Malad Kandivli Education Society's

NAGINDAS KHANDWALA COLLEGE

OF COMMERCE, ARTS & MANAGEMENT STUDIES

AND SHANTABEN NAGINDAS KHANDWALA COLLEGE OF SCIENCE

(Re-accredited (3rd 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

Autonomous (2016-17)

Providing Syllabus copy of the courses highlighting the focus on employability/ entrepreneurship/ skill development along with their course outcomes.

Sr. No.	Courses	2016-17	2017-18	2018-19	2019-20	2020-21	Total
1	Bachelor of Commerce (B.COM)	✓	✓	✓	✓	✓	5
2	Bachelor of Arts (B.A)	✓	✓	✓	✓	✓	5
3	Bachelor in Management Studies- (BMS)	✓	✓	✓	✓	✓	5
4	Bachelor of Commerce (Accounts and Finance)- BAF	✓	✓	✓	✓	✓	5
5	Bachelor of Commerce (Banking and Insurance)-BBI	✓	✓	✓	✓	✓	5
6	Bachelor of Commerce (Financial Markets)-BFM	✓	✓	✓	✓	✓	5
7	Bachelor of Science - Information Technology (B.Sc IT)	✓	✓	✓	✓	✓	5
8	Bachelor of Science- Computer Science(B.Sc CS)	✓	✓	✓	✓	✓	5
9	Bachelor of Arts- Multimedia and Mass Communication (B.A.MMC)	✓	✓	✓	✓	✓	5
10	Bachelor of Management Studies- Sports Management (BMS-SM)	X	X	✓	✓	✓	3
11	B. Com. Honours in Actuarial Studies	X	X	X	✓	✓	2
12	B.A. Honours in Apparel Design and Construction	X	X	X	✓	✓	2
13	B. Com. Honours in International Accounting	X	X	X	✓	✓	2
14	Bachelor of Management Studies- E commerce operations	X	X	X	X	✓	1
15	B.Sc. (Honours) in Integrative Nutrition & Dietetics	X	X	X	X	✓	1
16	BBA in Tourism and Travel Management	X	X	X	X	✓	1
17	B.Sc. in Interior Design	X	X	X	X	✓	1
18	Master Of Commerce-(M.COM)-Accountancy	✓	✓	✓	✓	✓	5
19	Master Of Commerce-(M.COM)-Management						
20	Master of Arts (Economics)	✓	✓	✓	✓	✓	5
21	Master of Arts (Geography)	✓	✓	✓	✓	✓	5
22	Master of Arts (Psychology)	X	X	X	✓	✓	2
23	Master of Science (Information Technology) (M.Sc IT)	✓	✓	✓	✓	✓	5
24	Master's Degree - Sports Management (MSM)	X	X	✓	✓	✓	3
25	Master of Science (Geo-informatics) (M.Sc GeoInformatics)	X	X	X	X	✓	1
							84

Prof. (Dr.) Moushumi Datta
I/c. 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 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Accounting 1

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AC1	2014UCHAAC	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	**Corporate Governance, Corporate Organization and Business Types**	15
Module2	**Financing of Corporates and Taxation:**	15
Module3	**Issue of Shares, Reward Policy for Shareholders, Mergers and Acquisition**	15
Module4	**Project Evaluation**	15
	Total	60

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**Corporate Governance, Corporate Organisation and Business Types** (Employability, Skill Development)	15
	- purpose and process of regulating the financial reporting information of incorporated entities - key principles of corporate governance and the regulation of companies - relationship between finance and the real resources and objectives of an organisation - relationship between the stakeholders in an organisation(including lenders and investors) - role and effects of the capital markets - maximisation of shareholder wealth as the main goal of financial management in a company - problems relating to the maximisation of shareholder wealth in practice: social responsibility concerns, agency problems and divergent objectives - the strategies employed by managers to maximize shareholder wealth - determinants of value and the actions managers can take to influence value - the distinctive characteristics of different types of business structures: sole traders, partnerships, limited companies and limited liability partnerships as business entities - different types of loan and share capital - authorised and issued share capital - economic advantages and disadvantages of a limited company as a business entity - the main differences between a private and public company	
2	**Financing of Corporates and Taxation** (Employability, Entrepreneurship, Skill Development)	15

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- Types of medium term company finance:
  - hire purchase
  - credit sale
  - leasing
  - bank loans
- Types of short term company finance:
  - bank overdrafts
  - trade credit
  - factoring
  - bills of exchange
  - commercial paper
- Alternative methods of raising finance outside the regular banking system including
  - shadow banking
  - direct project financing
  - crowd-funding
  - micro-finance
- Basic principles of personal taxation of income and capital gains
- Basic principles of corporate taxation
- Different systems of company taxation from the points of view of an individual shareholder and the company
- Basic principles of double taxation relief
- 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.
- Reasons a company might have for seeking a quotation on the stock exchange
- The characteristics of
  - debenture stocks
  - unsecured loan stocks
  - Eurobonds
  - preference shares
  - ordinary shares
  - convertible unsecured loan stocks
  - convertible preference shares
  - warrants
  - floating rate notes
  - subordinated debt
  - options issued by companies
- The characteristics and possible uses by a non-financial company of:
  - financial futures
  - options
  - interest rate and currency swaps

3	**Issue of Shares, Reward Policy for Shareholders, Mergers and Acquisition:** (Employability, Skill Development)	15

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	- Methods of obtaining a quotation for securities: - introduction - placing - offer for sale - offer for sale by tender - offer for subscription - New issues to existing shareholders: - scrip issue - rights issue - Role of underwriting in the issue of securities. - Factors to be considered by a company when deciding on its capital structure - Effect of the capital structure of a company on the market valuation of the company - Effect of taxation on the capital structure used by a company - Principal factors that a company should consider in setting dividend policy - Alternative ways of distributing profits, such as buybacks - Effect of the dividend policy on the market valuation of a company - Companies growth with the different ways of company restructuring - Relationship between growth and profitability - Constraints on a firm's growth - Motives for mergers and acquisitions - Characteristics of a merger - Methods of evaluating a target company - Steps that a buyer will usually take in a leveraged buyout - Cost of Capital of a company - Concept - Impact of nature of investment projects - Weighted average cost of capital of a company	
4	**Project Evaluation (Employability, Entrepreneurship, Skill Development)**	**15**

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NAGINDAS KHANDWALA COLLEGE OF COMMERCE
ARTS & MANAGEMENT STUDIES AND SHANTABEN
NAGINDAS KHANDWALA COLLEGE OF SCIENCE
(AUTONOMOUS)
MALAD (W), MUMBAI - 400 064

- Methods to determine the viability of a capital project
- Cash flow projections and techniques to estimate cashflows
- Methods commonly used to evaluate risky investments including simulation and certainty equivalents
- Issues in establishing the required rate of return for a capital project
- Factors underlying the choice of discount rate within project assessment including:
  - the assumptions and limitations in the use of the weighted average cost of capital
  - the allowance for leverage
  - the allowance for risk
- Methods for identifying the risks that may be present for different types of project
- Techniques for ascertaining the probability of occurrence of different risks over varying timescales and the financial impact of occurrence
- Techniques for ascertaining the distribution of the possible financial outcomes of a capital project

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 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present.

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- 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.

Nagindas Khandwala College (Autonomous)
B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

First Year Semester I

2. Actuarial Statistics 1A (Theory)

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Statistics 1A

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS1A	2012UCHAAS	Actuarial Statistics 1A (Theory and Practical)	CC	4+2

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	**Summary Statistics and Probability**	15
Module2	**Discrete Random Variables and Discrete Distributions**	15
Module3	**Continuous Random Variables and Continuous Distributions**	15
Module4	**Data Analysis**	15
	Total	60

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**Summary Statistics and Probability (Employability, Skill development)**	15
	• Data types and Presentation: Frequency distribution, tabular, graphical and diagrammatic presentation • Data interpretation • Summary Measures: Measures of central tendency, location, dispersion, skewness, kurtosis *and* moments • Probability using Classical approach, Empirical approach and Axiomatic approach • Probability of compound events using Addition theorem, Multiplication theorem and Bayes' theorem	
2	**Discrete Random Variables and Discrete Distributions (Employability, Skill development)**	15
	• Discrete random variable, probability mass function, cumulative distribution function, calculation of probability • Expectation, variance, median, mode, moments and other measures. Properties of Expectation and Variance • 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) • 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 • Joint Discrete Probability Distribution: Joint, Marginal and Conditional Probability functions, Joint CDF, Covariance and Correlation Coefficient, Joint Moment Generating Function	

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3	**Continuous Random Variables and Continuous Distributions** **(Employability, Skill development)**	15
	• Continuous random variable, probability density function, cumulative distribution function, survival function, calculation of probability • Expectation, variance, median, mode, moments and other measures • 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 • Central Limit theorem and its applications • Joint Discrete Probability Distribution: Joint, Marginal and Conditional Probability functions, Joint CDF, Covariance and Correlation Coefficient, Joint Moment Generating Function • Conditional Expectation, Conditional Variance and their key result	
4	**Data Analysis** **(Employability, Skill development)**	15
	• Exploratory Data Analysis involving calculation of summary statistics and data visualization • Pearson's, Spearman's and Kendall's measures of correlation for bivariate data • Principal Component Analysis • Random sampling and sampling distributions of sample mean, sample variance, sample proportion • Fisher-Cochran's theorem, Student's t and Snedecor's F statistics and their distributions	

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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

a. Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15 marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

b. External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present.

• 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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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

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 40% weight (20 marks). It would involve Journal assessment (35% weight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end-results (20% 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.
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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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

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 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Statistics 1B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS1B	2013UCHAAS	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 lea
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	**Point and Interval Estimation (Employability, Skill Development)**	15
	• Define Population, Sample, Parameter, Statistic, Estimator, Estimate, Bias, Mean Square Error, Unbiased Estimator, Efficiency, Sufficiency, Consistency	
	• Methods of Point Estimation: Method of Moments, Method of Percentiles, Method of Maximum Likelihood Estimation, Method of Least Squares, Method of Minimum Chi-square	
	• Properties of M.L.E., Cramer Rao Lower Bound for Variance of an Unbiased Estimator	
	• Bootstrap Method to estimate properties of an estimator	
	• Concept of Confidence Interval, Confidence interval for an unknown parameter using a given sampling distribution	
	• Confidence Interval for Mean, Proportion, Poisson Mean, Difference between means, Variance, Ratio of Variances, Coefficient of Correlation	
2	**Hypothesis Testing and Tests of Significance (Employability, Skill Development)**	15
	• 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	
	• Probability-value of a test, Likelihood ratio test	
	• Large Sample Tests as Applications of Normal Distribution: Tests for One/Two Population Mean(s)/Proportion(s)	
	• Large Sample Tests for Population Correlation Coefficient(s) using Fisher's z-transformation	
	• Chi-square Test for (i) one population variance, (ii) goodness of fit, (iii) independence of attributes	
	• 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	
	F-test for (i) comparison of two population variances, (ii) simultaneous equality between several population means (ANOVA)	

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3	**Regression Theory and Its Applications (Employability, Skill Development)**	15
	• Concepts of response variables, explanatory variables	
	• Simple linear regression model with single explanatory variable : derivation of least squares estimates of slope and intercept parameters and their interpretation	
	• Multiple linear regression model with several explanatory variables: derivation of least squares estimates of parameters and their interpretation	
	• Use measures of model fit to select an appropriate set of explanatory variables.	
	• 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	
	• 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.	
	• 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	
	• Apply statistical tests to determine the acceptability of a fitted model: Pearson's Chi-square test and the Likelihood ratio test	

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4	**Bayesian Statistics & Data Analysis (Employability, Skill Development)**	15
	• concepts of prior probability and posterior probability • use of Bayes' Theorem to calculate simple conditional probabilities • concepts of prior distribution, posterior distribution and conjugate prior distribution • derivation of posterior distribution for a parameter in simple cases • concept of a loss function • derivation of Bayesian estimates of parameters using simple loss functions • Explain what is meant by the credibility premium formula and describe the role played by the credibility factor • Explain the Bayesian approach to credibility theory and use it to derive credibility premiums in simple cases • Explain the empirical Bayes' approach to credibility theory and use it to derive credibility premiums in simple cases • Explain the differences between the two approaches and state the assumptions underlying each of them	

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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Theory Examination: Total Marks 100

- Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present.

- 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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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

Nagindas Khandwala College

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

- calculate point estimate band interval estimates of parameters under different distribution environments (Apply)
- calculate test statistic and perform a test of significance for various parameters under appropriate distributional environments (Evaluate, Analyse)
- interpret the results of the linear regression model and generalised linear models (Analyse)
- fit a linear regression model to a data set and interpret the output (Understand, Apply)
- fit a generalised linear model to a data set and interpret the output (Understand, Apply, Analyse)
- 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 40% weight (20 marks). It would involve Journal assessment (35% wight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (20% 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.
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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.

Nagindas Khandwala College

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 2020-21

Nagindas Khandwala College

Syllabus: Foundation Course

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
FC	2011UCHAFC	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	**Indian Society and Globalization**	10
Module2	**Impact of Politics and Power Changes**	10
Module3	**Actuarial Profession**	10
Module4	**How some influential people have impacted our lives?**	15
	Total	**45**

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**Indian Society and Globalisation**	10
	• Multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, gender, geographical location and level of education • Concepts of liberalization, privatization and globalization • Growth of information technology and communication and its impact manifested in everyday life • Impact of globalization on industry: changes in employment and increasing migration • Effect of Globalization on economic and financial growth • Changes in agrarian sector due to globalization	
2	**Impact of Politics and Power Changes**	10
	Impact of Uncertainties about the ruling party and their policies on • Financial markets • Agriculture sector • Subsidies and taxation • Growth plans of companies • Social Welfare Schemes	
3	**Actuarial Profession** (Employability)	10
	• What is actuarial science • Who is an actuary • Role of an actuary • What is needed to become a good student of actuarial science • Applications of Actuarial science in various fields • Future scope for an actuary • History of Actuarial profession in India • Institute of Actuaries of India – Structure, Role, Responsibilities • Ethics for Actuary	
4	**How some influential people have impacted our lives?**	15

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	The lives of people to include (but not limited to)	
	- Gautam Buddha - Mahatma Gandhi - Swami Vivekanand - Dhirubhai Ambani - J R D Tata - Kautilya - S Ramanujan - Rabindranath Tagore - Mother Teresa - Warren Buffet - Bill Gates - Albert Einstein - Isaac Newton - Leonardo Da Vinci The students are expected to learn suitable Software and make Presentations of different personalities. (Skill Development)	

Reference Books andArticles:

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

Nagindas Khandwala College

Examination: Total Marks 100

- Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15 marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present

- Passing shall be independent in Internal Component called Continuous Internal Evaluation (CIE) 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 I

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

With effect from Academic Year 2020-21

Syllabus: Mathematics for Actuaries 1

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
MA1	2014UCHAMA	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	**Numerical methods**	10
Module2	**Matrices, Determinants and Elementary Calculus**	12
Module3	**Algebra**	13
Module4	**Finite Differences and their Applications**	10
	Total	45

Detailed Syllabus

Module	Topics	No. of Lectures
1	**Numerical methods** (Skill Development)	10
	- Measures of Absolute and Relative Changes - Measures of Absolute and Relative Errors - Linearly interpolating an intermediate value of a function based on two given values - Simple iterative methods to solve a non-linear equation	
2	**Matrices, Determinants and Elementary Calculus** (Skill Development)	13
	- Vector algebra with simple operations ➢ Matrix operations - Determinants and their applications - Mathematical constants & standard functions: ➢ Functions: x^n, a^x, e^x, ln x. Definition, basic properties, graphs. Absolute values, Minimum and maximum values. Concepts of limit and continuity	
3	**Algebra** (Skill Development)	12
	- Solution of simple equations, including simultaneous equations (not necessarily linear) - Use of Matrix Algebra and Determinants in solving Linear Equations - Solution of quadratic equations - Solution of inequalities - Summation of terms (Σ) and Product of terms (π). - Summation of terms in Arithmetic Progression and Geometric Progression Σr and Σr^2 where r represents a natural number ranging from 1 to n. - Binomial expansions of $(a + b)n$ where n is a positive integer and $(1 + x)p$ where p is a real number with condition for convergence.	
4	**Finite Differences and their Applications** (Skill Development)	10

- Operators: E, Δ, B.
- Finite differences and their tables
- Applications to estimation of missing number.
- Newton's and Lagrange's Formulae
- Applications to interpolation and extrapolations
- Solution of Simple Difference equations
- Their applications in Markov Chain and other problems

Reference Books:

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

Examination: Total Marks 100

- Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present.

- 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.

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 2020-21

Nagindas Khandwala College

Syllabus: R Programming and Analytics

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
RP	2015UCHARP	R Programming and Analytics (Practical)	SEC	4+2

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 DPLYP 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	**Introduction**	15
Module2	**Getting Deeper in R**	15
Module3	**Advanced Concepts**	15
Module4	**Applications to various tools**	15
	Total	60

Nagindas Khandwala College

Detailed Syllabus

Module	Topics	No. of Lectures
1	**Introduction** (Employability, Entrepreneurship, Skill Development)	15
	• Big Data and Data Mining	
	• Technology and Tools for Big Data mining, A framework for tackling Big Data Analytics Project	
	• Introduction to Business Analytics	
	• Introduction to R Programming	
2	**Getting Deeper in R** (Employability, Entrepreneurship, Skill Development)	15
	• R Data Structure	
	• Apply Functions	
	• Data Visualization	
	• Data mining	
	• Big Data Processing and Storage Systems, their integration with R	
3	**Advanced Concepts** (Employability, Entrepreneurship, Skill Development)	15
	• Classification	
	• Clustering	
	• Association	
	• Predictive Modeling	
	• Data Science and unstructured data analysis.	
4	**Applications to various tools including (but not limited to)** (Employability, Entrepreneurship, Skill Development)	15
	• Descriptive measures in Statistics	
	• Estimation	
	• Hypothesis Testing	
	• Regression Analysis	
	• Time Series Forecasting	

Nagindas Khandwala College

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	9788817371690 4 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 40% weight (40 marks). It would involve Journal assessment (35% wight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end-results (20% 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.

Nagindas Khandwala College

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 2020-21

Syllabus: Actuarial Accounting 2

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AC2	2024UCHAAC	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	**Basic Concepts of Accounting**	15
Module2	**Construction of Accounting Statements, Insurance Company Accounts and Group Accounts**	15
Module3	**Measures of Comparison of Accounts**	15
Module4	**Constructing management information and evaluating working**	15
	Total	60

Detailed Syllabus

Module	Topics	No. of Lectures
1	**Basic Concepts of Accounting** (Employability, Entrepreneurship, Skill Development) • Why companies are required to produce annual reports and accounts • Value of financial reporting on environmental, social and economic sustainability • Fundamental accounting concepts which should be adopted in the drawing up of company accounts • Basic accounting items and their classification • Purpose of a: o statement of financial position o statement of comprehensive income o cash flow statement o notes to the accounts • Depreciation o Purpose o Methods of Calculation • Reserves o types : Retained earnings, Revaluation reserve and Share Premium reserve o how do they arise and how they may be used	15
2	**Construction of Accounting Statements, Insurance Company Accounts and Group Accounts** (Employability, Entrepreneurship, Skill Development) • Trial balance • Construction of o statements of financial position o statements of profit or loss o cash flow statements • Insurance company accounts: o how different from other companies' account o structure and content • Concepts of holding company, subsidiary company and associated company • Purpose of consolidated accounts • Goodwill arising on consolidation of group accounts • Minority interest	15

3	**Measures of Comparison of Accounts** (Employability, Entrepreneurship, Skill Development)	15

	• Measures useful to lenders:
	  o priority percentages and gearing
	  o interest cover and asset cover for loan capital
	• Measures useful to owners/investors:
	  o price earnings ratio
	  o dividend yield
	  o dividend cover
	  o EBITDA
	  o (Net) earnings per share
	• Understanding the possible effects of interest rate movements on a highly geared company.
	• Accounting ratios which indicate:
	  o profitability
	  o liquidity
	  o efficiency
	• Shortcomings of historical cost accounting
	• Limitations in the interpretation of company accounts
	• How reported figures can be manipulated to create a false impression of a company's financial position	

4	**Constructing management information and evaluating working capital** (Employability, Entrepreneurship, Skill Development)	15

	• Working capital position of a company
	  o Analysis of accounts receivables, accounts payables and inventory ratios
	  o Evaluate policies for working capital management, including its individual elements
	  o Methods for financing working capital
	  o Analysis of the short term cash position of a company
	  o Measures to manage the short term cash position of a company
	  o Dividend sustainability
	• Forecasts and budgets as sources of management information. Their
	  o Functions
	  o Purpose
	  o Basic examples	

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 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours and 60 marks shall have 4questions 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.

Nagindas Khandwala College

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 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Statistics 2A

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS2A	2022UCHAAS	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	**Random variables and distributions for risk modeling (Employability, Skill Development)**	15
	• Loss distributions, with and without risk sharing • statistical distributions suitable for modeling individual and aggregate losses and their properties • concepts of excesses (deductibles), reinsurance and retention limits • operation of simple forms of proportional and excess of loss reinsurance • 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. • 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. • Fit a statistical distribution to a dataset and calculate appropriate goodness of fit measures. • Compound distributions and their applications in risk modeling (including reinsurance) o construction of models appropriate for short term insurance contracts in terms of the numbers of claims and the amounts of individual claims o Compound Poisson distribution, its characteristics and its applications related to aggregate losses o derivation of the mean, variance, moment generating function and coefficient of skewness for compound Binomial, compound Poisson and compound Negative binomial distributions	
2	**Introduction to Copulas and Extreme Value Theory (Employability)**	15

Nagindas Khandwala College

	• Copulas
	   o copula as a multivariate distribution function which is a function of the marginal distribution functions of its variates and its implications for analysis
	   o 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
	   o Gaussian copula and the Archimedean family of copulas
	• Extreme Value Theory
	   o Extreme value distributions, suitable for modeling the distribution of severity of loss and their relationships
	   o Calculation of various measures of tail weight and interpretation of the results to compare the tail weights		

3	**Time Series Models-I (Employability, Skill Development)**		**15**

	• Concepts underlying time series models
	   o general properties of stationary, I(0), and integrated, I(1), univariate time series
	   o stationary random series
	   o a filter applied to a stationary random series
	   o backwards shift operator, backwards difference operator
	   o characteristic equation of time series and its roots
	
	• Basic properties of following time series models:
	   o autoregressive (AR)
	   o moving average (MA)
	   o autoregressive moving average (ARMA)
	   o autoregressive integrated moving average (ARIMA)		

4	**Advanced concepts and Applications of Time Series and Machine Learning (Employability, Skill Development)**		**15**

- Advanced concepts of time series
  - concept and properties of discrete random walks and random walks with normally distributed increments, both with and without drift
  - basic concept of a multivariate autoregressive model
  - co-integrated time series
  - Markov property of time series and illustrations
  - methodology to rearrange a univariate time series model as a multivariate Markov model.

- Applications of time series models
  - identification, estimation and diagnosis of a time series model
  - the criteria for choosing between models and the diagnostic tests to be applied to the residuals of a time series after estimation
  - other non-stationary, non-linear time series models.
  - simple applications of a time series model, including random walk, autoregressive and co-integrated models as applied to security prices and other economic variables
  - 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)
- Elementary Principles and Applications of Machine learning
  - main branches of machine learning
  - illustrations of the types of problems typically addressed by machine learning
  - application of high-level concepts relevant to learning from data
  - examples of key supervised and unsupervised machine learning techniques
  - difference between regression and classification
  - difference between generative and discriminative models
  - use of appropriate software to apply machine learning techniques (e.g. penalised regression and decision trees) to simple problems
  - demonstrate an understanding of the perspectives of statisticians,
  - data scientists, and other quantitative researchers from non-actuarial backgrounds

Nagindas Khandwala College

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 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. Internal options may be present.

- In the theory examination, a candidate is permitted to use a designated, non-programmable scientific calculator and a specified Actuarial Tables Book.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

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 2020- 21

Nagindas Khandwala College

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 40% weight (20 marks). It would involve Journal assessment (35% wight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (20% 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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

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 2020-21

Syllabus: Actuarial Statistics 2B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AS2B	2023UCHAAS	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	**Stochastic Processes and Markov Chains**	15
Module 2	**Markov Processes and Their Applications**	15
Module 3	**Survival models**	15
Module 4	**Calculation of Exposed to Risk and Graduation**	15
	Total	60

Detailed Syllabus

Module	Topics	No. of Lectures
1	**Stochastic Processes and Markov Chains** (Employability, Skill Development)	15
	• Description, classification and basic characteristics of stochastic processes o definition of a general stochastic process and a counting process o classification a stochastic process according to time and value and examples of each type o simple random walk o possible applications of mixed processes o characteristics: stationary and weakly stationary, Markov property, white noise, filtration • Markov chain and its Applications o essential features of a Markov chain model o Chapman-Kolmogorov equations that represent a Markov chain o stationary distribution for a Markov chain in simple cases o a system of frequency based experience rating in terms of a Markov chain and other simple applications o a time inhomogeneous Markov chain model and describe simple applications o use of Markov chain as a tool for modeling and show how	
2	**Markov Processes and Their Applications** (Employability, Skill Development)	15

		o Markov Processes	
		o definition, time homogeneous and time inhomogeneous cases	
		o essential features of a Markov process model	
		o 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	
		o derivation of the Kolmogorov equations for a Markov process with time independent and time/age dependent transition intensities	
		o solution of the Kolmogorov equations in simple cases	
		o simple survival models, sickness models and marriage models in terms of Markov processes and other simple applications	
		o 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	
		o sickness and marriage models in terms of duration dependent Markov processes and other simple applications	
		o uses of Markov jump processes as a tool for modeling and show how they can be simulated	
3		**Survival models** (Employability, Skill Development)	15

- Concept of survival models
- model of lifetime or failure time from age x as a random variable
- consistency condition between the random variable representing lifetimes from different ages.
- cumulative distribution function and density functions of the random future lifetime
- survival function, the force of mortality or hazard rate and relationships between them
- actuarial symbols $_tp_x$ and $_tq_x$ and derive integral formulae for $_tp_x$ in terms of force of mortality
- Gompertz and Makeham laws of mortality
- curtate future lifetime from age x and its probability function
- the symbols e_x and e^0_x and an approximate relation between them
- expected value and variance of the complete and curtate future lifetimes and derive expressions for them

- Two-state model of a single decrement and compare its assumptions with those of the random lifetime model
- Estimation procedures for lifetime distributions
- ways in which lifetime data might be censored
- the estimation of the empirical survival function in the absence of censoring, and what problems are introduced by censoring
- Kaplan-Meier (or product limit) estimator of the survival function in the presence of censoring, its computation and estimate of its variance
- Nelson-Aalen estimator of the cumulative hazard rate in the presence of censoring, its computation and estimate of its variance
- Models for proportional hazards and their application to estimate the impact of covariates on the hazard
- 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
- 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
- their asymptotic joint distribution
- the Poisson approximation to the estimator in the case of a single decrement

| 4 | **Calculation of Exposed to Risk and Graduation** **(Employability, Skill Development)** | 15 |

- Estimation of transition intensities dependent on age (exact or census)
  - importance of dividing the data into homogeneous classes, including subdivision by age and sex
  - principle of correspondence and its fundamental importance in the estimation procedure
  - the data needed for the exact calculation of a central exposed to risk (waiting time) depending on age and sex
  - calculation of a central exposed to risk given the above data
  - estimates of transition probabilities, including in the single decrement model the actuarial estimate based on the simple adjustment to the central exposed to risk.
  - the assumptions underlying the census approximation of waiting times
  - concept of the rate interval
  - 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
  - Specify the age to which estimates of transition intensities or probabilities apply

- Graduation and graduation tests
  - Concept, need, objective of graduation and desirable characteristics of graduated rates
  - Methods of Graduation: Graphical method, Parametric formula method, Standard Table based method, Spline functions method
  - Graduation tests for
    - smoothness
    - adherence
      - overall goodness
      - consistent bias
      - detecting the presence of individual ages where the fit is poor
      - detecting the consistency of the "shape" of the crude estimates and the standard table
  - For each test describe:
    - formulation of the hypothesis
    - test statistic
    - distribution of the test statistic using approximations where appropriate
    - calculation of the test statistic and conclusion thereof
  - Describe how the above tests should be amended to allow for the presence of duplicate policies

• Mortality projection
   o the approaches to the forecasting of future mortality rates based on extrapolation, explanation and expectation, and their advantages and disadvantages
   o Lee-Carter, age-period-cohort, and p-spline regression models for forecasting mortality.
   o main sources of error in mortality forecasts	

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*Grimmett, Geoffrey; Stirzaker, David.*	3rd 2001	Oxford University Press
5.	Modeling, analysis, design, and control of stochastic systems. – *Kulkarni, Vidyadhar G.*	1999	Springner

Theory Examination: Total Marks 100

- Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15 marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours and 60 marks shall have 4questions 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.

Nagindas Khandwala College (Autonomous)

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 2020- 21

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.

Practical Examination: Total Marks 50

- Continuous Internal examination shall carry 40% weight (20 marks). It would involve Journal assessment (35% wight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end- results (20% 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 II

5. Advanced Excel with Macros [Practical]

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Syllabus: Advanced Excel with Macros [Practical]

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
ASEX	2025UCHAEX	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	**Introduction to Microsoft EXCEL**	15
Module2	**Working with formulas and functions**	15
Module3	**Creating Charts, Graphs and Advanced Features**	15
Module4	**Programming EXCEL with VBA**	15
	Total	60

Detailed Syllabus:

Module	Detail	No. of Lectures
Module 1	**Introduction to Microsoft EXCEL**(Employability, Entrepreneurship, Skill Development)	15
	Introduction to Microsoft EXCEL: Utility, Specifications. Create your first worksheet. **Creating and Operating on worksheets**: Entering data, editing data, Window view controls, working with cells and ranges, Introducing Table, formatting worksheets, using and creating Templates, printing from worksheets.	
Module 2	**Working with formulas and functions** (Employability, Entrepreneurship, Skill Development)	15
	Working with formulas and functions: Introducing formulas and functions. 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.	
Module 3	**Creating Charts, Graphs and Advanced Features** (Employability, Entrepreneurship, Skill Development)	15
	Creating charts and graphics: create and edit charts of the following types: Column, Bar, Line, Pie, XY charts. **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	
Module 4	**Programming EXCEL with VBA** (Employability, Entrepreneurship, Skill Development)	15
	Programming EXCEL with VBA: 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.	

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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3.	Learn Excel 2019 Essential Skills with the Smart Method by Mike Smart	2018	www.amazon.com
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 40% weight (40 marks). It would involve Journal assessment (35% wight) and class participation (5% weight).

- End examination carrying 60% weight shall be of 4 hours. The examination will involve Viva (20% weight) and an end-exam activity (40% weight). The examiners shall evaluate the performance based on actual working (20% weight) and end-results (20% 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

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus And Question Paper Pattern Of

First Year Semester II

1. Environmental Studies

Under Academic Autonomy and Credit, Grading and

Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Environmental Studies

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
ES	2021UCHAES	Environmental Studies	AECC	3

Course Objective

To provide a basic understanding of environment around us in terms of natural resources, institutions and people around us, changes appearing in the environment, measuring their impact, assessment of risk and some methods of managing such risks.

Course Outcome:

On successful completion of this course, a student shall be able to

CO1: Describe what is importance of environmental study (Level: Knowledge)
CO2: State the natural resources around us (Level: Understand)
CO3: Describe ecosystems and their characteristics (Level: Understand)
CO4: Describe biodiversity and its significance (Level: Understand)
CO5: Describe different types of pollution and their impact (Level: Knowledge)
CO6: Discuss social issues and environment (Level: Knowledge)
CO7: Describe how human population is affected by environmental issues (Level: Understand)
CO8: Describe actuarial and statistical models useful in assessing certain environmental risks and methods to deal with those risks (Level: Apply)

Syllabus: Environmental Studies
Modules at a Glance

Sr. No.	Topics	No. of lectures
Module1	Environmental Studies, Natural Resources and Ecosystems	12
Module2	Biodiversity and Its Conservation, Environmental Pollution and Social Issues and The Environment	10
Module3	Social Issues, Human Population and The Environment	10
Module4	Actuarial and Statistical Aspects	13
	Total	**45**

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**Environmental Studies, Natural Resources and Ecosystems**	12
	Definition, Scope, Importance, Need for Public Awareness - Institutions in Environment, People in Environment **Natural Resources:** Introduction, Renewable and Non-Renewable Resources - Natural resources and associated problems, Non-renewable resources, Renewable resources, Forest Resources **Ecosystems:** Concept of an ecosystem, Understanding ecosystems, Ecosystem degradation, Resource utilization, Structure and functions of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. The water cycle, The Carbon cycle, The Oxygen cycle, The Nitrogen cycle, The energy cycle, Integration of cycles in nature, Ecological succession, Food chains, Food webs and Ecological pyramids, The ecological pyramids, Introduction, Types, Characteristic features, Structure and functions. The students are expected to learn suitable Software and make Presentations of different topics. (Skill Development)	
2	**Biodiversity And Its Conservation, Environmental Pollution and Social**	10
	Biodiversity And Its Conservation: Definition, Genetic, Species, Ecosystem Diversity, Genetic diversity, Species diversity, Ecosystem diversity, Biogeographic Classification of India, Value of Biodiversity. **Environmental Pollution:** Definition, Causes, Effects and Control Measures of, Air Pollution, Air Quality Index, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Solid Waste Management: Causes, Effects and Control Measures. Role of Individuals in Pollution Prevention, Disaster Management: Floods, Earthquakes, Cyclones, Landslides. The students are expected to learn suitable Software and make Presentations of different topics. (Skill Development)	
3	**Social Issues, Human Population and The Environment**	10

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(AUTONOMOUS)
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	Social issues and the environment From Unsustainable to Sustainable Development, Urban Problems Related To Energy, Water Conservation, Rain Water Harvesting, Water conservation, Resettlement And Rehabilitation Of People – Problems and Concerns. Preserving resources for future generations, The rights of animals. The conservation ethic and traditional value systems of India, Climate Change, Global Warming, Environmental Values, Valuing Nature, Valuing cultures, Social justice,	
	Human Population And The Environment: Population Growth, Variation Among Nations, Global population growth, Population Explosion – Family Welfare Program, Methods of sterilization, Urbanization, Environmental And Human Health, Environmental health, Climate and health, Infectious diseases, Water-related diseases, Risks due to chemicals in food, Cancer and environment, Human Rights, Equitable use of Resources, Women And Child Welfare, Role of Information Technology In Environment And Human Health.	
	The students are expected to learn suitable Software and make Presentations of different topics. (Skill Development)	
4	**Actuarial and Statistical Aspects**	**13**
	- Actuaries, Environmental Policy and the Public Interest: - Introduction - Why should actuaries be interested in the environment? - Climate Change and Investment Policy - Modeling the specific impact of climate change - RAMP (Risk Analysis and Management for Projects) methodology - Actuaries and climate change - Impact of climate change - Responses to climate change - Other actuarial aspects like - Agricultural insurance - Catastrophe risk - Capital market solutions including Carbon pricing / emissions trading, weather derivatives, catastrophic bonds - Impact modeling - Impact of Global Warming	

Nagindas Khandwala College

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	Environmental Studies, Erach Bharucha	2004	UGC
2.	Environmental Studies	2015	YCMOU
3.	Climate Sources for Actuaries by Mark Alberts		Society of Actuaries, USA
4.	Actuaries, Environmental Policy and the Public Interest By Nick Silver and Paul Dickinson	2003	Institute of Actuaries, UK

Examination: Total Marks 50

- Continuous Internal examination shall carry 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours' duration shall carry 60% weight (60 marks). It shall have 4 questions each with 15 marks. 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.

Nagindas Khandwala College

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 2020-21

Syllabus: Mathematics for Actuaries 2

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
MA1	2024UCHAMA	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	**Differential Calculus**	15
Module2	**Integral Calculus**	15
Module3	**More Applications of Calculus**	15
Module4	**Machine Learning**	15
	Total	60

Detailed Syllabus

Module	Topics	No. of Lectures
1	**Differential Calculus** (Skill Development)	15
	• Derivative as rate of change. Derivative as gradient of a curve. • Derivative of simple functions: x^n, a^x, e^x, ln x. • Derivatives of sums, products, quotients and "functions of a function". • The concept of a higher-order (repeated) derivative • Application of derivative to find the maximum or minimum value of a function over a • specified range • Identify the nature of stationary points • The meaning of a partial derivative, notations, evaluation. • Extreme values of functions of two variables	
2	**Integral Calculus** (Skill Development)	15
	• 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. • The interpretation of a definite integral as the area under a graph • Integration of the standard functions xn, ax and ex. • 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 • Determine when a definite integral converges	
3	**More Applications of Calculus** (Skill Development)	15

	• 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. • Apply the Taylor series expansions for e^x and $\ln(1+x)$ and, in the latter case, determine when the series converges. • Concept of Differential equation and solution of $dy/dx + Py = Q$ where P and Q are functions of x. Applications of this solution in Actuarial study.		
4	**Machine Learning** (Skill Development)		**15**

	Understanding of elementary principles of Machine Learning and their applications • the main branches of machine learning • examples of the types of problems typically addressed by Machine Learning. Understanding in detail how to use appropriate software to apply Machine Learning techniques (*eg* penalised regression and decision trees) to simple problems		

Reference Books:

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 40% weight (40 marks). It would involve a Power Point Presentation (15marks), a written test under no supervision carrying 20 marks and Class participation carrying 5 marks.

- External examination of 2 hours and 60 marks shall have 4questions 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.

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

4. Actuarial Mathematics 1 Practical

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: <mark>Actuarial Mathematics 1Practical</mark> (Employability, Skill Development)

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM1P	1934UCHAM	Actuarial Mathematics 1 (Practical)	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value known cash flows as well as those which are dependent on death, survival, or other uncertain risks.

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

CO1: apply the basic principles of data analysis in actuarial modeling (Level: Apply)

CO2: apply, interpret and discuss mathematical techniques used to model and value cashflows which are contingent on mortality and morbidity risks (Level: Apply, Analyse)

CO3: use spreadsheet software for a variety of calculations (including use of first principle and various software functions) (Level: Apply)

Course Contents:

All topics included in Actuarial Mathematics 1A, 1B and 1C involving numerical calculations can be considered to design practical activities.

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Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT1	2018	Actuarial Education Company acted@bpp.com
2.	ActEd Study Material Subject CT5	2018	Actuarial Education Company acted@bpp.com
3.	The Theory of Interest by Kellison	2006	0256091501 Irwin Mc-Graw Hill
4.	Actuarial Mathematics By Bowers, L. Newton	2006	0938959468 Society of Actuaries
5.	An Introduction to the Mathematics of Finance by McCutcheon, J. J.; Scott, W. F.Heinemann,	1986	9780434912285 Institute and Faculty of Actuaries' Online Publications Shop
6.	Life Contingencies Neill, Alistair	NA	Heinemann
7.	The analysis of Mortality and other actuarial statistics	NA	Faculty of Actuaries

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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

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

1. **Actuarial Mathematics 1A**

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 1A

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM1A	1931UCHAM	Actuarial Mathematics 1A	CC	4

Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value known cashflows

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

CO1: describe the basic principles of data analysis in actuarial modeling (Level: Knowledge)

CO2: calculate present value, real value of money (Level: Evaluate)

CO3: modify financial values at different times by inflating/deflating them to compare (Level: Analyse)

CO4: describe, interpret and discuss the theories on interest rates (Level: Knowledge, Analyse)

CO5: use interest rate models for decision making in various actuarial applications (Level: Apply)

Actuarial Mathematics 1A

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	**Data Analysis and Basics of Actuarial Modeling**	15
Module 2	**Theory of Interest Rates**	15
Module 3	**Annuities and Their Applications**	15
Module 4	**Term Structure of Interest Rate Models**	15
	Total	**60**

Nagindas Khandwala College

Detailed Syllabus

Module	Modules / Units

1	**Data Analysis and Basics of Actuarial Modeling** (Employability, Skill Development)
	• Data Analysis
	
	   o possible aims of data analysis, e.g. descriptive, inferential and predictive
	   o stages of conducting a data analysis to solve real-world problems in a scientific manner and the tools suitable for each stage
	   o sources of data and the characteristics of different data including extremely large data sets
	   o meaning and value of reproducible research and the elements required to ensure a data analysis is reproducible
	
	• Actuarial Modeling
	   o Need and method of model use for all model applications (including pricing, reserving, and capital modeling)
	   o benefits and limitations of modeling
	   o stochastic and deterministic models
	   o scenario-based models and proxy models
	   o process of deciding suitability of a model for any particular application
	   o the short-run and long-run properties of a model, its use in deciding the suitability of a model for any particular application
	   o analysis of the potential output from a model and its use in the choice of model
	   o sensitivity testing of assumptions and its importance in the modeling process
	   o considerations while communicating the results following the application of a model
	
	• Generalized Cashflow model
	   o Identification of inflows and outflows in each future time period and determination of its nature (i.e. fixed/variable and certain/uncertain) of amount and timing for a given cashflow process
	   o cashflow model the operation of financial instruments like a zero coupon bond, a fixed interest security, an index-linked security, cash on deposit, an equity, an interest-only loan, a repayment loan, and an annuity certain; and an insurance contract like endowment, term assurance, contingent annuity, car insurance and health cash plans

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2	**Theory of Interest Rates (Employability, Skill Development)**
	- Interest rates expressed in different time periods - Describe the relationship between the rates of interest and discount over one effective period arithmetically and by general reasoning. - Derive the relationships between the rate of interest payable once per measurement period (effective rate of interest) and the rate of interest payable $p(> 1)$ times per measurement period (nominal rate of interest)and the force of interest. - Calculate the equivalent annual rate of interest implied by the accumulation of a sum of money over a specified period where the force of interest is a function of time - Understanding of real and nominal interest rates - Time value of money using the concepts of compound interest and discounting - Accumulation of a single investment at a constant rate of interest under the operation of simple and compound interest - Definition of the present value of a future payment - Discounting of a single investment under the operation of a simple (commercial)discount at a constant rate of discount - Calculation of present value and accumulated value for a given stream of cashflows under the following individual or combination of scenarios: - Cashflows are equal at each time period - Cashflows vary with time which may or may not be a continuous function of time - Some of the cashflows are deferred for a period of time - Rate of interest or discount is constant - Rate of interest or discount varies with time which may or may not be a continuous function of time
3	**Annuities and Their Applications (Employability, Skill Development)**
	Definition and derivation of the following compound interest functions (where payments can bein advance or in arrears) in terms i, v, n, d, δ, $i(p)$ and $d(p)$: $$a_{\overline{n}},\ s_{\overline{n}},\ a_{\overline{n}}^{(p)},\ s_{\overline{n}}^{(p)},\ \ddot{a}_{\overline{n}},\ \ddot{s}_{\overline{n}},\ \ddot{a}_{\overline{n}}^{(p)},\ \ddot{s}_{\overline{n}}^{(p)},\ \bar{a}_{\overline{n}}\ \text{and}\ \bar{s}_{\overline{n}}$$ $$_{m|}a_{\overline{n}},\ _{m|}a_{\overline{n}}^{(p)},\ _{m|}\ddot{a}_{\overline{n}},\ _{m|}\ddot{a}_{\overline{n}}^{(p)}\ \text{and}\ _{m|}\bar{a}_{\overline{n}}$$ $$(Ia)_{\overline{n}},\ (I\ddot{a})_{\overline{n}},\ (\bar{I}a)_{\overline{n}}\ \text{and}\ (\bar{I}\bar{a})_{\overline{n}}$$

Nagindas Khandwala College

4	**Term Structure of Interest Rate Models** (Employability, Skill Development)

	• Term structure of interest rates
	  o main factors influencing the term structure of interest rates
	  o Meaning, evaluation and derivation of the relationships between:
	    ➢ discrete spot rates and forward rates
	    ➢ continuous spot rates and forward rates
	  o Concepts of par yield and yield to maturity
	
	• Understanding duration, convexity and immunisation of cashflows
	  o Definition of the duration and convexity of a cashflow sequence, understanding of their use in estimating the sensitivity of the value of the cashflow sequence to a shift in interest rates
	  o Evaluation of the duration and convexity of a cashflow sequence
	  o Use of duration and convexity in the (Redington) immunisation of a portfolio of liabilities

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT1	2018	Actuarial Education Company acted@bpp.com
2.	The Theory of Interest by Kellison	2006	0256091501 Irwin Mc-Graw Hill
3.	Actuarial Mathematics By Bowers, L. Newton	2006	0938959468 Society of Actuaries
4.	An Introduction to the Mathematics of Finance by McCutcheon, J. J.; Scott, W. F.Heinemann,	1986	9780434912285 Institute and Faculty of Actuaries' Online Publications Shop

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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.

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

2. Actuarial Mathematics 1B

Under Academic Autonomy and Credit, Grading and

Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 1B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM1B	1932UCHAM	Actuarial Mathematics 1B	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling
as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value known cashflows as well as those which are dependent on death, survival, or other uncertain risks.

Course Outcome: On successful completion of this course, student should be able to
CO1: understand and apply equation of values by cashflow inflation/deflation approach (Understand, Apply)
CO2: describe, interpret and discuss mathematical techniques used to model and value cashflows which are contingent on mortality and morbidity risks [including single decrement models and multiple decrement models] (Knowledge, Apply, Analyse)

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	**Equation of Value and its Applications in Loan Scheduling**	15
Module 2	**More Applications of Equation of Value**	15
Module 3	**Single Decrement Models**	15
Module 4	**Multiple Decrement and Multiple Life Models**	15
		60

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Detailed Syllabus

Sr. No.	Modules / Units
1	**Equation of Value and its Applications in Loan Scheduling (Employability, Skill Development)** • Equation of value o Definition of an equation of value, where payment or receipt is certain o Adjustment to allow for uncertain receipts or payments o Two conditions required for existence of an exact solution • Use of equation of value to loan scheduling o In case of loans to be repaid by regular instalmentsofinterest and capital, determine ➢ repayment instalments, interest and capital components ➢ the effective interest rate (APR) ➢ schedule of repayments
2	**More Applications of Equation of Value (Employability, Skill Development)** • In case of a bond (fixed-interest or index-linked) where the investor is subject to deduction of income tax on coupon payments and redemption payments are subject to deduction of capital gains tax, calculate o price of the bond o yield (nominal or real allowing for inflation) from the bond o the running yield and the redemption yield for the bond upper and lower bounds for the present value of the bond - when the redemption date can be a single date within a given range at the option of the borrower • In case of ordinary share (or property), given constant or variable rate of growth of dividends (or rents), calculate the present value or yield (nominal or real allowing for inflation • In project appraisals: o calculation of the net present value and accumulated profit of the receipts and payments from an investment project at given rates of interest o calculation of the internal rate of return, payback period and discounted payback period and discuss their suitability for assessing the suitability of

Nagindas Khandwala College

3	**Single Decrement Models** (Employability, Skill Development)
	• Assurance and annuity contracts

- Assurance and annuity contracts
  - Definition of the following terms:
    - ➤ whole life assurance
    - ➤ term assurance
    - ➤ pure endowment
    - ➤ endowment assurance
    - ➤ whole life level annuity
    - ➤ temporary level annuity
  - ➤ guaranteed level annuity premium
  - ➤ benefit (immediate and deferred)

- Description of Operation of conventional with-profits contracts, in which profits are distributed by the use of regular reversionary bonuses and by terminal bonuses
  - Description of the benefits payable under the above assurance- type contracts

- Description of Operation of conventional unit-linked contracts, in which death benefits are expressed as combination of absolute amount and relative to a unit fund and where maturity benefits can also be guaranteed to a minimum absolute amount or rate of investment return

- Description of Operation of accumulating with-profits contracts, in which benefits take the form of an accumulating fund of premiums, where either:
  - the fund is defined in monetary terms, has no explicit charges, and is increased by the addition of regular guaranteed and bonus interest payments plus a terminal bonus; or
  - the fund is defined in terms of the value of a unit fund, is subject to explicit charges, and is increased by regular bonus additions plus a terminal bonus (Unitised with-profits).
  - ➤ In the case of unitised with-profits, the regular additions can take the form
    of (a) unit price increases (guaranteed and/or discretionary), or (b)
    allocations of additional units [may be with a guaranteed minimum monetary death benefit]

- Life Table
  - Description of functions l_x and d_x and $l_{[x]:r}$ and $d_{[x]:r}$.
  - Definition of fhe following probabilities: $_np_x, _nq_x, _{n|m}q_x, _{n|}q_x$ and $_np_{[x]:r}$, $_n q_{[x]:r}, _{n|m}q_{[x]:r}, _{n|}q_{[x]:r}$.
  - Expressions for the probabilities in terms of life table functions
- Definition of the assurance and annuity factors
  - Extension of the annuity factors to allow for the possibility that payments are more frequent than annual but less frequent than

Nagindas Khandwala College

		continuous.
		• Understanding of the relations between
		o annuities payable in advance and in arrear
		o temporary, deferred and whole life annuities
		• Understanding of and the use of the relations between
		o assurance and annuity factors using equation of value (including their select and continuous equivalents)
		• Development of the expressions(in the form of sums/integrals)for the means and variances of the present value of the benefit payments under various assurance and annuity contracts, assuming constant deterministic interest rate

4	**Multiple Decrement and Multiple Life Models** (Employability, Skill Development)
	
	• Mortality study involving two lives
	  o Definition and use of assurance and annuity functions involving two lives
	    where cashflows dependent upon the death or survival of either or both of two lives including the cases where functions dependent upon a fixed term as well as age
	• Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events
	• Definition of health insurance and description of health insurance contracts with simple premium and benefit structures.
	• Valuation of a cashflow, contingent upon multiple transition events using a multiple-state Markov Model, in terms of the forces and probabilities of transition.
	• Development of expressions for the expected present values of cashflows that are
	contingent upon multiple transition events, including simple health insurance premiums and benefits and their calculations in simple cases (including cases where regular premiums and sickness benefits are payable continuously and assurance benefits are payable immediately on transition.
	• Description and use of methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events
	• Definition of a multiple decrement model as a special case of multiple-state Markov model.
	• Derivation of dependent probabilities for a multiple decrement model in terms of given forces of transition, assuming forces of transition are constant over single years of age
	• Derivation of forces of transition from given dependent probabilities, assuming forces of transition are constant over single years of age.

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT1	2018	Actuarial Education Company acted@bpp.com
2.	ActEd Study Material Subject CT5	2018	Actuarial Education Company acted@bpp.com
3.	The Theory of Interest by Kellison	2006	0256091501 Irwin Mc-GrawHill
4.	Actuarial Mathematics By Bowers, L. Newton	2006	0938959468 Society of Actuaries
5.	An Introduction to the Mathematics of Finance by McCutcheon, J. J.; Scott, W. F. Heinemann,	1986	9780434912285 Institute and Faculty of Actuaries' Online Publications Shop
6.	Life Contingencies Neill, Alistair	NA	Heinemann
7.	The analysis of Mortality and other actuarial statistics	NA	Faculty of Actuaries

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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

3. Actuarial Mathematics 1C

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 1C

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM1C	1933UCHAM	Actuarial Mathematics 1C	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value known cashflows as well as those which are dependent on death, survival, or other uncertain risks.

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

CO1: determine premiums for life insurance plans with or without profit (Analyse)

CO2: determine premiums/benefits for benefit plans for individual life coverage plans (Analyse)

CO3: understand reserves and calculate reserves (Knowledge, Evaluate)

CO4: develop capability to perform profit testing to finalise premiums (Analyse, Apply)

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	**Pricing**	12
Module 2	**Gross Premium Reserves**	18
Module 3	**Net Premium and Mortality Profit**	18
Module 4	**Profit Testing for Classical Contacts and Unit-linked Contract**	12
		60

Nagindas Khandwala College

Detailed Syllabus

Sr. No.	Modules / Units
1	**Pricing (Employability, Skill Development)** • Gross random future loss under an insurance contract and principle of equivalence o Description of gross premiums of assurance and annuity contracts o Calculation of gross premiums for various insurance contract benefits under various scenarios using the equivalence principle or otherwise where ➤ contracts may accept only single premium ➤ regular premiums and annuity benefits may be payable annually, more frequently than annually, or continuously ➤ death benefits (which increase or decrease by a constant compound rate or by a constant monetary amount) may be payable at the end of the year of death, or immediately on death. ➤ survival benefits (other than annuities) may be payable at defined intervals other than at maturity.
2	**Gross Premium Reserves (Employability, Skill Development)** • Need for an insurance company to set up reserves • Definition of gross premium reserve of assurance and annuity contracts • Calculation of gross premium prospective and retrospective reserves • Conditions under which, the prospective reserve is equal to the retrospective reserve allowing for expenses. o Proof of the equality under the appropriate conditions in cases ➤ with or without allowance for expenses ➤ with benefits that are fixed/ increasing / decreasing • Derive recursive relationships between successive periodic gross premium reserves, and use this relationship to calculate the profit earned from a contract during the period

Nagindas Khandwala College

3	**Net Premium and Mortality Profit** (Employability, Skill Development)
	
	• Net Premium
	  o Concepts of net premiums and net premium valuation and their relationship with gross premiums and gross premium valuation respectively
	  o Definition of
	    ➢ death strain
	    ➢ death strain at risk
	    ➢ expected death strain
	    ➢ actual death strain
	    ➢ mortality profit
	  o Calculation of the above terms for a single policy or a portfolio of policies (as appropriate):

	➢ for policies with death benefits payable immediately on death or at the end of the year of death ➢ for policies paying annuity benefits at the start of the year or on survival to the end of the year ➢ for policies where single or non-single premiums are payable

4	**Profit Testing for Classical Contacts and Unit-linked Contract (Employability, Skill Development)**
	
	• Projection of expected future cashflows for whole life, endowment and term assurances, annuities, unit-linked contracts, and conventional/unitised with-profits contracts, incorporating multiple decrement models as appropriate.
	  o Profit test of life insurance contracts of the types listed above and determination of the profit vector, the profit signature, the net present value and the profit margin
	  o Use of a profit test to price a product and use a profit test to calculate a premium for life insurance contracts of the types listed above
	  o Determination of gross premium reserves using the above cash flow projection model and its inclusion the profit testing
	  o Determination of non-unit reserves for unit-linked contracts

Nagindas Khandwala College

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	Actuarial Mathematics By Bowers, L. Newton	2006	0938959468 Society of Actuaries
2.	An Introduction to the Mathematics of Finance by McCutcheon, J. J.; Scott, W. F.Heinemann,	1986	9780434912285 Institute and Faculty of Actuaries' Online Publications Shop
3.	An Introduction to the Mathematics of Finance by McCutcheon, J. J.; Scott, W. F.Heinemann,	1986	9780434912285 Institute and Faculty of Actuaries' Online Publications Shop
4.	Life Contingencies Neill, Alistair	NA	Heinemann
5.	The analysis of Mortality and other actuarial statistics	NA	Faculty of Actuaries

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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

5. Insurance Principles and Designing of Insurance Products
Under Academic Autonomy and Credit, Grading and

Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Insurance Principles and Product Design

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
IP	1935UCHAIP	Insurance Principles and Product Design (Theory and Practical)	CC	4+2

Course Objective: The aim of this course is to provide a grounding in the principles of insurance, underwriting process, sales process, claim process and types of life and non-life insurance products (including designing of products).

Course Outcome: After successful completion of this course, student should be able to

CO1: Describe Purpose and Process of insurance (Understand)

CO2: Apply their understanding in designing insurance contract needs (Apply)

CO3: State the purpose and products of life insurance processes from acceptance of application till closure due to claim or otherwise (Understand)

CO4: Describe products of employee benefits (Understand)

CO5: Describe products of Non-life insurance (Understand)

CO6: Appraise Rating practices and premium calculations (Apply)

Modules at a Glance

Sr. No.	Modules	No. of lectures
Module 1	**Insurance Principles, Life Insurance Products and Underwriting**	15
Module 2	**Life insurance Practices**	15
Module 3	**Non-life Insurance: Proposal, Documentation and Underwriting**	15
Module 4	**Non-life Insurance: New Business, Renewal and Claims**	15
	Total	60

Nagindas Khandwala College

Sr. No.	Modules / Units
1	**Insurance Principles, Life Insurance Products and Underwriting** **(Employability, Skill Development)** • Risk o Concept, Classification, Assessment, Transfer o Insurance as tool to transfer of risk • Concept of Insurance o Classification of Insurance o Principles of Insurance: Basic, Economic, Legal, Financial and Actuarial. • Life Insurance organisation –Indian context - The distribution system. • Insurance intermediaries - Life insurance Advisors: functions, appointment and continuance, remuneration, Agents' Regulations. Trends in Global scene • Plans of Life Insurance – term insurance, whole life insurance, pure endowment, endowment assurance, money back, education annuity, children's plans, mortgage redemption type plans, annuities and individual pension plans • Group Insurance – Nature and Type, Gratuity liability, Group Superannuation Schemes, Social Security Schemes. • Other Special Need Plans: Industrial assurance, micro insurance, salary savings scheme, sickness and disability cover with unit linked schemes.
2	**Life insurance Practices** (Employability, Skill Development) • Proposal form and other document o Documents for proof of age o Medical reports o Special medical reports o Underwriting of proposal. o Policy document, policy conditions, duplicate policy, alteration, types of revivals including calculations. • Premium: Premium calculation, Days of grace, Non-Forfeiture Options, Lapse and Revival Schemes. • Types of claims under a life insurance policy – survival benefit, maturity claims, early death claims, death claims, Accident benefit and disability benefit claims, claims under critical illness settlement options including calculations. • Benefit transfer, Discontinuation, Calculations of surrender values and loan values. • Defined Benefit and Defined Contribution Pension Plans. • Valuation, Bonus and Distribution of surplus

Nagindas Khandwala College

3	**Non-life Insurance: Proposal, Documentation and Underwriting (Employability, Skill Development)**
	- Non-life Insurance Forms – Proposals – Cover Notes – Certificates of Insurances – Policies – Endorsements – Renewal Receipts - Scope of Fire, Marine (Cargo and Hull), Motor, Miscellaneous Accident, Aviation, Engineering, Liability, Professional Indemnity, Agricultural Insurances. - Special classes of non-life insurances: Oil and Energy, satellite Insurances and Special Contingency covers, Industrial. All Risks, Project Insurances and Advanced Loss of Profits. - Physical and Moral hazard – Rating Practice (Tariff/ Non-tariff) – Bonus / Malus methods of premium calculation – Return of premium – Pre – acceptance risk inspection – Risk inspections for special rating and premium discounts – Periodic inspections of large projects. - Underwriting practice in India and other important insurance markets – Co-insurance and re-insurance practice
4	**Non-life Insurance: New Business, Renewal and Claims (Employability, Skill Development)** - New Business and Renewal Procedure - Claims Procedure - Risk management and Risk Control - The structure of the Insurance market in India – Insurance marketing network and customer service.

Nagindas Khandwala College

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher/Seller
1.	Principles of Insurance	2015	Insurance Institute of India
2.	Practice of Non-life Insurance	2015	Insurance Institute of India
3.	Practice of Life Insurance	2015	Insurance Institute of India
4.	Life Insurance Vol. I, II	2002	ICFAI University Press
5.	Pension Systems, A New Focus	2002	ICFAI University Press
6.	Insurance Underwriting	2006	ICFAI University Press
7.	Non-Life Insurance Kumar K B S	2010	ICFAI University Press

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.

Nagindas Khandwala College

5. Insurance Principles and Designing of Insurance Product (Practical)
   (Employability, Skill Development)

Objective: The aim of this course is to provide an insight into designing of insurance products.

Course Outcome: After successful completion of this course, student should be able to
CO1: Understand the sources of ideas to design product (Level: Understand)
CO2: Conduct a survey to know the available products and their features in the market (Level: Knowledge)
CO3: Conduct a survey to understand need for different types of products, product features (Level: Understand)
CO4: Demonstrate the understanding by designing the features of some innovative products in life insurance, annuities, non-life insurance and health insurance
(Level: Understand, Analyse, Create)

Contents:
1. Survey of available products
2. Survey of required products/features
3. Design of a life insurance product
4. Design of an annuity product
5. Design of a non-life insurance product
6. Design of a health insurance product

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.

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester IV

1. Actuarial Mathematics 2A

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 2A

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM2A	1941UCHAM	Actuarial Mathematics 2A	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on investors' mind frame and behaviour that may affect investment decisions. This will enhance ability to communicate with other financial professionals and critically evaluate modern financial theories.

Course Outcome: On successful completion of this course, student should be able to
CO1: describe, interpret and discuss the theories on the behavior of financial markets (including models for interest rates) (Level: Knowledge, Apply)
CO2: discuss the advantages and disadvantages of different measures of investment risk (Level: Understand, Analyse)
CO3: use them for decision making in various actuarial applications (Level: Apply)

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	**Rational Choice Theory**	15
Module 2	**Rational Expectations Theory and Behavioural Economics**	15
Module 3	**Measures of Investment Risk**	15
Module 4	**Stochastic Interest Rate Models**	15
	Total	**60**

Nagindas Khandwala College

Detailed Syllabus

Sr. No.	Modules / Units
1	**Rational Choice Theory** (Employability, Skill Development) • Utility Theory o Meaning of terms: Utility and Utility Functions o Axioms underlying Utility theory and Expected Utility Theorem o Mathematical expressions in a utility function of the following economic characteristics of investors: ➢ non-satiation ➢ risk aversion, risk neutrality and risk seeking ➢ decreasing or increasing absolute and relative risk aversion o Commonly used utility functions (including quadratic, logarithmic, power) ➢ their economic properties ➢ comparison of investment opportunities with their use o Analysis of simple insurance problems using utility theory • Absolute and Stochastic Dominance o Absolute dominance o Stochastic dominance ➢ concept and use ➢ first order stochastic dominance ➢ second order stochastic dominance

Nagindas Khandwala College

2	**Rational Expectations Theory and Behavioural Economics** **(Employability, Skill Development)** Rational Expectations Theory ○ three forms of the Efficient Market Hypothesis and their impact on investment management ○ the evidence for or against each form of the Efficient Market Hypothesis • Behavioural Economics ○ Kahneman and Tversky's Prospect theory critique of expected utility theory ○ In the context of financial markets, meaning of ➢ framing ➢ heuristics ➢ bias ○ Features of behaviour in such markets: ➢ the herd instinct ➢ anchoring and adjustment ➢ self-attribution bias ➢ loss aversion ➢ confirmation bias ➢ availability bias ➢ familiarity bias ○ Bernartzi and Thaler solution to the equity premium puzzle

Nagindas Khandwala College

3	**Measures of Investment Risk** (Employability, Skill Development)
	
	 • Properties of Investment Risk
	    o Definition of the following measures:
	      ➢ variance of Return
	      ➢ downside semi-variance of return
	      ➢ shortfall probabilities
	      ➢ Value at Risk (VaR)
	      ➢ Tail VaR
	    o Relationship of above measures with the form of an investor's utility function
	    o Comparison of investment opportunities by calculating above measures
	    o Effect of Distribution of returns and thickness of its tail on the assessment of risk
	 • Risk and Insurance Companies
	    o How insurance companies help to reduce risk
	    o Meaning of the terms: 'moral hazard' and 'adverse selection'

4	**Stochastic Interest Rate Models** (Employability, Skill Development)
	
	 • Deterministic model and stochastic model for interest rate
	 • The stochastic model where annual rates of return are independently and identically distributed (and other simple models)
	    o Mean and variance of the accumulated amount of a single premium
	    o Recursive relationships for the mean and variance to enable evaluation
	    o Derivation of the model and its properties when $(1+i)$ for each year has independent log-normal distribution
	    o Application of the above models in calculating relevant probabilities

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT1	2018	Actuarial Education Company acted@bpp.com
2.	The Theory of Interest by Kellison	2006	0256091501 Irwin Mc-Graw Hill
3.	ActEd Study Material Subject CT8	2018	Actuarial Education Company acted@bpp.com
4.	Financial economics with applications to investments, insurance and pensions by Panjer	2001	978-0938959489. The Actuarial Foundation
5.	Modern portfolio theory and investment analysis by Elton, Edwin J, Martin J Gruber, Stephen J Brown and William N. Goetzmann	8th 2010	978-0470505847 John Wiley

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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester IV

2. Actuarial Mathematics 2B

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 2B

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM2B	1942UCHAM	Actuarial Mathematics 2B	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on stochastic asset models which can be used to make investment decisions. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories.

Course Outcome: On successful completion of this course, student should be able to
   CO1: describe, construct, interpret and discuss the models underlying asset valuations, portfolio design, security prices, interest rates and credit risk. (Level: Create, Apply, Analyse)
   CO2: describe properties of Standard Brownian motion (Level: Knowledge)
   CO3: understand development of stochastic calculus and its applications (Level: Understand, Apply)

Modules at a Glance

Sr. No.	Modules	No. of lectures
Module 1	**Mean Variance Portfolio Theory**	15
Module 2	**Asset Pricing Models and Models for Investment Returns**	15
Module 3	**Stochastic Models for Security Prices and Stochastic Calculus**	15
Module 4	**Models for Term Structure of Interest Rates and Credit Risk**	15
	Total	**60**

Nagindas Khandwala College

Detailed Syllabus

Sr. No.	Modules / Units
1	**Mean Variance Portfolio Theory** (Employability, Skill Development) • assumptions of mean-variance portfolio theory • conditions (including derivation in simple cases) under which application of mean-variance portfolio theory leads to the selection of an optimum portfolio • calculation of the expected return and variance of return of a portfolio of many risky assets, given the expected return, variance and covariance of returns of the individual assets, using mean-variance portfolio theory • benefits of diversification using mean-variance portfolio theory
2	**Asset Pricing Models and Models for Investment Returns** (Employability, Skill Development) • Asset pricing models o Assumptions, principal results and uses of the Sharpe-Lintner-Mossin Capital Asset Pricing Model (CAPM). ➢ limitations of the basic CAPM and some of the attempts made to develop the theory to overcome these limitations ➢ calculations using the CAPM o Main issues involved in estimating parameters for asset pricing models • Single and multifactor models for investment returns o Types of multifactor models of asset returns: ➢ macroeconomic models ➢ fundamental factor models ➢ statistical factor models o single index model of asset returns. o concepts of diversifiable and non-diversifiable risk o construction of the different types of multifactor models o calculations using both single and multi-factor models

Nagindas Khandwala College

3	**Stochastic Models for Security Prices and Stochastic Calculus**
	(Employability, Skill Development)
	
	• Continuous time log-normal model of security prices
	 o empirical evidence for or against the model
	 o applications of the model
	
	• Standard Brownian motion (SBM) or Wiener process
	 o Definition and properties
	 o Simple problems based on distribution of SBM
	 o General Brownian motion and Geometric Brownian motion
	 o Martingale
	
	• Stochastic Calculus and Its Applications
	 o Gradual evolution of Ito integral
	 o Concepts of Stochastic differential equation, diffusion
	  processes and mean-reverting processes
	 o Ito's Lemma and its applications to simple problems
	 o stochastic differential equation for geometric Brownian motion
	  and its
	  solution
	 o stochastic differential equation for the Ornstein-Uhlenbeck
	  process and its solution

Nagindas Khandwala College

4	**Models for Term Structure of Interest Rates and Credit Risk** **(Employability, Skill Development)**
	Term Structure of Interest Rate Models

4 | **Models for Term Structure of Interest Rates and Credit Risk**
(Employability, Skill Development)

- Term Structure of Interest Rate Models
  - principal concepts and terms underlying the theory of a term structure of interest rates
  - desirable characteristics of the models for the term-structure of interest rates
  - Application of the term structure of interest rates to modeling various cash flows, including calculating the sensitivity of the value to changes in the term structure
  - the risk-neutral approach to the pricing of zero-coupon bonds and interest-rate derivatives for a general one-factor diffusion model for the risk-free rate of interest
  - the state-price deflators approach to the pricing of zero-coupon bonds and interest-rate derivatives for a general one-factor diffusion model for the risk-free rate of interest
  - Basic Characteristics of the Vasicek model, Cox-Ingersoll-Ross model and Hull-White model for the term-structure of interest rates
  - Limitations of one-factor models

- Simple models for Credit Risk
  - Definition of credit event and recovery rate
  - Different approaches to model credit risk
    - structural models
    - reduced form models
    - intensity-based models
  - Models of Credit Risk
    - Merton model
    - two-state model for credit ratings with a constant transition intensity
    - Jarrow-Lando-Turnbull model for credit ratings
    - generalization of two-state model to incorporate stochastic transition intensity

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT8	2018	Actuarial Education Company acted@bpp.com
2.	Financial economics with applications to investments, insurance and pensions by Panjer	2001	978-0938959489. The Actuarial Foundation
3.	Modern portfolio theory and investment analysis by Elton, Edwin J, Martin J Gruber, Stephen J Brown and William N. Goetzmann	8th 2010	978-0470505847 John Wiley

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..

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester IV

3. Actuarial Mathematics 2C

Under Academic Autonomy and Credit, Grading and
Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Actuarial Mathematics 2C

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM2C	1943UCHAM	Actuarial Mathematics 2C	CC	4

Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on deterministic and stochastic liability models and the valuation of financial derivatives. This will enhance ability to communicate with other financial professionals and critically evaluate modern financial theories.

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

CO1: describe ruin situation, calculate ruin probability and determine capital needed to restrict ruin chances (Level: Knowledge, Evaluate, Apply)

CO2: describe, construct, interpret and discuss the models underlying liability valuations (Level: Knowledge, Evaluate, Apply)

CO3: describe, construct, interpret and discuss the models underlying option pricing. (Level: Knowledge, Evaluate, Apply)

Modules at a Glance

Sr. No.	Topics	No. of lectures
Module 1	**Ruin theory**	15
Module 2	**Run-off triangles**	15
Module 3	**Option pricing and valuations-I**	15
Module 4	**Option pricing and valuations-II**	15
		60

Nagindas Khandwala College

Detailed Syllabus

Sr. No.	Modules / Units
1	**Ruin theory** (Employability, Skill Development) • Aggregate claim process and the cash-flow process for a risk • Application of the Poisson process and the distribution of inter-event times to calculate probabilities of the number of events in a given time interval and waiting times • Definition of Compound Poisson process and calculation of probabilities using simulation • Definition of the probability of ruin in infinite/finite and continuous/discrete time the relationships between the different probabilities of ruin • The Adjustment coefficient and Lundberg's inequality • Effect on the probability of ruin, in both finite and infinite time, of changing parameter values by reasoning or simulation • Calculation of probabilities of ruin by simulation

2	**Run-off triangles** (Employability, Skill Development)
	
	 • Run-off Triangles to determine future liabilities
	    o In non-life insurance, concept of reserve and its need, IBNR reserve
	    o Definition of development factor and understanding of how a set of assumed development factors can be used to project the future development of a delay triangle
	    o Basic chain ladder method for completing the delay triangle using development factors
	      ➢ adjustment to make explicit allowance for inflation
	    o Average cost per claim method for estimating outstanding claim amounts
	    o Bornhuetter-Ferguson method for estimating outstanding claim amounts
	      ➢ adjustment to make explicit allowance for inflation
	    o Statistical Model for delay triangle
	      ➢ assumptions underlying the model for various methods discussed above.

Nagindas Khandwala College

3	**Option pricing and valuations-I** (Employability, Skill Development)
	
	• **Characteristics of Derivative Securities**
	   o Concepts of arbitrage and a complete market
	   o Factors that affect option prices
	   o Derivation of specific results for options which are not model dependent:
	      ➢ valuation of a forward contract
	      ➢ upper and lower bounds for European and American call and put options
	      ➢ put-call parity
	• Greeks
	   o Definitions
	   o Uses
	• The Binomial Model
	   o Definitions, assumptions, background
	   o One-period model
	   o Two-period model
	   o Derivations of risk neutral probability and current price of the option using binomial tree
	   o Use of binomial lattice in deriving option price for multi-period model
	   o difference between the real-world measure and the risk-neutral measure
	   o state-price deflator approach to pricing and its application in Binomial model
	   o five-step procedure for deriving option price using Martingale approach

4	**Option pricing and valuations-II** (Employability, Skill Development)
	
	• Black-Scholes derivative-pricing model
	   o Derivation of the Black-Scholes partial differential equation both in its basic and Garman-Kohlhagen forms
	   o Martingale Approach to derive Black-Scholes formula
	      ➢ Concepts of complete market, equivalent martingale measure, Martingale representation theorem
	      ➢ Derivation of Black-Scholes option pricing formula by martingale approach by 5-step procedure
	      ➢ Calculation of option prices
	      ➢ the validity of the assumptions underlying the Black-Scholes model
	   o Application of Black-Scholes formula to Value basic benefit guarantees

Nagindas Khandwala College

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT6	2018	Actuarial Education Company acted@bpp.com
2.	Introductory Statistics with Applications in General Insurance Hoss, Ian, Zehnwirth	2nd	Cambridge University Press
3.	Loss Models : From Data to Decisions Klugman, Panjer, Willmot	1988	John Wiley & Sons
4.	ActEd Study Material Subject CT8	2018	Actuarial Education Company acted@bpp.com
5.	Financial economics with applications to investments, insurance and pensions by Panjer	2001	978-0938959489. The Actuarial Foundation
6.	Options, futures and other derivatives by Hull C., Shankarsan Basu	2019	Pearson

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.

Nagindas Khandwala College

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester IV

4. Actuarial Mathematics 2 Practical

Under Academic Autonomy and Credit, Grading and Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: <mark>Actuarial Mathematics 2 Practical</mark> (Employability, Skill Development)

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
AM2P	1944UCHAM	Actuarial Mathematics 2 (Practical)	CC	4

Course Objective: The aim of this course is to provide a grounding in the principles of modeling as applied to actuarial work – focusing particularly on stochastic asset liability models and the valuation of financial derivatives. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories

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

CO1: apply the theories on the behavior of financial markets (Level: Apply)

CO2: calculate different measures of investment risk (Level: Evaluate)

CO3: apply the models underlying asset valuations (Level: Apply)

CO4: apply the models underlying liability valuations (Level: Apply)

CO5: apply the models underlying option pricing (Level: Apply)

Contents:
All topics included in Actuarial Mathematics 2A, 2B and 2C involving numerical calculations can be considered to design practical activities.

Nagindas Khandwala College

Reference Books:

Sr. No.	Title Author	Edition Year	ISBN Publisher
1.	ActEd Study Material Subject CT1	2018	Actuarial Education Company acted@bpp.com
2.	The Theory of Interest by Kellison	2006	0256091501 Irwin Mc-Graw Hill
3.	ActEd Study Material Subject CT6	2018	Actuarial Education Company acted@bpp.com
4.	Introductory Statistics with Applications in General Insurance Hoss, Ian, Zehnwirth	2nd	Cambridge University Press
5.	Loss Models : From Data to Decisions Klugman, Panjer, Willmot	1988	John Wiley & Sons
6.	ActEd Study Material Subject CT8	2018	Actuarial Education Company acted@bpp.com
7.	Financial economics with applications to investments, insurance and pensions by Panjer	2001	978-0938959489. The Actuarial Foundation
8.	Options, futures and other derivatives by Hull C., ShankarsanBasu	9th 2016	Pearson

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

Nagindas Khandwala College

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

Nagindas Khandwala College (Autonomous)

B. Com. (Honours) in Actuarial Studies

Syllabus and Question Paper Pattern Of

Second Year Semester III

5. Data Analytics

Under Academic Autonomy and Credit, Grading and

Semester System

With effect from Academic Year 2020-21

Nagindas Khandwala College

Syllabus: Data Analytics

Course Abbreviation	Course Code	Full Course Name	Type of Course	No of Credits
DA	1945UCHADA	Data Analytics (Theory and Practical)	CC	4+2

Objective: The aim of this course is to provide a grounding in the applications of R- programming, Excel and other softwares in business analytics

Outcome: After successful completion of this course, student should be able to

CO1: Demonstrate skills to analyse business problems and solve them with the help of various technological tools including R-Programming, Excel (Knowledge, Apply, Analyse)

CO2: Appraise Big Data needs and techniques to tackle them (Knowledge)

Modules at a Glance

Sr. No.	Modules	No. of lectures
Module 1	**Insurance Analytics**	15
Module 2	**HR Analytics**	15
Module 3	**Venture Funds Analytics**	15
Module 4	**Creditworthiness of Customers**	15
	Total	60

Nagindas Khandwala College

Sr. No.	Modules / Units
1	**Insurance Analytics** (**Employability, Entrepreneurship**, **Skill Development**) (a) Life Insurance: Perform predictive analysis to forecast life duration of an insure/ proposer (b) Non-life Insurance(including Health insurance): Predict the time of occurrence of a loss event and size of the loss
2	**HR Analytics** Entrepreneurship (**Employability, Entrepreneurship**, **Skill Development**) HR department is looking for solutions to many a problems such as • How to evaluate candidates who have applied for a job • How to evaluate performances of employees and carry out their appraisals for revision of pay, promotion, etc. • Predict how long a given employee may work before quitting or retiring Assess their data needs and how to analyse them.
3	**Venture Funds Analytics** (**Employability, Entrepreneurship**, **Skill Development**) Venture Funds are always looking for new avenues to invest their surplus funds in the start-ups. Help these funds identify the geographies and sectors for its investment to maximise the return. Also help them in zeroising on the available proposals.
4	**Creditworthiness of Customers** (**Employability, Entrepreneurship**, **Skill Development**) Learn how predictive analytics can be used to decide the creditworthiness of customers and whether they • can be issued a credit card or not • granted a loan or not and the rate of interest to be charged

Nagindas Khandwala College

Reference Books:

Sr. No.	Title / Author	Edition Year	ISBN Publisher/Seller
1.	Business Analytics: Data Analysis & Decision Making by S. Christian Albright and Wayne L. Winston	5th Edition 2014	CENGAGE Learning
2.	Business Analytics for Managers: Taking Business Intelligence Beyond Reporting By Gert H. N. Laursen, JesperThorlund	2nd Edition	WILEY
3.	Business Intelligence Guidebook: From Data Integration to Analytics By Rick Sherman	2011	Morgan Kaufmann
4.	Competing on Analytics: The New Science of Winning By Thomas H. Davenport, Jeanne G. Harris	2006	Harvard Business School Press

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.

Nagindas Khandwala College

5. Data Analytics (Practical) (Employability, Entrepreneurship, Skill Development)

Objective: The aim of this course is to provide a grounding in the applications of R-programming, Excel and other softwares in business analytics

Outcome: After successful completion of this course, student should be able to
CO1: Demonstrate skills to analyse business problems and solve them with the help of various technological tools including R-Programming, Excel (Apply, Analyse)
CO2: Appraise Big Data needs and techniques to tackle them (Apply, Analyse)

Contents:

Collect data on various applications and carry out the practical exercises analysing these data.

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.
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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.

Nagindas Khandwala College