machine learning (**Knowledge, Apply**)

## Syllabus: Actuarial Statistics 2A [Theory]

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	Random variables and distributions for risk modeling	15
Module2	Introduction to Copulas and Extreme Value Theory	15
Module3	Time Series Models-I	15
Module4	Advanced concepts and Applications of Time Series and Machine Learning	15
	Total	60

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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p><b>Random variables and distributions for risk modeling (Employability, Skill Development)</b></p> <ul style="list-style-type: none"> <li>• Loss distributions, with and without risk sharing</li> <li>• statistical distributions suitable for modeling individual and aggregate losses and their properties</li> <li>• concepts of excesses (deductibles), reinsurance and retention limits</li> <li>• operation of simple forms of proportional and excess of loss reinsurance</li> <li>• derivation of the distribution and determination of corresponding moments of the claim amounts paid by the insurer and the reinsurer in the presence of excesses(deductibles) and reinsurance.</li> <li>• Estimate the parameters of a failure time or loss distribution when the data is complete, or when it is incomplete, using maximum likelihood and the method of moments.</li> <li>• Fit a statistical distribution to a dataset and calculate appropriate goodness of fit measures.</li> <li>• Compound distributions and their applications in risk modeling (including reinsurance) <ul style="list-style-type: none"> <li>○ construction of models appropriate for short term insurance contracts in terms of the numbers of claims and the amounts of individual claims</li> <li>○ Compound Poisson distribution, its characteristics and its applications related to aggregate losses</li> <li>○ derivation of the mean, variance, moment generating function and coefficient of skewness for compound Binomial, compound Poisson and compound Negative binomial distributions</li> </ul> </li> </ul>	15
2	<p><b>Introduction to Copulas and Extreme Value Theory (Employability)</b></p>	15

  
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	<ul style="list-style-type: none"> <li>• Copulas <ul style="list-style-type: none"> <li>○ copula as a multivariate distribution function which is a function of the marginal distribution functions of its variates and its implications for analysis</li> <li>○ meaning of the terms dependence or concordance, upper and lower tail dependence and use of tail dependence in selecting a copula suitable for modeling particular types of risk</li> <li>○ Gaussian copula and the Archimedean family of copulas</li> </ul> </li> <li>• Extreme Value Theory <ul style="list-style-type: none"> <li>○ Extreme value distributions, suitable for modeling the distribution of severity of loss and their relationships</li> <li>○ Calculation of various measures of tail weight and interpretation of the results to compare the tail weights</li> </ul> </li> </ul>	
3	<b>Time Series Models-I (Employability, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Concepts underlying time series models <ul style="list-style-type: none"> <li>○ general properties of stationary, <math>I(0)</math>, and integrated, <math>I(1)</math>, univariate time series</li> <li>○ stationary random series</li> <li>○ a filter applied to a stationary random series</li> <li>○ backwards shift operator, backwards difference operator</li> <li>○ characteristic equation of time series and its roots</li> </ul> </li> <li>• Basic properties of following time series models: <ul style="list-style-type: none"> <li>○ autoregressive (AR)</li> <li>○ moving average (MA)</li> <li>○ autoregressive moving average (ARMA)</li> <li>○ autoregressive integrated moving average (ARIMA)</li> </ul> </li> </ul>	
4	<b>Advanced concepts and Applications of Time Series and Machine Learning (Employability, Skill Development)</b>	15

  
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	<ul style="list-style-type: none"> <li>• Advanced concepts of time series <ul style="list-style-type: none"> <li>o concept and properties of discrete random walks and random walks with normally distributed increments, both with and without drift</li> <li>o basic concept of a multivariate autoregressive model</li> <li>o co-integrated time series</li> <li>o Markov property of time series and illustrations</li> <li>o methodology to rearrange a univariate time series model as a multivariate Markov model.</li> </ul> </li> <li>• Applications of time series models <ul style="list-style-type: none"> <li>o identification, estimation and diagnosis of a time series model</li> <li>o the criteria for choosing between models and the diagnostic tests to be applied to the residuals of a time series after estimation</li> <li>o other non-stationary, non-linear time series models.</li> <li>o simple applications of a time series model, including random walk, autoregressive and co-integrated models as applied to security prices and other economic variables</li> <li>o deterministic forecasts from time series data, using simple extrapolation and moving average models, applying smoothing techniques and seasonal adjustment when appropriate (including Box-Jenkins methodology)</li> </ul> </li> <li>• Elementary Principles and Applications of Machine learning <ul style="list-style-type: none"> <li>o main branches of machine learning</li> <li>o illustrations of the types of problems typically addressed by machine learning</li> <li>o application of high-level concepts relevant to learning from data</li> <li>o examples of key supervised and unsupervised machine learning techniques</li> <li>o difference between regression and classification</li> <li>o difference between generative and discriminative models</li> <li>o use of appropriate software to apply machine learning techniques (e.g. penalised regression and decision trees) to simple problems</li> <li>o demonstrate an understanding of the perspectives of statisticians, data scientists, and other quantitative researchers from non-actuarial backgrounds</li> </ul> </li> </ul>	
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**Reference Books:**

Sr. No	Title and Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT6	2018	Actuarial Education Company acted@bpp.com
2.	Actuarial Mathematics Bowers, L. Newton, et. el.	2nd	ISBN 0938959468 Society of Actuaries
3.	ActEd Study Material Subject ST9	2018	Actuarial Education Company acted@bpp.com
4.	ActEd Study Material Subject CS2	2019	Actuarial Education Company acted@bpp.com

**Theory Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

  
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Syllabus And Question Paper Pattern Of

**First Year Semester II**

**2. Actuarial Statistics 2A [Practical]**

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2019- 20

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## Practical on Actuarial Statistics 2A (30 lectures)

### Course Outcome

On successful completion of this course, student should be able to use scientific calculator, spreadsheet software, R studio (if required) to

**CO1:** calculate moments and cumulative probabilities for loss distributions (Level: Evaluate)

**CO2:** calculate the estimates of the parameters of a failure time or loss distribution when the data is complete, or when it is incomplete, using maximum likelihood and the method of moments (Level: Evaluate, Apply)

**CO3:** fit a statistical distribution to a dataset and calculate appropriate goodness of fit measures (Level: Apply, Analyse)

**CO4:** calculate various measures of tail weight and interpret the results to compare the tail weights (Level: Apply)

**CO5:** calculate sample autocorrelation coefficients and use them for estimating parameters in a time series model (Level: Evaluate, Apply)

**CO6:** calculate forecasts based on time series models (Level: Apply)

**CO7:** use appropriate software to apply machine learning techniques (Level: Apply)

A student should carry out practical exercises to achieve the above mentioned competence

### Practical Examination: Total Marks 50

- Continuous Internal examination shall carry 25% weight. It would involve a written test under no supervision carrying 20% weight and Class participation carrying 5% weight.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination, a candidate is permitted to use a designated, non-programmable scientific calculator, a computer with Excel, R software and a specified Actuarial Tables Book.

*Theory and Practical marks scored by a student shall then be merged in the ratio of 2:1 to convert to a total of 100 marks.*

*The Passing criteria will apply after the merger of theory and practical marks. A student shall be considered to have PASSED if he/she obtains at least 40% marks in each of CIE and EE components.*

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**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester II**

**3. Actuarial Statistics 2B [Theory]**

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2019- 20

  
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Page 1 | 10

## Syllabus: Actuarial Statistics 2B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS2B	1923UCHAAS	Actuarial Statistics 2B (Theory and Practical)	CC	4+2

### Course Objective

The aim of this subject is to provide a strong background of mathematical and statistical modeling techniques that are of particular relevance to actuarial work, including stochastic processes and survival models and their application.

### Course Outcome

On successful completion of this subject, a student will be able to:

CO1: describe and apply Markov chains and Markov processes (Level: Knowledge, Apply)

CO2: describe and apply techniques of survival analysis (Level: Knowledge, Apply)

CO3: describe and apply methods of Graduation (Level: Knowledge, Apply)

CO4: test statistically the graduated rates for appropriateness (Level: Analyse)

## Syllabus: Actuarial Statistics 2B [Theory]

### Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	<b>Stochastic Processes and Markov Chains</b>	15
Module 2	<b>Markov Processes and Their Applications</b>	15
Module 3	<b>Survival models</b>	15
Module 4	<b>Calculation of Exposed to Risk and Graduation</b>	15
	<b>Total</b>	60

  
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### Detailed Syllabus

Module	Topics	No. of Lectures
1	<b>Stochastic Processes and Markov Chains (Employability, Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Description, classification and basic characteristics of stochastic processes                             <ul style="list-style-type: none"> <li>○ definition of a general stochastic process and a counting process</li> <li>○ classification a stochastic process according to time and value and examples of each type</li> <li>○ simple random walk</li> <li>○ possible applications of mixed processes</li> <li>○ characteristics: stationary and weakly stationary, Markov property, white noise, filtration</li> </ul> </li>   <li>• Markov chain and its Applications                             <ul style="list-style-type: none"> <li>○ essential features of a Markov chain model</li> <li>○ Chapman-Kolmogorov equations that represent a Markov chain</li> <li>○ stationary distribution for a Markov chain in simple cases</li> <li>○ a system of frequency based experience rating in terms of a Markov chain and other simple applications</li> <li>○ a time inhomogeneous Markov chain model and describe simple applications</li> <li>○ use of Markov chain as a tool for modeling and show how</li> </ul> </li> </ul>	
2	<b>Markov Processes and Their Applications (Employability, Skill Development)</b>	15

  
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	<ul style="list-style-type: none"> <li>○ Markov Processes <ul style="list-style-type: none"> <li>○ definition, time homogeneous and time inhomogeneous cases</li> <li>○ essential features of a Markov process model</li> <li>○ definition of Poisson process, derivation of the distribution of the number of events in a given time interval, derivation of the distribution of inter-event times, and application of these results</li> <li>○ derivation of the Kolmogorov equations for a Markov process with time independent and time/age dependent transition intensities</li> <li>○ solution of the Kolmogorov equations in simple cases</li> <li>○ simple survival models, sickness models and marriage models in terms of Markov processes and other simple applications</li> <li>○ Kolmogorov equations for a model where the transition intensities depend not only on age/time, but also on the duration of stay in one or more states</li> <li>○ sickness and marriage models in terms of duration dependent Markov processes and other simple applications</li> <li>○ uses of Markov jump processes as a tool for modeling and show how they can be simulated</li> </ul> </li> </ul>	
3	<b>Survival models (Employability, Skill Development)</b>	15

  
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	<ul style="list-style-type: none"> <li>• Concept of survival models</li> <li>• model of lifetime or failure time from age <math>x</math> as a random variable</li> <li>• consistency condition between the random variable representing lifetimes from different ages.</li> <li>• cumulative distribution function and density functions of the random future lifetime</li> <li>• survival function, the force of mortality or hazard rate and relationships between them</li> <li>• actuarial symbols <math>{}_p x</math> and <math>{}_q x</math> and derive integral formulae for <math>{}_p x</math> in terms of force of mortality</li> <li>• Gompertz and Makeham laws of mortality</li> <li>• curtate future lifetime from age <math>x</math> and its probability function</li> <li>• the symbols <math>e_x</math> and <math>e_x^0</math> and an approximate relation between them</li> <li>• expected value and variance of the complete and curtate future lifetimes and derive expressions for them</li>   <li>• Two-state model of a single decrement and compare its assumptions with those of the random lifetime model</li> <li>• Estimation procedures for lifetime distributions</li> <li>• ways in which lifetime data might be censored</li> <li>• the estimation of the empirical survival function in the absence of censoring, and what problems are introduced by censoring</li> <li>• Kaplan-Meier (or product limit) estimator of the survival function in the presence of censoring, its computation and estimate of its variance</li> <li>• Nelson-Aalen estimator of the cumulative hazard rate in the presence of censoring, its computation and estimate of its variance</li> <li>• Models for proportional hazards and their application to estimate the impact of covariates on the hazard</li> <li>• Cox model for proportional hazards, derivation of the partial likelihood estimate in the absence of ties, and the asymptotic distribution of the partial likelihood estimator</li> <li>• Derivation of Maximum likelihood estimators for constant transition intensities with a well drawn observational plan in respect of a finite number of individuals observed during a finite period of time, and other resulting statistics, including the waiting times</li> <li>• their asymptotic joint distribution</li> <li>• the Poisson approximation to the estimator in the case of a single decrement</li> </ul>	
4	<b>Calculation of Exposed to Risk and Graduation (Employability, Skill Development)</b>	15

  
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	<ul style="list-style-type: none"> <li>• Estimation of transition intensities dependent on age (exact or census) <ul style="list-style-type: none"> <li>○ importance of dividing the data into homogeneous classes, including subdivision by age and sex</li> <li>○ principle of correspondence and its fundamental importance in the estimation procedure</li> <li>○ the data needed for the exact calculation of a central exposed to risk (waiting time) depending on age and sex</li> <li>○ calculation of a central exposed to risk given the above data</li> <li>○ estimates of transition probabilities, including in the single decrement model the actuarial estimate based on the simple adjustment to the central exposed to risk.</li> <li>○ the assumptions underlying the census approximation of waiting times</li> <li>○ concept of the rate interval</li> <li>○ Develop census formulae given age at birthday where the age may be classified as next, last, or nearest relative to the birthday as appropriate, and the deaths and census data may use different definitions of age</li> <li>○ Specify the age to which estimates of transition intensities or probabilities apply</li> </ul> </li> <li>• Graduation and graduation tests <ul style="list-style-type: none"> <li>○ Concept, need, objective of graduation and desirable characteristics of graduated rates</li> <li>○ Methods of Graduation: Graphical method, Parametric formula method, Standard Table based method, Spline functions method</li> <li>○ Graduation tests for <ul style="list-style-type: none"> <li>➤ smoothness</li> <li>➤ adherence <ul style="list-style-type: none"> <li>▪ overall goodness</li> <li>▪ consistent bias</li> <li>▪ detecting the presence of individual ages where the fit is poor</li> <li>▪ detecting the consistency of the “shape” of the crude estimates and the standard table</li> </ul> </li> </ul> </li> <li>○ For each test describe: <ul style="list-style-type: none"> <li>➤ formulation of the hypothesis</li> <li>➤ test statistic</li> <li>➤ distribution of the test statistic using approximations where appropriate</li> <li>➤ calculation of the test statistic and conclusion thereof</li> </ul> </li> <li>○ Describe how the above tests should be amended to allow for the presence of duplicate policies</li> </ul> </li> </ul>	
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	<ul style="list-style-type: none"> <li>• Mortality projection <ul style="list-style-type: none"> <li>○ the approaches to the forecasting of future mortality rates based on extrapolation, explanation and expectation, and their advantages and disadvantages</li> <li>○ Lee-Carter, age-period-cohort, and p-spline regression models for forecasting mortality.</li> <li>○ main sources of error in mortality forecasts</li> </ul> </li> </ul>	
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**Reference Books:**

Sr. No.	Title and Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT6	2018	Actuarial Education Company acted@bpp.com
2.	Actuarial Mathematics Bowers, L. Newton, et. el.	2nd	ISBN 0938959468 Society of Actuaries
3.	Survival models and their estimation	1988	Actex Publications
4.	Probability and random processes. by <i>Grimmett, Geoffrey; Stirzaker, David.</i>	3rd 2001	Oxford University Press
5.	Modeling, analysis, design, and control of stochastic systems. – <i>Kulkarni, Vidyadhar G.</i>	1999	Springner

**Theory Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

  
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Syllabus And Question Paper Pattern Of

**First Year Semester II**

**3. Actuarial Statistics 2B [Practical]**

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2019- 20

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Page 8 | 10

**Syllabus: Actuarial Statistics 2B [Practical] – No of Lectures -30**

**Topics**

**Course Outcome**

On successful completion of this course, student should be able to use scientific calculator, spreadsheet software, R studio (if required) to

- CO1: calculate probabilities pertaining to simple stochastic process like simple random walk (Level: Evaluate)
- CO2: calculate multistep and steady-state probabilities using Markov Chain model (Level: Apply)
- CO3: calculate probabilities, expected waiting time in a state, expected time to reach from one state to another and other measures for Markov model (Level: Evaluate)
- CO4: calculation of probability, mean pertaining to lifespan based on different lifetime patterns (Level: Evaluate)
- CO5: calculate the Kaplan-Meier (or product limit) estimate of the survival function in the presence of censoring and estimate its variance (Level: Evaluate)
- CO6: calculate the Nelson-Aalen estimate of the cumulative hazard rate in the presence of censoring and estimate its variance (Level: Evaluate)
- CO7: apply Cox regression model to estimate proportionate hazards of two dissimilar lives (Level: Apply)
- CO8: compute maximum likelihood estimators for the constant transition intensities in Markov models using transition frequency data (Level: Analyse)
- CO9: obtain estimates of central exposed to risk and hence estimates of transition probabilities in single decrement models (Level: Analyse)
- CO10: carry out graduation by different standard methods (Level: Analyse)
- CO11: carry out statistical tests of graduated rates for smoothness and adherence including tests for overall fit, presence of bias (Level: Analyse)
- CO12: use an appropriate computer software package to apply Lee- Carter, age-period-cohort and p-spline regression models (Level: Apply)

A student to carry out practical exercises to achieve the above mentioned competence.

  
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### **Practical Examination: Total Marks 50**

- Continuous Internal examination shall carry 25% weight. It would involve a written test under no supervision carrying 20% weight and Class participation carrying 5% weight.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination, a candidate is permitted to use a designated, non- programmable scientific calculator, a computer with Excel, R software and a specified Actuarial Tables Book.

*Theory and Practical marks scored by a student shall then be merged in the ratio of 2:1 to convert to a total of 100 marks.*

*The Passing criteria will apply after the merger of theory and practical marks. A student shall be considered to have PASSED if he/she obtains at least 40% marks in each of CIE and EE component.*

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Page 10 | 10

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**Nagindas Khandwala College (Autonomous)**

Syllabus and Question Paper Pattern Of

**First Year Semester II**

**5. Advanced Excel with Macros [Practical]**

Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

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## Syllabus: Advanced Excel with Macros [Practical]

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
ASEX	1925UCHAEX	Advanced Excel with Macros [Practical]	SEC	4

### Course Objective

This course is aiming at providing grounding in Excel and its advanced features including various Excel functions useful in actuarial analytics and enable building Excel macros using visual basic.

### Course Outcome

On successful completion of this course, student should be able to

**CO1:** Demonstrate knowledge of Utility, Specifications (**Knowledge**)

**CO2:** Creating and Operating on worksheets: Entering data, editing data, Window view controls, working with cells and ranges, Introducing Tables, formatting worksheets, using and creating Templates, printing from worksheets (**Create, Apply**)

**CO3:** Demonstrate Working with formats and functions: Introducing formulas and functions (**Knowledge**)

**CO4:** Creating formulas using functions useful for text manipulation, date and time related applications, counting and summing, formulas to LookUp values, useful for financial and statistical applications and formulas with array functions (**Create**)

**CO5:** Creating charts and graphics: create and edit charts of the following types: Column, Bar, Line, Pie, XY charts (**Create**)

**CO6:** Use Advanced Features: Creating and using outlines, linking and consolidating worksheets, sharing data with other applications, analyzing data using MS Query with external database files, performing what-if analysis, analyzing data using Goal Seek and Solver (**Apply**)

**CO7:** Demonstrate Programming Ability in EXCEL with VBA using VBA sub-procedures and VBA functions, Create VBA Macros, record actions to create them, write VBA Code. (**Apply**)

A student to carry out practical exercises (particularly related to actuarial work) to achieve the above mentioned competence.

## Syllabus: Advanced Excel with Macros [Practical] Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Introduction to Microsoft EXCEL</b>	15
Module2	<b>Working with formulas and functions</b>	15
Module3	<b>Creating Charts, Graphs and Advanced Features</b>	15
Module4	<b>Programming EXCEL with VBA</b>	15
	<b>Total</b>	<b>60</b>

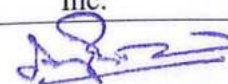
**Detailed Syllabus:**

Module	Detail	No. of Lectures
Module 1	<b>Introduction to Microsoft EXCEL (Employability, Entrepreneurship, Skill Development)</b>	15
	<p><b>Introduction to Microsoft EXCEL:</b> Utility, Specifications. Create your first worksheet.</p> <p><b>Creating and Operating on worksheets:</b> Entering data, editing data, Window view controls, working with cells and ranges, Introducing Table, formatting worksheets, using and creating Templates, printing from worksheets.</p>	
Module 2	<b>Working with formulas and functions (Employability, Entrepreneurship, Skill Development)</b>	15
	<p><b>Working with formulas and functions:</b> Introducing formulas and functions.</p> <p>Creating formulas using functions useful for text manipulation, date and time related applications, counting and summing, formulas to LookUp values, useful for financial and statistical applications and formulas with array functions.</p>	
Module 3	<b>Creating Charts, Graphs and Advanced Features (Employability, Entrepreneurship, Skill Development)</b>	15
	<p><b>Creating charts and graphics:</b> create and edit charts of the following types: Column, Bar, Line, Pie, XY charts.</p> <p><b>Advanced Features:</b> Creating and using outlines, linking and consolidating worksheets, sharing data with other applications, analyzing data using MS Query with external database files, performing what-if analysis, analyzing data using Goal Seek and Solver</p>	
Module 4	<b>Programming EXCEL with VBA (Employability, Entrepreneurship, Skill Development)</b>	15
	<p><b>Programming EXCEL with VBA:</b> Introduction of VBA Macros, VBA sub procedures and VBA functions, Create VBA Macros, record actions to create them. Write VBA Code. VBA Functions. VBA Examples.</p>	

**Reference Books:**

Sr. No.	Title Author	Edition Year	ISBN Publisher/Seller
1.	2016 Microsoft Excel Bible, John Walkenbach	2016	Wiley
2.	Professor Teaches Word, Excel, & Power Point 2010	2010	Individual Software, Inc.

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Page 3 | 4

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3.	Learn Excel 2019 Essential Skills with the Smart Method by Mike Smart	2018	<a href="http://www.amazon.com">www.amazon.com</a>
4.	Excel VBA and Macros: Programming Basics for Absolute Beginners by Philippe A. Louis	2018	Philippe A. Louis Sold by Amazon Asia-Pacific Holdings Private Limited

### Examination: Total Marks 100

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- End examination carrying 75% weight shall be of 4 hours. The examination will involve Journal (20% weight), Viva (20% weight) and an end-exam activity (35% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (15% weight).
- The practical examination shall be evaluated by one external examiner and one internal examiner.
- In this practical examination, a candidate is permitted to use a designated, non- programmable scientific calculator, a computer with Excel and a specified Actuarial Tables Book.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.



**Nagindas Khandwala College (Autonomous)**

**B. Com. (Honours) in Actuarial Studies**

Syllabus And Question Paper Pattern Of

**First Year Semester II**

**4. Mathematics for Actuaries (Theory)-2**  
Under Academic Autonomy and Credit, Grading and  
Semester System

With effect from Academic Year 2019- 20

## Syllabus: Mathematics for Actuaries 2

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
MA2	1924UCHAMA	Mathematics for Actuaries 2	DSE	3

### Topics

#### Course Objective

The aim of this course is to

- provide a basic understanding of certain mathematical concepts needed for studying actuarial science
- provide basics of machine learning

#### Course Outcome

On successful completion of this course, student should be able to

- CO1: understand apply differential calculus in actuarial analysis (Level: Apply)
- CO2: understand apply integral calculus in actuarial analysis (Level: Apply)
- CO3: understand certain more theories of calculus (Level: Knowledge)
- CO4: understand basics of machine learning (Level: Knowledge)


## Syllabus: Mathematics for Actuaries 2 (Theory) Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	<b>Differential Calculus</b>	15
Module2	<b>Integral Calculus</b>	15
Module3	<b>More Applications of Calculus</b>	15
Module4	<b>Machine Learning</b>	15
	Total	60

### Detailed Syllabus

Module	Topics	No. of Lectures
1	<b>Differential Calculus (Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Derivative as rate of change. Derivative as gradient of a curve.</li> <li>• Derivative of simple functions: <math>x^n</math>, <math>a^x</math>, <math>e^x</math>, <math>\ln x</math>.</li> <li>• Derivatives of sums, products, quotients and “functions of a function”.</li>   <li>• The concept of a higher-order (repeated) derivative</li> <li>• Application of derivative to find the maximum or minimum value of a function over a specified range</li> <li>• Identify the nature of stationary points</li> <li>• The meaning of a partial derivative, notations, evaluation.</li> <li>• Extreme values of functions of two variables</li> </ul>	
2	<b>Integral Calculus (Skill Development)</b>	15
	<ul style="list-style-type: none"> <li>• Meaning of indefinite integral as the anti-derivative of a function and the meaning of a definite integral as the limit of a sum of infinitesimal elements.</li> <li>• The interpretation of a definite integral as the area under a graph</li> <li>• Integration of the standard functions <math>x^n</math>, <math>ax</math> and <math>ex</math>.</li> <li>• Solution of indefinite and definite integrals by inspection, by identifying and applying an appropriate substitution, by integration by parts, by using simple partial fractions where the fractions initially have a quadratic denominator or by a combination of these methods</li> <li>• Determine when a definite integral converges</li> </ul>	
3	<b>More Applications of Calculus (Skill Development)</b>	15

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	<ul style="list-style-type: none"> <li>State and apply Taylor series and Maclaurin series in their simplest form, including using these to determine the approximate change in a function where the argument is varied by a small amount.</li> <li>Apply the Taylor series expansions for <math>e^x</math> and <math>\ln(1+x)</math> and, in the latter case, determine when the series converges.</li> <li>Concept of Differential equation and solution of <math>dy/dx + Py = Q</math> where P and Q are functions of x. Applications of this solution in Actuarial study.</li> </ul>	
4	<b>Machine Learning (Skill Development)</b>	15

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ooks:

Sr. No.	Title Author	ISBN Publisher
1.	Calculus: Early Transcendentals James Stewart ISBN-13: 9780534393212	Brooks/Cole Pub Company.
2.	Calculus James Stewart ISBN-13: 9780534393397	Thompson Learning

**Examination: Total Marks 100**

- Continuous Internal examination shall carry 25% weight (25 marks). It would involve a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.
- External examination of 2 1/2 hours and 75 marks shall have 5 questions of 15 marks each. Internal options may be provided.
- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.
- Passing shall be independent in Internal Component called Continuous Assessment (CA) and External Component called End Examination (EE).

A student must score at least 40% marks in each component in order to pass in the subject.



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