



Chikitsak Samuha's
Sir Sitaram and Lady Shantabai Patkar College of Arts
& Science and V.P. Varde College of Commerce and
Economics S. V. Road, Goregaon (West), Mumbai –
400062.

AUTONOMOUS

“Reaccredited with 'A+ Grade' by NAAC (3rd Cycle),
with an institutional score of 3.53, ISO 9001-2015, Best
College 2016-17, Approved For DBT STAR COLLEGE
SCHEME”

SYLLABUS FOR PROGRAM (B.Sc.) FIRST
YEAR, SECOND YEAR AND THIRD YEAR

COURSE: - ACTUARIAL SCIENCE AND
QUANTITATIVE FINANCE

**(Choice based Credit and Grading System with
effect from the academic year 2019–2020)**

Syllabus Committee

CONVENOR: Dr. (Mrs.) Sharmishtha Matkar

CO-CONVENOR: Dr. B.M. Rai

CHAIRMAN (BOS): Mr. Akash Rughani

MEMBERS (BOS):

Sr. No.	Name of the Members
1.	Dr. (Mrs.) Mala Kharkar
2.	Mr. Akash Rughani
3.	Mr. Pratik Gandhi
4.	Mr. Devarshi Shah
5.	Mr. Ameya Ambulkar
6.	Mr. Vijay Khare
7.	Dr. (Mrs.) Kavita Laghate
8.	Mr. Harsh Jogani
9.	Mrs. Sonali Jadhav

Preamble

Since 1964, Chikitsak Samuhha's Sir Sitaram and Lady Shantabai Patkar College of Arts and Science and V.P. Varde College of Commerce and Economics, has been enriching lives by imparting higher education. The college has been accredited with an 'A+' grade in the 3rd NAAC cycle. Over the years, we have made great strides in the field of education and in 2019, the University Grants Commission and the University of Mumbai has conferred an 'Autonomy Status' on our College.

One of the principal outcomes of being granted autonomy is that we have the opportunity to accommodate a 'student centric system', where we can infuse new methods of teaching with a competitive and dynamic syllabus that keeps up with the changing industry requirements and technology, and the changing aspirations and expectations of a driven society.

Officially, the syllabus is a document in academic learning that serves to outline, the main components of a subject, and its learning outcomes. It is a roadmap to accomplishing the course objectives. We believe that it is also an opportunity for us to match our educator's passion for teaching with the student's enthusiasm to learn and excel. Therefore, we have devised a 'student centric syllabus' that shifts the focus from simply, "What will be covered in the semester?" to "How can the course further the intellectual and academic growth of the student?" It is our aim to enhance the quality of education, generate enthusiasm amongst students about academic pursuits, improve the ability of the students to research and innovate, by designing a relevant syllabus, relevant courses, better evaluation methods and impart flexibility to choose courses that match their goals, interests and skills.

The manner in which our syllabus is framed helps the students to develop their cognitive skills—such as evaluating, analyzing and understanding how all pieces of a 'concept' fit together, thereby, giving them a strong foundation in the field of their choice. Additionally, we have introduced certain extra credits that develop soft skills, (such as emotional intelligence, handling pressure and stress, courage for making tough decisions, conflict resolution, building ethics), inculcate community service and other skills that will help students to successfully navigate their lives and be ready to be local, national and global citizen.

The new credit-based system will allow the students to obtain maximum benefits from all resources made available to them by the College. A course is assigned credits based on classroom teaching hours and the course content. It gives the students the benefit to select from a wide variety of courses. Apart from assisting the students with the course content, the syllabus will also provide the students with a guide to semester teaching schedule, examination pattern and grading policies.

Our Board of Studies for each subject is constituted in a manner that will benefit from the diversity and rich experience of renowned individuals from Mumbai and other Universities, industry experts and our alumni.

Our experienced faculty, along with the guidance of a judicious and perceptive Governing Council, are dedicated to provide meaningful academic experiences and a rewarding career for our students. Thus, we have constructed a syllabus that is designed to enhance the rapport between students and teachers, to motivate and empower the students, to focus on skill development for employability, thereby making them locally relevant and globally competent.

Pedagogy

1. Teachers impart their knowledge to the students using different mediums such as Blackboard, PowerPoint presentations, Videos, Audios, and Animations, to give the students an insight and to extend their horizons of understanding through better visualizations of the concepts.
2. Our teachers propose and discuss questions in the classrooms, to engage the students into actively participating in the interactions and helping the students groom their communication skills and gain confidence to put forth their views, ideas and to share their knowledge with other peers.
3. Students are given Case Studies to expand their area of interests and knowledge in the field of research and analysis with respect to different topics. Case Studies help inculcate research culture and motivate students into further selecting their domain of interest.
4. Presentation of Case Studies and Research Papers is included to provide them a platform to showcase skills and mannerisms to present their research work.
5. Regular Assignments and Mini Projects are given to the students helping them summarize and revise the topics being covered in the curriculum.

Scheme of Examination and Paper Pattern

Evaluation Scheme:

1. Internal Evaluation (40 Marks).

- i. Test - 10 marks: 1 Class test.
- ii. Project Work/Case Studies and Assignments - 25 marks: Includes Research Work, Documentation, Presentation and submission of assignments.
- iii. Active participation - 5 marks: Inputs, overall conduct, attendance in the class.

2. External Examination: 60 marks

Question No.	Unit No. Based on and Pattern	Total Marks
	(Objective or Subjective)	
Q. 1.	If objective 10 MCQs – 1.5 Marks each If Subjective (5+5+5)	15 Marks
Q. 2.	3 Qs. Of 5 Marks each (5+5+5)	15 Marks
Q. 3.	3 Qs. Of 5 Marks each (5+5+5)	15 Marks
Option to attempt either Qs 4 or Qs 5		
Q. 4.	One question or can be divided into multiple parts	15 Marks
Q. 5.	One question or can be divided into multiple parts	15 Marks

F.Y.B. Sc. (IT)
Choice based Credit and Grading System
(To be implemented from Academic Year 2019-20)
Semester I & II

[illegible]

Semester-I			
Course Code	Course Type	Course Title	Credits
PUSASQF1.1	Core Subject	Calculus	3
PUSASQF1.2	Core Subject	Probability and Statistics – 1	4
PUSASQF1.3	Core Subject	Financial Mathematics	4
PUSASQF1.4	Core Subject	Business Finance -1	3
PUSASQF1.5	Core Subject	Life Insurance - Principles, Products and Practices	3
PUSASQF1.6	Core Subject	Applications of IT- Basics of Excel	3
Total Credits			20

Semester-II			
Course Code	Course Type	Course Title	Credits
PUSASQF2.1	Core Subject	Numerical methods and Algebra	3
PUSASQF2.2	Core Subject	Probability and Statistics - 2	4
PUSASQF2.3	Core Subject	Business Finance – 2	4
PUSASQF2.4	Core Subject	Introduction to Actuarial Models	3
PUSASQF2.5	Core Subject	Non-Life Insurance - Principles, Products, Practices	3
PUSASQF2.6	Core Subject	Applications of IT- Basics of R	3
Total Credits			20

SEMESTER I

Course: PUSASQF 1.1	Calculus (Credits: 3 Lectures/Week: 3)	
Objectives: The objective of this course is to establish a foundation of math and application of it so as to have a uniform base for the students. The course introduces the basics and advance details of various topics and its application through derivatives and integration to be precise.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the graphs of various function and the fundamentals of calculus. 2) Understand the modules of limits, continuity and derivatives with its application. 3) Understand integration and series expansion that will be used in future subjects in detail.		
Unit I	Pre-Calculus and Graphs Reviewing various mathematical functions and their graphical representation. Limits and Continuity The concept and application of limits and continuity as a mathematical process, the exceptions and nuances of using limits correctly, and how limits are used to create other mathematical tools in calculus.	12L
Unit II	Differentiation Defining differentiation through the use of limits and how they relate to rates of changes. Also, understanding and developing methods and formulas that facilitate the calculation of derivatives. Application of derivatives Using derivatives as a tool for examining properties of functions and applying these to develop techniques for optimization, approximation methods, curve sketching, and solving problems of related rates.	12L

Unit III	Definite and Indefinite integrals Understanding the relationship between integration and differentiation, and how definite and indefinite integrals are related. Also, developing integration as a mathematical tool and how this relates to the curriculum to be covered in the course.	12L
Unit IV	Differential equations Applying basic ideas of differential equations, both ordinary and partial, which are widely used in the modelling and analysis. Taylor and Maclaurin series Understanding the function as a series expansion.	12L

Text books and References:

1. Edexcel AS and A Level Modular Mathematics – Core Mathematics 1, 2, 3 & 4
2. Fundamentals of Calculus: Carla Morris and Robert Stark
3. Understanding basic Calculus: S.K. Chung

Course: PUSASQF 1.2	Probability and Statistics – 1 (Credits: 4 Lectures/Week: 4)	
Objectives: The objective of this course is to provide the fundamental concepts associated with the probability and descriptive statistics. The concepts dig deep in the topics such as probability distributions. At an overall level it provide a base to develop advanced statistics upon.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand importance and use of descriptive statistics. 2) Apply probability to various situations 3) Identify and use a particular probability distribution. 4) Apply various generating functions and joint distributions		
Unit I	Summarizing data Understanding how to summarize data using tabular and graphical methods. Descriptive statistics Describing and calculating measures of central tendency, measures of dispersion and moments. Fundamentals of Probability Understanding elementary probability rules, conditional probability and independence. Also, apply and explain the bayes theorem. Random Variables Understanding the difference between discrete and continuous variables. Learning how to find and use probability and distribution functions to find expectation, variance and higher order moments of univariate random variables and their linear functions. Function transformation and simulation techniques to generate random variables using ITM – Inverse transform method	15L

Unit II	Theoretical discrete distributions Studying standard discrete distributions, using them to find probabilities, basic calculations to find moments, median and mode of these distributions and understanding their applications. Theoretical continuous distributions Studying standard continuous distributions, using them to find probabilities, basic calculations to find moments, median and mode of these distributions and understanding their applications.	15L
Unit III	Generating Functions Understanding the definition of PGF, MGF and CGF, learning how to derive and use them to find probabilities, moments and cumulants. Understanding the relations between the various generating functions and their applications as an alternative specification of its probability distribution	15L
Unit IV	Joint Distributions Extend the concepts learned in random variables section for univariate data to bivariate and multivariate datasets by understanding how to work with joint distributions, marginal and conditional distribution. Understand the relationship between variables through various correlation coefficients; distribution of linear function of random variables using convolutions, MGF etc Conditional Expectations Conditional Expectation and Variance using joint and conditional distribution for both discrete and continuous random variables	15L

Text books and References:

1. John E. Freund's Mathematical statistics with applications. 8th ed. Miller, I. and Miller, M.; [Freund, J. E.] Prentice Hall International, 2013.
2. Probability Theory: Introduction to Random Variables and Probability Distributions, Mark Smart
3. Statistics by David Freedman, Robert Pisani and Roger Purves.

Course: PUSASQF 1.3	Financial Mathematics (Credits: 4 Lectures/Week: 3)	
Objectives: The objective of this course is to introduce the concept of time value of money and thus discounting and accumulating various cashflows through the topics of loan schedule and capital budgeting. Expected Learning Outcomes: At end of the course, students will be able to: 1. Understand the role of time value of money 2. Apply discounting and accumulating techniques to various cashflows. 3. Explain annuities and apply discounting and accumulating methodologies to various types of annuities 4. Understand the working of amortizing schedule 5. Use various techniques to make investment decisions		
Unit I	Financial products and its cashflows Understanding the cashflows for various financial products and securities. Measurement of interest Understanding principles of accumulation/discounting using interest rates, nominal rates, effective rates and continuous rates. Understanding and applying the concept equivalent rates.	15L
Unit II	Real and monetary interest rate Defining real and monetary interest rates. Understanding rates under inflationary and deflationary scenarios. Discounting and accumulating cashflows Extend the understanding of discounting and accumulating cashflows for constant and variable interest rates.	15L
Unit III	Annuities Extending the concepts of discounting and accumulating to annuities paid in arears, due and continuously Equation of value Understanding the theory on equation of value and solving to find the unknown quantity. Understanding the principles where cashflows are uncertain.	15L

Unit IV	Amortizing schedule/ Loan schedule Preparing and understanding the calculation of amortizing loan schedule, capital and interest elements using various calculations. Understanding the concepts of flat rates and Annual Percentage Rate. Capital budgeting Compare, contrast and understand the use various criterions to make investment decisions.	15L
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Text books and References:

1. Actuarial mathematics. Bowers, N. L.; Gerber, H. U.; Hickman, J, C. et al. 2nd ed. Society of Actuaries, 1997.
2. An introduction to the mathematics of finance: a deterministic approach. S J Garrett. 2nd ed. Butterworth-Heinemann, 2013.
3. Mathematics of compound interest. Butcher, M. V.; Nesbitt, C. J. Ulrich's Books, 1971.
4. Theory of financial decision making. Ingersoll, J. E. Rowman & Littlefield, 1987. 474 pages
5. The theory of interest. Kellison, S. G. 3rd ed. Irwin, 2008.

Course: PUSASQF 1.4	Business Finance – 1 (Credits: 3 Lectures/Week : 3)	
Objectives: The objective of this course is to familiarize students with different concepts of finance, entities, tax system, capital allocation and dividends. The students will apply the concepts and demonstrate the analytical skills on topics such as optimal capital allocation and the dividend policy that a company should follow. Also, the students get familiarize with the various financing alternatives that they have.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the general financial terminology 2) Understand the various sources of finance that a business entities can rely upon. 3) Express and demonstrate with logical reasoning the deciding factors for optimal capital allocation and dividend structure 4) Explain the main psychological biases that an investor might possess.		
Unit I	Basics of Finance Understanding the basics of financial decision making and role of a finance manager. Implication of the financial decisions on various stakeholders in an organization and managing each stakeholder goals. Types of Business Entities Understanding the various business entities that are possible in the Indian business ecosystem eg Sole Proprietorship, Partnership, Hindu Undivided Family (HUFs), Limited Liability Partnerships, Companies etc. Reasoning the basis of selection of business entity for various ventures depending on the risk involved. Indian and International Tax System Principles of Taxation, Direct and Indirect Taxes. Basis of Personal and Corporate Taxation in India. International tax and understanding the concept of double taxation reliefs.	12L
Unit II	Sources of Finance – 1 Explain the source of finance for short term working capital purposes. Eg : Bank Overdraft, Cash Credits, Trade Credit, Bills of Exchange etc. Study medium term sources of finance being hire purchase and leases. Understand types of leases - financial leases and operating leases. Sources of Finance – 2	12L

	Basics of long-term finance via Debt (Bonds, Inflation Linked Bonds, Eurobonds) and Equity. Understanding the new age hybrid instruments of convertible bonds, bonds with options, etc. Study the process of equity issuances. Understand the reasons for company to raise finance via equity.	
Unit III	Capital Structure and Financial Leverage Explain the concept of capital structure and factors influencing the debt and equity mix in the company. Define Leverage and it's impact on business cycles. Dividend policy and decisions Define the concept of dividend. Study the impact of dividend policy and its impact on the financial markets.	12L
Unit IV	Mergers and Divestitures Learn the reasons and basics of mergers, acquisitions and divestitures through various examples. Understand the concept of synergies and cost benefits through such corporate tie-ups. Financial Planning Short term planning of working capital being predominantly receivables and inventory. Long term planning for projects and new investments for attainment of business objectives. Understanding the concept of prediction and management of cashflows in such financial planning decisions. Behavioural Finance Decoding the human biases in decision making. Study various theories propounded to explain such biases and understanding its impact and consequences.	12L

Text books and References:

1. Economics for business. 7th ed. Sloman, J.; Hinde, K; Garratt, D. - Pearson, 2016.
2. Fundamentals of financial management: concise edition. 7th ed. Brigham, E. F.; Houston, J. F. 7th ed. - South-Western, 2011.
3. How to understand the financial pages. 2nd ed. Davidson, A. - Kogan Page, 2008.
4. Principles of corporate finance: global edition. 12th ed. Brealey, R. A.; Myers, S. C.; Allen, F. - McGraw-Hill, 2016.

Course: PUSASQF 1.5	Life Insurance - Principles, Products and Practices (Credits: 3 Lectures/Week: 5)	
Objectives: The objective of this course is to introduce the students to the realities of the life insurance markets. The students will be made familiarized with various conventions of life insurance market, the overall operation of the life ins. Co. and functions of each department that play a vital role in the co.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the products and their risks 2) Explain the product cycle 3) Understand the factors while developing the product, underwriting process and claim settlement		
Unit I	Introduction to Insurance Understand insurance and its main characteristics Explain the concept of insurable risk Compare and contrast wager insurance and hedging Study basic classification of Insurance. Also, the costs and benefits to the society from insurance. The Fundamental Principles of Life Insurance Understand the various fundamental principles involved in insurance like Utmost good faith, Insurable interest, Indemnity, Proximate cause, Subrogation, Contribution and Mitigation Life Insurance Products Explain the various products available. Understand the variations in the product offered by the various life insurance companies in the Indian market scenario.	12L
Unit II	Group Insurance Study the concept and basics of group life insurance in Indian market. Understand the benefits offered by group insurance to its members. Compare and contrast group insurance with individual insurance. Determine and understand the various groups for which group insurance cover can be taken. Product development Explain the need for developing the product and understand the base line features	12L

	involved in developing various life insurance products. Explain the factors and its impact on product design Underwriting Explain underwriting and the principles of underwriting. Understand the process of underwriting and the factors that influence underwriting decisions. Explain the risks involved in the underwriting process.	
Unit III	Pricing Elements Explain the various elements involved in the pricing of Life Insurance Products and its objectives. Understand the various sources of information for pricing elements. Also, evaluate the savings and investment aspect of insurance in decision making. Distribution Channels of Life Insurance Explaining the various sources of distribution of life insurance products - marketing intermediaries, financial institutions etc. Study the distribution channels of various life insurance companies in the Indian markets. Claim Settlement Explain what is claim and its various types. Understand the entire claim settlement process and the role performed by various stakeholders involved in it. Study the claim settlement process followed by various Indian life insurance companies and understand how the industry operates.	12L
Unit IV	Stages of Life insurance Policies Understand the various stages of life insurance policies being surrender, death/claim, revival, lapsation etc. Analyse the concept of persistency and the industry scenario in India. Risk and Actuarial Valuation Determine the various risks faced by the life insurance companies and it's implication on the product, it's development and it's reserving. Also, understand the theory underpinning the actuarial role in valuation and its importance.	12L

Text books and References:

1. Principles of Risk Management and Insurance by George E. Rejda (Published by Pearson Education Asia)
2. Life and Health Insurance by Kenneth Black & Harold Skipper Jr. (Published by Prentice Hall)
3. Insurance Regulatory and Development Authority – Regulations
4. Publications of Insurance Institute of India

Course: PUSASQF 1.6	Applications of IT- Basics of Excel (Credits: 3 Lectures/Week : 3)	
Objectives: The objective of this course is to familiarize students with the usage of MS Excel and application of it in various situations particularly in understanding financial cashflows. Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand and use excel and develop the skill for further advance use 2) Analyse the data and use various formulas 3) Make pivots, charts, plots to visualize the data 4) Apply the concepts of financial mathematics using the first principles		
Unit I	Overview of Microsoft Excel Examine the value of using Excel to make decisions. Learn how to start Excel and become familiar with the Excel workbook and saving workbooks. Understand how to navigate worksheets. Examine the Excel Ribbon, right-click menu options and the Status Bar. Become familiar with the features in the Excel Help window Entering, Editing and Managing data Understand how to enter data, delete data and use the undo command in a worksheet. Examine how to edit data in a worksheet and how Auto Fill is used when entering data. Examine how to adjust, hide, insert and delete rows and columns in a worksheet. Learn how to move data to different locations in a worksheet. Formatting and data analysis Use formatting techniques as introduced in the Excel Spreadsheet Guidelines to enhance the appearance of a worksheet. Examine how to enter multiple lines of text in a cell location. Understand how to add borders to a worksheet. Examine how to use the AutoSum feature to calculate totals. Use the Cut, Copy, and Paste commands to manipulate the data on a worksheet. Understand how to move, rename, insert, and delete worksheet tabs. Printing, Protection and saving Use the Page Layout tab to prepare a worksheet for printing. Add headers and footers to a printed worksheet and examine how to print worksheets	12L

	and workbooks Save files and understand the importance and use of protecting workbook, worksheet and cells. Understand built-in and creating custom templates. Pivot tables Understanding the use of Pivot Tables in excel along with pivot charts	
Unit II	Writing formulas Understanding and applying Basic, Statistical, Financial, Logical, Text, Date and Time, lookup and reference and various other functions Conditional formatting and Goal seek Use Conditional Formatting techniques to provide flexible highlighting, applying specified formatting only when certain conditions are met Use and apply Goal seek function in excel under various scenarios	12L
Unit III	Presenting data and Charts Understand Inserting and editing Charts in excel (including line, bar, column, stacked column) Apply formatting commands to the X and Y axes, chart area and the plot area of a chart. Enhance the visual appearance of the chart title and chart legend by using various formatting techniques. Employ series lines and annotations to enhance trends and provide additional information on a chart. Auditing, Error identification, solving and review Checking inserted formulas for its correctness and completeness Understand how to identify and solve errors in excel	12L
Unit IV	Financial Mathematics (using first principles) Apply the principles learned in financial mathematics on excel using first principles	12L

Text books and References:

1. Excel 2016 Bible, by John Walkenbach
2. Excel 2016 for Dummies, by Greg Harvey
3. Building Financial Models with Microsoft Excel, by K. Scott Proctor

SEMESTER II

Course: PUSASQF 2.1	Numerical methods and Algebra (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to familiarize students with basics of algebra for future use. The students will learn and apply the concepts of numerical methods by learning topics such as vectors, matrices and series expansion.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the concepts of errors and approximations 2) Apply vectors and matrix operations to solve business problems 3) Solve algebraic and quadratic equations. 4) Understand and apply the concepts of series and expansion		
Unit I	Errors, Dimensions and Interpolation Calculate errors in estimation and compare actual versus estimated values Calculate and understand various dimensions of a quantity (units of measurement). Use linear interpolation to estimate value of a function Iterative Methods Introduce and explain modern computational methods for linear and nonlinear equations, systems and their applications	12L
Unit II	Vectors and Matrices Apply vectors to solve a real-world problem. Also, introduce the concept of eigen values, vectors and its application. Use matrices to organize large sets of data and understand the matrix operations to solve real world problems	12L
Unit III	Algebraic and Quadratic equations Evaluate general algebraic expressions, while learning how to interpret parentheses and alongside performing the correct order of operations Inequalities and Modulus functions Solve equations with inequalities and understand weak and strict inequality Understand the concept of absolute values. Solve equations and inequalities involving modulus and graph modulus functions	12L
Unit IV	Series and expansion Understand the concepts of series involving finite arithmetic, geometric progressions or infinite geometric progressions. Recognise and apply the binomial expansion of expressions	12L

Text books and References:

1. "The Algebraic Eigenvalue Problem" by J H Wilkinson
2. "An Introduction to Numerical Analysis" by K E Atkinson
3. "Matrix Computations" by G E Golub and C F Van Loan
4. "Numerical Methods" by Shishir Gupta and Shukhendu Dey

Course: PUSASQF 2.2	Probability and Statistics - 2 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concepts estimation and sampling theory. The students will also understand the use and need of regression and GLM modelling. Also, familiarizing with the concept of analysis of variance.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the various theories for estimation 2) Use CLT and hypothesis 3) Analyse various data sets and apply regression concepts to understand the interaction elements 4) Extend the concept of linear regression to more dynamic GLM 5) Practically apply the analysis of variance		
Unit I	Central Limit Theorem Statistical and practical applications of CLT and learning to perform various calculations using it Sampling Distributions Statistical inference and associated results, distributions of sample statistics, t and F results and how to use all these for population projection using sample information and large sample tests Theory of Estimation 1 Learning point estimation methods to find single value estimates of population parameters using sample information. Also, understand the properties, efficiency and asymptotic distributions of these estimators	15L
Unit II	Theory of estimation 2 Learning Interval estimation to construct symmetric/one sided confidence intervals for unknown parameters Testing of hypothesis Testing for unknown parameters, learning about p- value and types of errors, performing chi-square tests including goodness of fitness and contingency tables, bootstrapping and various other non-parametric tests	15L

Unit III	Correlation analysis and regression Exploratory data analysis for linear and nonlinear data sets, calculating various correlation coefficients, bivariate and multivariate analysis, dimension reduction using PCA (Principal component analysis), building predictive linear models and learning the mathematics associated with it. Performing residual analysis, selection of explanatory variables and extending the scope to higher level interaction elements and dealing with outliers	15L
Unit IV	Generalised Linear Models Extending the scope of linear models by allowing for non-normal distributions and categorical variables to construct linear models. Learning about exponential family, link functions and linear predictors. Selection of explanatory variables and constructing a predictive model and checking for the acceptability of fitted models Analysis of Variance Learning about treatment effects and one-way ANOVA along with its practical application. Partitioning the total variability in regression models using ANOVA for hypothesis testing of linear association of variables and significance of slope parameters for explanatory variables.	15L
Text books and References: 1. John E. Freund's Mathematical statistics with applications. 8th ed. Miller, I. and Miller, M.; [Freund, J. E.] Prentice Hall International, 2013. 2. Regression modelling with actuarial and financial implications. Frees, E.W. Cambridge University Press, 2010. 3. Generalized linear models. 2nd ed. McCullagh, P. and Nelder, J.A. Chapman & Hall/CRC Press, 1989.		

Course: PUSASQF 2.3	Business Finance – 2 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of accounting and analysis of accounts. The students will use the accounts to do the fundamental analysis and project assessment.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand various accounting concepts 2) Build and analyses financial reports 3) Explain the use of cost of equity, debt and thus the concept of WACC 4) Discuss the various investment evaluation techniques and apply it for decision making.		
Unit I	Accounting Terminology Understanding the basic of accounting concepts, conventions and principles. Apply accounting concepts for recording financial transactions via journal entries Regulatory overview Explain the role of various regulators in the financial world like SEBI (Securities and exchange board of India), competition commission, registrar of companies. Also, overview of the Indian accounting standards (Ind AS) in light of international accounting standards.	15L
Unit II	Introduction to Financial Reporting Study the contents of an annual report of a company. Understand the role and reports of the directors, auditors and regulators in the affairs of a company. Overview of the recent accounting frauds. Management Accounting Drawing up companies’ final accounts through ledgers and trial balance. Analysing the financial reporting (Statement of profit and loss, Balance sheet, Cash flow statement and statement of change in equity) format applicable to Indian companies.	15L
Unit III	Analysis of accounts/ Fundamental analysis Interpretation of financial statements of the companies using ratio analysis and understanding the limitations of the same. Explain group structures (Subsidiaries, Associates and Joint ventures) and its representation on a standalone and consolidated basis in financial statements.	15L

Unit IV	Cost of Capital Define cost of capital and calculate weighted average cost of capital. Discuss various methods for calculation of cost of equity. Understand the interaction of WACC in investment decision making. Project Assessment State the objectives of capital investment decisions Discuss the importance and purpose of capital budgeting for a business entity. Calculate cashflows in capital budgeting and try to explain the basic principles for measuring the same. Discuss the various investment evaluation techniques and apply it for decision making.	15L
Text books and References: 1. Accounting and finance for non-specialists. 9th ed. Atrill, P.; McLaney, E. Prentice Hall, 2015. 2. Accounting in a business context. 5th ed. Berry, A.; Jarvis, R. - Cengage, 2011. 3. Accounting: understanding and practice. 4th ed. Leiwy, D and Perks, R. - McGraw-Hill, 2015. 4. Interpreting company reports and accounts. 10th ed. Holmes, G.; Sugden, A.; Gee, P. - FT Prentice Hall, 2008. 5. Management accounting for decisions makers. 8th ed. Atrill, P.; McLaney, E. - Prentice Hall, 2015.		

Course: PUSASQF 2.4	Introduction to Actuarial Models (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic understanding required to build and analyse a statistical and Actuarial model. Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the purpose of modelling 2) Apply the modelling process to various real life situations 3) Explain the suitability factors for a particular evaluation and analyse the model in detail 4) Demonstrate the effective way of communicating the analysis and results.		
Unit I	Introduction to Models and data analysis Describe why and how models are used including, in general terms, the use of models for pricing, reserving, and capital modelling Fundamentals of modelling Explain the benefits and limitations of modelling and analyze realistic examples. Describe the characteristics of, and explain the use, of scenario-based and proxy models	12L
Unit II	Modelling process Understand and explain the few steps in the modelling process Deterministic Vs Stochastic model Explain the difference between a stochastic and a deterministic model, and identify the advantages/disadvantages of each of the model.	12L
Unit III	Modelling, Analysing and suitability Determine and understand the factors to be considered in modelling. Describe, in general terms, how to decide whether a model is suitable for any particular application. Explain the difference between the short-run and long-run properties of a model, and how this may be relevant in deciding whether a model is suitable for any particular application. Describe, in general terms, how to analyse the potential output from a model, and explain why this is relevant to the choice of model.	12L
Unit IV	Results and communication Understand the importance of sensitivity and stress testing of assumptions and explain why this forms an important part of the modelling process. Explain the factors that must be considered when communicating the results following the application of a model and produce appropriate documentation.	12L

Text books and References:

1. Actuarial Models: The Mathematics of Insurance, Second Edition by Vladimir Rotar
2. Introduction to actuarial modeling. Hickman, J. C. North American Actuarial Journal (1997)
3. An introduction to statistical modelling. Dobson, A. J. - Chapman & Hall, 1983. 125 pages.

Course: PUSASQF 2.5	Non-Life Insurance - Principles, Products, Practices (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the students to the realities of the Non - life insurance markets. The students will be made familiarized with various conventions of Non - life insurance market, the overall operation of the Non - life ins. Co. and functions of each department that play a vital role in the co.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the products and their risks 2) Explain the product cycle 3) Understand the factors while developing the product, underwriting process and claim settlement		
Unit I	Introduction to Non – life insurance Evolution of non- life insurance market in India. Study the stakeholders in the insurance market Study the role of tariff advisory committee and the evolution of de-tariffing. Contract design Determine the fundamental principles governing general insurance and health insurance Also, understand the various non-life insurance contracts	12L
Unit II	Legislation Overview of various regulation applicable to a general insurance business (Insurance act, IRDAI act, the GI council) Underwriting process Explain underwriting and the principles of underwriting. Understand the process of underwriting and the factors influencing underwriting decisions. Explain the risks involved in the underwriting process. Evaluate underwriting factors for certain special products	12L
Unit III	Product, Underwriting and Claim Settlement – 1 Corporate product lines: Property (Fire and Engineering Insurance), Marine Insurance, Miscellaneous Insurance (Liability Insurance, crop insurance, credit insurance)	12L

Unit IV	Product, Underwriting and Claim Settlement – 2 Retail product lines: Health, Motor and Travel insurance	12L
Text books and References: 1. Risk Management and Insurance by Trieschmann, Gustavason & Hoyt (Published by Thomson South - Western) 2. Insurance Regulatory and Development Authority – Regulations 3. Publications of Insurance Institute of India 1. IC 51 - Fire hazards of specific industries 2. IC 52 - General fire hazards 3. IC 54 - Fire insurance underwriting 4. IC 55 - Consequential loss insurance 5. IC 56 - Fire insurance claims 6. IC 57 - Fire & consequential loss insurance 7. IC 61 - Cargo loss prevention 8. IC 62 - Commercial geography 9. IC 63 - Marine clauses 10. IC 65 - Marine underwriting 11. IC 66 - Marine insurance claims 12. IC 85 – Reinsurance 4. Risk Management and Insurance by Williams, Jr., Smith and Young (Published by McGraw Hill International Editions)		

Course: PUSASQF 2.6	Applications of IT- Basics of R (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to make student use – one of the most sought after statistical tool in the current market: R. The students will learn various techniques for analysis and solve the statistical concepts in R.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the baics of R 2) Manipulate, Manage and Visualize data in R 3) Perform various statistical analysis and understand the outcome		
Unit I	Getting started with R Introduction to R, CRAN and R Studio Data types, Directories, Packages and Functions Basic operators, String functions, Numeric functions Data structures, Control Structures Data Manipulation in R Filtering Data Using Brackets Filtering Data with the Subset Command and Dplyr package Recoding Categorical and Continuous Variables Sorting Data Frames Compute New Variables	12L
Unit II	Data Management in R Importing/Exporting external data in R Modifying data, Creating subsets, Sorting Merging and aggregating data “Apply” family functions Data Visualization Graphics in R using GGLOT2 package Building Charts, Bar plots, Pie charts, Histograms Cumulative Frequency Line Charts, Column Charts, Mean Plots Visualizing distributions through Boxplot and Density graphs Visualizing Relationships through Scatterplots, Bubble chart, Heatmap and Trendline Creating Frequency Tables in Base R and PLYR package Building Cross Tables using packages xtabs and CrossTable	12L

Unit III	Statistical Inference Frequency and contingency tables Correlation and probability distributions Nonparametric tests of group differences Performing Univariate Analyses One-Sample T Test Binomial Test Chi-Square Test for Goodness-of-Fit	12L
Unit IV	Application of Probability and Statistics concepts in R	12L
Text books and References: 1. Handbook of programming with R by Garrett Grolemond 2. The Art of R programming by Norman Matloff 3. An Introduction To Statistical Learning With Applications in R by Trevor Hastie and Rob Tibshirani 4. Learning RStudio For R Statistical Computing by Mark P.J.van der Loo		

Semester III & IV

[illegible]

Semester-III			
Course Code	Course Type	Course Title	Credits
PUSASQF3.1	Core Subject	Business Economics – Micro	3
PUSASQF3.2	Core Subject	Statistical and Risk Modelling - 1	3
PUSASQF3.3	Core Subject	Portfolio Theory and Security Analysis	4
PUSASQF3.4	Core Subject	Introduction to Derivatives and Financial Markets	4
PUSASQF3.5	Core Subject	Applications of IT- Python	3
PUSASQF3.6	Core Subject	Project work – 1	3
Total Credits			20

Semester-IV			
Course Code	Course Type	Course Title	Credits
PUSASQF4.1	Core Subject	Business Economics – Macro	3
PUSASQF4.2	Core Subject	Statistical and Risk Modelling - 2	3
PUSASQF4.3	Core Subject	Financial Engineering - 1	4
PUSASQF4.4	Core Subject	Fixed Income Products	3
PUSASQF4.5	Core Subject	Statistical Modelling in R	4
PUSASQF4.6	Core Subject	Advance Application of Excel	3
Total Credits			20

SEMESTER III

Course: PUSASQF 3.1	Business Economics – Micro (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to familiarize students with basics of Economics particularly the micro economics. The course initially revolve around different economic school of thought, consumer behaviour, demand supply, price mechanism and then digs deep into pricing and strategies for various types of firms.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the various economic concepts. 2) Evaluate various economic theories and behaviors 3) Understand the product, cost, revenue and profit concepts 4) Evaluate various theories of firms		
Unit I	Economics and Economies Understanding economic concepts such as basic economic problem, scarcity and choices to be made and contrasting between Microeconomics and Macroeconomics. Analysing the different economic school of thoughts. Market Equilibrium, Price Mechanism and Market Efficiency Analysing the workings of a free market and the behaviour of firms and consumers in such a market. Understanding the role of Price Mechanism. Discussing how equilibrium price and quantity are achieved and how the equilibrium changes with changes in demand and supply.	12L
Unit II	Demand and Supply Analysing Individual Demand and Market Demand. Analysing Individual Supply and Market Supply. Understanding the difference between shift of the curve and movement along the curves, determinants of Demand and Supply. Describe the role and importance of advertising for a firm. Describe price expectation and price bubble and how firms deal with uncertainty in future market movements – price controls, indirect taxes and subsidies. Elasticities Calculate and evaluate price and income elasticities of demand and supply. Discuss the factors that affect elasticity and how the workings of the market are affected. Consumer Behaviour Discussing consumer demand and behaviour. Also, understanding concepts of utility, rational choice and consumer preferences using indifference curves. Analysing the various concepts of Behavioural economics.	12L

Unit III	Cost, Revenues and Profits Distinguish between short run and long run in the context of production and how cost and output vary with the same. Define total product, average product and marginal product. Explain economic costs and distinguish between explicit and implicit costs. Compare and contrast between total costs, marginal costs and average costs. Define total Revenue, average revenue and marginal revenue. Explain the concept of economies of scale and the factors that give rise to the same. Describe economic profit and how firms can arrive at its profit maximising output. Also, understand the shut-down price in short and long run.	12L
Unit IV	Theory of Firm 1 Discuss the assumptions, revenue curves and Profit maximisation in long run and short run in perfect competition and monopoly. Analyse how output and price are determined in such markets in the short and long run. Describe the barriers to entry in a monopoly market Theory of Firm 2 Discuss the assumptions, revenue curves and how firms in this type of market only normal profits are made in the long run. Discuss the assumptions, revenue curves and the role of interdependence in the dilemma faced by oligopolistic firms – whether to compete or collude. Explain how game theory can illustrate the strategic interdependence between the oligopolies. Price Determination and Strategies Understand how prices are determined and factors that affect the ability of a firm to determine its price. Describe price discrimination and average cost pricing and how pricing varies for different products.	12L

Text books and References:

1. Economics. 10th ed. Sloman, J. Pearson, 2018
2. Business economics. Perman, R.; Scouller, J. Oxford University Press, 1999.
3. Economics. 9th ed. Begg, D. K. H.; Fischer, S.; Dornbusch, R. McGraw-Hill, 2008.
4. Economics. 13th ed. Lipsey, R. G.; Chrystal, K. A. Oxford University Press, 2015.
5. Economics: international edition. 3rd ed. Krugman, P.; Wells, R. Worth; Macmillan, 2013.
6. Economics. 3rd ed. Mankiw, N. G.; Taylor, M. P. Cengage, 2014.
7. Economics for business. 4th ed. Begg, D. K. H.; Ward, D. McGraw-Hill, 2013.
8. Essentials of economics. 5th ed. Sloman, J.; Garratt, D. FT Prentice Hall, 2010.
9. Foundations of economics. 7th ed. Bade, R.; Parkin, M. Pearson, 2015.

Course: PUSASQF 3.2	Statistical and Risk Modelling - 1 (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of life time modelling i.e. estimating lifetime distribution, and making of life tables through the topics such as graduation and mortality projection.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the life time distribution and various methods of estimating it. 2) Understand the principle of correspondence and its relevance in the estimation procedures 3) Explain the importance of graduation and apply various tests to check the level of graduation 4) Discuss various approaches to forecast future mortality rates.		
Unit I	Survival Modelling Explain and interpret survival models and transitioning between states. Calculate and interpret standard functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life. Understand and apply approximate methods for fractional ages based on uniform distribution of deaths, constant force of mortality and Balducci assumption Nonparametric estimation of a lifetime distribution Define censoring and describe the various types of censoring involved in lifetime data Calculate nonparametric estimates of survival models using the Kaplan-Meier and Nelson-Aalen formulas	12L
Unit II	Proportional hazard model Describe proportional hazard models and its application Compare survival rates in different groups Assess the relationship of risk factors and survival times using the Cox regression model, and assess the appropriateness and adequacy of the model Derive partial likelihood estimator and their asymptotic distribution Age-dependent transition intensities Describe how to estimate transition intensities depending on age, exactly or using the census approximation. Understand the principle of correspondence and its relevance in the estimation procedures considering various age definitions	12L

Unit III	Graduation – 1 Describe the process of graduation and the desirable properties of graduated rates Describe how to test crude estimates for consistency with a standard table or a set of graduated estimates Apply and understand the smoothness test for graduated rates Graduation – 2 Understand the various methods of graduation such as: Parametric formula, standard table and spline functions. Compare and contrast the above-mentioned methods	12L
Unit IV	Statistical mortality projection methods Discuss the approaches to the forecasting of future mortality rates based on extrapolation, explanation and expectation, and their advantages and disadvantages. Understand the Lee-Carter, age-period-cohort, and p-spline regression models for forecasting mortality.	12L
Text books and References: 1. Analysing survival data from clinical trials and observational studies. Marubini, E.; Valsecchi, M. G. - John Wiley, 2004. 2. The analysis of mortality and other actuarial statistics. 3rd ed. Benjamin, B.; Pollard, J. H. - Institute and Faculty of Actuaries, 1993. 3. Modelling mortality with actuarial applications. Macdonald, A.S., Richards, S.J. and Currie, I.D. - Cambridge University Press, 2018 4. Mortality studies. Scott, W. F. - University of Aberdeen, Department of Mathematical Sciences, 2000 5. The statistical analysis of failure time data. 2nd ed. Kalbfleisch, J.D.; Prentice, R.L. - Wiley-Blackwell, 2002. 6. Survival models and data analysis. Elandt-Johnson, R. C.; Johnson, N. L. - John Wiley, 1999		

Course: PUSASQF 3.3	Portfolio Theory and Security Analysis (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of building and managing a portfolio. Also, analyzing the equities and bonds.		
Expected Learning Outcomes: At end of the course, students will be able to: 1) Explain utility theory and extending the theory to have optimal portfolio 2) Understand various risk measures 3) Describe various portfolio investing approaches and various management styles 4) Apply various portfolio theories like MPT, CAPM etc. 5) Explain the various methods of fundamental analysis and the factors influencing the same		
Unit I	Efficient market hypothesis Describe market efficiency and related concepts, including their importance to investment practitioners. Contrast weak form, semi strong form and strong form of market efficiency Describe market anomalies Economic approach to human behaviour Explain utility theory and how does it affect investment decisions. Explain the types of investors based on their preference towards Measures of investment risk Identification and evaluation of types of risk faced by an investor Compare and contrast various risk measures and interpret their application in real world scenarios	15L
Unit II	Portfolio management: Overview Describe portfolio approach to investing, types of investors and distinctive characteristics and needs of each Understand the steps in the portfolio management process Portfolio management Describe and discuss the principal active management “styles” (Value, growth, momentum, rotational). Understand the fundamental equity and bond portfolio management techniques	15L
Unit III	Modern portfolio theory Explain Modern Portfolio Theory and the Mean-Variance Framework. Create an Investment Portfolio and test its ability to achieve Investment Objectives Understand issues in portfolio construction, its management and its performance Models for asset returns Discuss the use of multifactor models in investment management Capital asset pricing model	15L

	Explain the capital asset pricing model (CAPM), including its assumptions, the security market line (SML) and the capital market line (CML) Calculate and interpret the expected return of an asset using the CAPM; Describe and demonstrate applications of the CAPM and the SML	
Unit IV	Principles of fundamental analysis (Equities and bonds) Define fundamental analysis and compare the same with other forms of security analysis Explain the various methods of fundamental analysis and the factors influencing the same Describe the various publicly available sources of information	15L

Text books and References:

1. Introduction to mathematical portfolio theory. Joshi, Mark S.; Paterson, Jane M. Cambridge University Press, 2013.
2. Modern portfolio theory and investment analysis. 9th ed. Elton, E. J.; Gruber, M. J.; Brown, S. J. et al. John Wiley, 2014.
3. Pioneering Portfolio Management by David Swensen
4. Investment Analysis and Portfolio Management by Frank Reilly and Keith Brown
5. Security Analysis and Portfolio Management by S. Kevin

Course: PUSASQF 3.4	Introduction to Derivatives and Financial Markets (Credits : 4 Lectures/Week : 5)	
The objective of this course is to establish a foundation for derivative and financial market. The students should be well versed with the various terminology and particularly how the market operates. It gives insights on various strategies that could be adopted using derivatives under different scenarios. Also, provides a brief introduction to alternative market investments. Expected Learning Outcomes: At end of the course, students will be able to: 1) Understand the financial market and system 2) Understand how the derivative market operate particularly Futures, Forward and Options. 3) Hedge optimally using derivatives 4) Explain various concepts involved in Alternative Investments		
Unit I	Introduction to Financial Markets and system Explain the main functions of the financial system and understand the classifications of assets and markets Describe the major types of assets that trade in organized markets, including their distinguishing characteristics and major subtypes Describe types of financial intermediaries and services that they provide Define primary and secondary markets and explain how secondary markets support primary markets Explain how securities, contracts, and currencies are traded in quote-driven, order-driven, and brokered markets Describe characteristics of a well-functioning financial system and objectives of market regulation	15L
Unit II	Introduction to Derivatives Introduce the concepts of forwards, futures and options market and overview of how they are used by hedgers, speculators and arbitrageurs. Mechanics of futures markets Understand of how the futures market operate Examine the issues such as contract specification, operation of margin accounts, exchange organisation etc. Compare futures contract with forward contracts and understand their payoffs Hedging strategies using futures Introduce various general issues associated with the way hedges are set up. Also, understand the appropriateness and optimal position for reducing risk. Explain an adjustment known as “tailing”	15L

	Determination of forward and futures prices Understand the relationship between forward (or futures) prices and spot prices Examine the relationship between futures prices and spot prices for various contracts	
Unit III	Mechanics of options markets Understand of how the options market operate Examine the issues such as contract specification, operation of margin accounts, trading etc. Properties of stock options Understand the factors affecting stock option prices. Explore the relationship between European option prices, American option prices and the underlying stock price. Understand the optimal scenarios for exercising the American option. Trading strategies involving options Examine the properties of portfolios consisting of positions in (a) an option and a zero-coupon bond, (b) an option and the asset underlying the option, and (c) two or more options on the same underlying asset.	15L
Unit IV	Alternative Investments – 1 Compare alternative investments with traditional investments Describe various alternative investments, including strategies, subcategories, potential benefits and risks, fee structures, and due diligence Describe potential benefits of alternative investments in the context of portfolio management Alternative Investments – 2 Describe, calculate, and interpret management and incentive fees and net-of fees returns to hedge funds Describe issues in valuing and calculating returns on hedge funds, private equity, real estate, commodities, and infrastructure; Describe risk management of alternative investments.	15L

Text books and References:

1. Options, futures and other derivatives: global edition. 9th ed. Hull, J. C. Prentice Hall, 2017.
2. Alternative Investments: CAIA Association (Author), Hossein Kazemi (Author), Keith H. Black (Author), Donald R. Chambers (Author)
3. Alternative Investments: Instruments, Performance, Benchmarks and Strategies by H. Kent Baker and Greg Filbeck

Course: PUSASQF 4.5	Statistical Modelling in R (Credits : 4 Lectures/Week : 5)
Objectives: Apply the advanced statistical concepts studied in probability and statistics over previous 2 semesters The topic for modelling shall be assigned by the faculty and shall be under their purview Expected Learning Outcomes: At end of the course, students will be able to: 4) Understand the mechanism and the key factors involved in data center designing. 5) Gain an insight into the standards introduced worldwide. 6) Perform basic calculations and also understand the assessment process for greening the information systems.	

SEMESTER IV

Course: PUSASQF 4.1	Business Economics – Macro (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to implement object oriented concepts like inheritance, data hiding and polymorphism in programming to help optimization of codes by reducing the lines of code and applying maximum features. This course also aims to understand implementation of classes, objects and methods. Expected Learning Outcomes: At end of the course, students will be able to: 5) Use the characteristics of an object oriented programming language in a program. 6) Use the basic object-oriented design principles in computer problem solving. 7) Identify and handle exceptions and that occur in the programs.		
Unit I	Market Failure Examine the concept of failure of the market to achieve allocative efficiency. Discuss the reasons that lead to market failure Government Intervention Learn about the Intervention of government by way of indirect taxes, subsidies and price controls.	12L
Unit II	Globalisation, International Trade and its Significance Define and explain globalisation, international trade and how they impact the firms. Protectionism Understand the disadvantages of free trade and the reasons which necessitate trade protection. The level of overall economic activity Describe the main macroeconomic objectives and understanding actual and potential growth Analyse of the circular flow of income Define GDP and its measurement and analyse economic growth Describe various phases of a business cycle	12L
Unit III	Unemployment and Inflation Using simple AS-AD model, understand the interaction of prices in an economy. Define the term unemployment and discuss the possible consequences of unemployment. Describe, using examples, the meaning of frictional, structural, seasonal and cyclical unemployment. Define inflation and the possible consequences of inflation. Explain, using diagrams the causes of inflation (demand-pull inflation, cost-push inflation). Assess the relationship between unemployment and inflation. Balance of Payments and Exchange rates Explain balance of payments and exchange rate and draw the relationship between these two macro-economic objectives. Determine how exchange rates are determined in the freely floating exchange rate system	12L

	and fixed exchange rate system. Outline the role of balance of payments. Explain the components of current account, capital account and financial account in balance of payment.	
Unit IV	Money and Interest Rate Evaluate the functions of money and interest rates and understand the relationship between them. Understand the role of banks and getting an insight on money multipliers Fiscal and Monetary Policy Explain the mechanism through which various fiscal and monetary policies can close an inflationary/ deflationary gap in an economy. Assess how central banks are usually instrumental in various policies around interest rates and exchange rates. Supply-side policies Elaborate the various supply-side policies (market-based policies and interventionist policies).	12L

Text books and References:

1. Economics. 10th ed. Sloman, J. Pearson, 2018
2. Business economics. Perman, R.; Scouller, J. Oxford University Press, 1999.
3. Economics. 9th ed. Begg, D. K. H.; Fischer, S.; Dornbusch, R. McGraw-Hill, 2008.
4. Economics. 13th ed. Lipsey, R. G.; Chrystal, K. A. Oxford University Press, 2015.
5. Economics: international edition. 3rd ed. Krugman, P.; Wells, R. Worth; Macmillan, 2013.
6. Economics. 3rd ed. Mankiw, N. G.; Taylor, M. P. Cengage, 2014.
7. Economics for business. 4th ed. Begg, D. K. H.; Ward, D. McGraw-Hill, 2013.
8. Essentials of economics. 5th ed. Sloman, J.; Garratt, D. FT Prentice Hall, 2010.
9. Foundations of economics. 7th ed. Bade, R.; Parkin, M. Pearson, 2015.

Course: PUSASQF 4.2	Statistical and Risk Modelling - 2 (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of an in-depth understanding of the Intel 8085 architecture and programming model. Also to enhance their skills to write assembly level programs and to do efficient I/O and memory management.		
Expected Learning Outcomes: At end of the course, students will be able to: 6) Describe the general architecture of a microcomputer system and 8085 Microprocessor, along with its organization. 7) Understand and realize the interfacing of memory & various I/O devices with 8085 microprocessor. 8) Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming. 9) Understand the architecture and operation of programmable interface devices and realize the programming and interfacing of it with 8085 microprocessor. 10) Understand multi core processor and its advantages.		
Unit I	Introduction to stochastic processes Understand the definition of a stochastic process, Markov process, counting process, mixed processes and a random walk Learn the definition and derive some basic properties of a Poisson process	12L
Unit II	Markov chains Classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space, and give examples of each type of process Classify the states of a Markov chain as periodic, aperiodic, reducible and irreducible Describe a time-inhomogeneous Markov chain and its simple applications Describe a Markov chain and its transition matrix Determine the stationery and equilibrium distributions of a Markov chain Solve the Kolmogorov equations in simple cases Calculate the distribution of a Markov chain at a given time Demonstrate how a Markov chain can be simulated	12L

Unit III	Markov jump process Define markov jump process and how they can be used as a tool for modelling. Define the two-state survival model, sickness models and other example multiple state models in terms of Markov jump processes. Define the jump chain model associated with a Markov jump process model and apply the results. Poisson model Define the Poisson process, state the distribution of the number of events in a given time interval, state the distribution of inter-event times, and apply these results.	12L
Unit IV	Markov Process State the Kolmogorov equations for a Markov process where the transition intensities depend not only on age/time, but also on the duration of stay in one or more states Demonstrate how a Markov jump process can be simulated Derive the Kolmogorov equations for a Markov process with time independent and time/age dependent transition intensities Understand survival, sickness and marriage models in terms of Markov processes	12L

Text books and References:

1. An actuarial survey of statistical models for decrement and transition data. Macdonald, A.S. British Actuarial Journal (1996)
2. Basic stochastic processes: a course through exercises. Brzezniak, Z.; Zastawniak, T. - Springer, 1998.
3. Competing risks and multistate models with R. - Beyersmann, J., Schumacher, M. and Allignol, A. - Springer, 2012.
4. Introduction to actuarial modeling. Hickman, J. C. North American Actuarial Journal (1997)

Course: PUSASQF 4.3	Financial Engineering - 1 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of developing and implementing solutions to problems encountered in all phases of the design process, creating dynamic web pages through JavaScript programming and understanding the interactions between client-side and server-side applications.		
Expected Learning Outcomes: At end of the course, students will be able to: 5) Learn the language of the web: HTML and CSS. 6) Understand the principles of creating an effective web page. 7) Become familiar with the database like MySql via interacting with the XAMPP and WAMP server.		
Unit I	Derivatives: Overview Define Arbitrage and no arbitrage principle. Define an option and understand various terminology applicable in an option contract Introduction to principles of derivative pricing Understand the fundamentals of expectation-based pricing Compare arbitrage-based pricing with expectation-based pricing Define and distinguish risk neutral and real-world measure	15L
Unit II	Discrete approach to pricing Understand and apply the binomial branch model to price options. Extend the approach to multiple steps of a binomial tree (recombining and non-recombining model). Understand the binomial representation theorem Expand the application of the binomial model to the continuous approaches Wiener processes and ITO's lemma Define and understand the properties of the wiener process. Understand stochastic calculus and its application in the financial world. Define Ito calculus and apply to stochastic process.	15L
Unit III	Probability measure and risk neutral pricing Understanding the probability measure and application of change of measure – the C-M-G theorem Define and apply martingale representation theorem. Construction of self-financing and replicating portfolios Black scholes model Derive and use the black scholes PDE to pricing Apply the martingale representation approach to derive the black scholes equation Use the black scholes model to price various types of options	15L

Unit IV	Greeks Understand and derive option greeks and its importance in risk management Construction of delta-gamma neutral portfolios Understand the relationship between greeks Volatility smiles Describe the volatility smile that the traders use in equity and foreign currency markets Explain the relationship between volatility smile and risk neutral probability distribution	15L
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Text books and References:

1. Financial calculus: an introduction to derivative pricing. Baxter, M.; Rennie, A. CUP, 1996.
2. Financial economics: with applications to investments, insurance and pensions. Panjer, H. H. (ed) The Actuarial Foundation, 2001.
3. Louis Bachelier's Theory of Speculation: the origins of modern finance. Bachelier, Louis; Davies, M. and Etheridge, A. (translators). Princeton University Press
4. Options, futures and other derivatives: global edition. 9th ed. Hull, J. C. Prentice Hall, 2017.

Course: PUSASQF 4.4	Fixed Income Products (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation. Expected Learning Outcomes: At end of the course, students will be able to: 5) Estimate the values based on various forms of data available. 6) Assume the probability and statistical value of the data. 7) Perform basic Linear regression and programming based on unknown dataset. 8) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Fixed income market: Overview Describe basic features of a fixed-income security and content of a bond indenture Compare affirmative and negative covenants and identify examples of each Describe how legal, regulatory, and tax considerations affect the issuance and trading of fixed-income securities Describe how cash flows of fixed-income securities are structured Describe contingency provisions affecting the timing and/or nature of cash flows of fixed-income securities and identify whether such provisions benefit the borrower or the lender Issuance, Funding and Trading of Fixed income markets Describe classifications of global fixed-income markets and the use of interbank offered rates as reference rates in floating-rate debt Explain mechanisms available for issuing bonds in primary markets and secondary markets for bonds Describe securities issued by various agencies and types of debt issued by corporations. Also, understand structured financial instruments, short-term funding alternatives available to banks, repos and the risks associated with them.	12L
Unit II	Fixed income valuation Define spot rates and calculate the price of a bond using spot rates and market discount rate Identify the relationships among a bond’s price, coupon rate, maturity, and market discount rate (YTM) Describe and calculate the flat price, accrued interest, and the full price of a bond. Also, understand matrix pricing Calculate and interpret annual yield on a bond for varying compounding periods in a year, yield measures for fixed-rate bonds and floating-rate notes and for money market instruments; Define and compare the spot curve, yield curve on coupon bonds, par curve, and forward curve;	12L

	Define forward rates and calculate spot rates from forward rates, vice versa, and the price of a bond using forward rates Compare, contrast, calculate, and interpret yield spread measures.	
Unit III	Fixed income risk and return – 1 Calculate and interpret the sources of return from investing in a fixed-rate bond Define, calculate, and interpret Macaulay, modified, and effective durations Understand why effective duration is the most appropriate measure of interest rate risk for bonds with embedded options Define and use key rate duration in measuring the sensitivity of bonds to changes in the shape of the benchmark yield curve Explain how a bond's maturity, coupon, and yield level affect its interest rate risk Calculate the duration of a portfolio and explain the limitations of portfolio duration Calculate and interpret the money duration of a bond and price value of a basis point (PVBp) Calculate and interpret approximate convexity and distinguish between approximate and effective convexity	12L
Unit IV	Fixed income risk and return – 2 Estimate the percentage price change of a bond for a specified change in yield, given the bond's approximate duration and convexity Describe how the term structure of yield volatility affects the interest rate risk of a bond Describe the relationships among a bond's holding period return, its duration, and the investment horizon Explain how changes in credit spread and liquidity affect yield-to-maturity of a bond and how duration and convexity can be used to estimate the price effect of the changes. Immunisation theory Explain and apply how duration and convexity are used in the (Redington) immunisation of a portfolio of liabilities.	12L

Text books and References:

1. The Handbook of Fixed Income Securities, 8 Edition by Frank Fabozzi
2. Fixed income mathematics by Frank Fabozzi
3. Fixed income securities, Wiley finance by Bruce Tuckman and Angel Serrat
4. Fixed – income securities by Lionel Martellini and Philippe Priaulet

Course: PUSASQF 3.5	Applications of IT- Python (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to encourage use of Python and understand the application in the Finance domain.		
Unit I	Introduction to Python framework and packages: Anaconda & pip Creating Python variables Numeric, string and logical operations Lists, Dictionaries, Tuples & sets Executing code through spyder Command Prompt Working with Jupyter notebook	12L
Unit II	Data Exploration Need for data summary & visualization Summarising numeric data in pandas Summarising categorical data Group wise summary of mixed data Visualisation using Seaborn package Conditional Statement, control structures and functions Writing for loops in Python While loops and conditional statements Writing custom functions	12L
Unit III	Data Massaging using Numpy and Pandas Introduction to NumPy arrays, functions & properties Introduction to Pandas & data frames Importing and exporting external data in Python Feature engineering using Python	12L

Unit IV	Generalised Linear Models Linear Regression Logistic Regression Regularisation of Generalised Linear Models Ridge, Lasso and Elastic net regression	12L
Text books and References: 1. Dive into Python, Mike 2. Learning Python, 4th Edition by Mark Lutz 3. Programming Python, 4th Edition by Mark Lutz		

Course: PUSASQF 4.6	Applications of IT- Advance Excel (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to encourage optimal usage of hardware and software resources, and to spread awareness regarding the hazardous effects of the resources being over utilized or underutilized. It also aims to focus on efficient power consumption, recycling of products and building infrastructures to curb the environmental damage caused due to the increase in requirement of computing and data processing.		
Expected Learning Outcomes: At end of the course, students will be able to: 7) Understand the mechanism and the key factors involved in data center designing. 8) Gain an insight into the standards introduced worldwide. 9) Perform basic calculations and also understand the assessment pro cess for greening the information systems.		
Unit I	Overview of Advanced VBA Introducing the VBA basics and understanding why it is necessary aspect of analytics function Variable definition and scoping Understand the object model of VBA Protection and event handling	12L
Unit II	Loops, Conditional Statements, and Data Handling in VBA Exercise to demonstrate the loops implementation – definition of criteria for loop execution, number of runs and difference between the different loops Explanation of the conditional statement through complex business logic to demonstrate capability in real time Understand dataset storage, access, and manipulation using all the points defined above plus VBA specific data techniques	12L
Unit III	Charts and Shapes Charts – Data manipulation, setting source data, properties modification Form controls – Understand the uses of form controls Handling shapes and their properties in VBA	12L

Unit IV	Application interaction File handling through VBA Data manipulation between different workbooks Consolidation of data into a single workbook Export data from the workbook in PDF, PPT, and Excel formats User forms in Excel User form design and properties User form events Data manipulation using the form	12L
Text books and References: 1. Excel VBA Macro Programming 2.VBA and Macros for Microsoft Excel (Business Solutions) by Bill Jelen 3.VBA and Macros: Microsoft Excel 2010 (Mrexcel Library)		

Semester V & VI

[illegible]

Semester-V			
Course Code	Course Type	Course Title	Credits
PUSASQF5.1	Core Subject	Business communication	3
PUSASQF5.2	Core Subject	Professional Ethics/Actuarial Practice standards	3
PUSASQF5.3	Core Subject	Model Documentation Analysis and Reporting	3
PUSASQF5.4	Core Subject	Internship	3
PUSASQF5.5A	Elective A	Statistical and risk modelling - 3	4
PUSASQF5.6A	Elective A	Pricing and Reserving for Life Insurance Products – 1	4
PUSASQF5.5B	Elective B	Risk Management and Investment Management – 1	4
PUSASQF5.6B	Elective B	Financial Engineering - 2	4
Total Credits			20

Semester-VI			
Course Code	Course Type	Course Title	Credits
PUSASQF6.1	Core Subject	Psychology of human behaviour at work/ Organizational Behaviour	3
PUSASQF6.2	Core Subject	Predictive Analytics and Machine Learning	3
PUSASQF6.3	Core Subject	Project Work -2 (For Elective A) / C++ (For Elective B)	3
PUSASQF6.4	Core Subject	Application on Bloomberg terminal or similar soft.	3
PUSASQF6.5A	Elective A	Statistical and risk modelling - 4	4
PUSASQF6.6A	Elective A	Pricing and Reserving for Life Insurance Products – 2	4
PUSASQF6.5B	Elective B	Risk Management and Investment Management – 2	4
PUSASQF6.6B	Elective B	BASEL	4
Total Credits			20

SEMESTER V

Course: PUSASQF 5.1	Business communication (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to implement object oriented concepts like inheritance, data hiding and polymorphism in programming to help optimization of codes by reducing the lines of code and applying maximum features. This course also aims to understand implementation of classes, objects and methods.		
Expected Learning Outcomes: At end of the course, students will be able to: 8) Use the characteristics of an object oriented programming language in a program. 9) Use the basic object-oriented design principles in computer problem solving. 10) Identify and handle exceptions and that occur in the programs.		
Unit I	Communication process Developing awareness of the complexity of the communication process Listening skills Developing effective listening skills in students so as to enable them to comprehend instructions and become a critical listener.	12L
Unit II	Speaking skills Developing effective oral skills so as to enable students to speak confidently interpersonally as well as in large groups	12L
Unit III	Writing skills develop effective writing skills so as enable students to write in a clear, coherent, concise, persuasive and audience centred manner	12L
Unit IV	Communication through electronic media Developing ability to communicate effectively with the help of electronic media	12L
Text books and References: 1. Ashley,A(1992) A Handbook Of Commercial Correspondence, Oxford University Press 2. Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon, New Delhi. 3. Benjamin, James (1993) Business and Professional Communication Concepts and Practices, Harper Collins College Publishers, New York 4. Eyre, E.C. (1985) Effective Communication Made Simple, Rupa and Co.Calcutta. 5. Fisher Dalmar, (1999), Communication in Organisation 6. Ludlow,Ron.(1995) The Essence of Effective Communication 7. Murphy, Herta and Hilde Brandt, Herbert W (1984) Effective Business Communication, McGraw Hill, New York. 8. Raman, Meenakshi and Sharma, Sangeeta (2004) Technical Communication: Principles and Practice, Oxford University Press		

Course: PUSASQF 5.2	Professional Ethics/Actuarial Practice standards (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of an in-depth understanding of the Intel 8085 architecture and programming model. Also to enhance their skills to write assembly level programs and to do efficient I/O and memory management.		
Expected Learning Outcomes: At end of the course, students will be able to: 11) Describe the general architecture of a microcomputer system and 8085 Microprocessor, along with its organization. 12) Understand and realize the interfacing of memory & various I/O devices with 8085 microprocessor. 13) Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming. 14) Understand the architecture and operation of programmable interface devices and realize the programming and interfacing of it with 8085 microprocessor. 15) Understand multi core processor and its advantages.		
Unit I	Introduction to professionalism Understand important characteristics of a profession and its advantages to interested parties Understand professionalism and its importance	12L
Unit II	Corporate governance Evolution of Corporate Governance – Ancient and Modern Concept Concept and principles of Corporate Governance Beneficiaries of Corporate Governance, Shareholder Activism and changing role of Institutional Investors Business Ethics vis-à-vis Corporate Governance Corporate Governance in various organizations Corporate Social Responsibilities and good corporate citizenship Ethics and ethical behaviour Understand the challenges and the need for ethics and ethical behaviour. Also, describe and apply the framework for ethical decision making	12L

Unit III	Code of Ethics and Standards of professional conduct Understand the components and ethical responsibilities required by the code and the standard Demonstrating the application of the Code of Ethics and Standards of Professional Conduct to situations involving issues of professional integrity Understand practices and procedures designed to prevent violations of the code and the standard	12L
Unit IV	Actuaries code Demonstrate a knowledge of the Actuaries' Code Actuarial practice standard 10 (APS 10) Understand Indian actuarial practice standard – APS 10 Global Investment Performance Standards Understand and demonstrate knowledge on creation, features, scope, and implementation of GIPS standards Also, describe the nine major sections of the GIPS standards	12L
Text books and References: 1. Ethics in quantitative finance. Joohnson, T. Palgrave Macmillan, 2017 2. A Global Standard for Professional Ethics: Cross-Border Business Concerns By Allen, Catherine; Bunting, Robert 3. APS 20, The Indian Actuaries Act 4. Complying with GIPS		

Course: PUSASQF 5.3	Model Documentation Analysis and Reporting (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of developing and implementing solutions to problems encountered in all phases of the design process, creating dynamic web pages through JavaScript programming and understanding the interactions between client-side and server-side applications.		
Expected Learning Outcomes: At end of the course, students will be able to: 8) Learn the language of the web: HTML and CSS. 9) Understand the principles of creating an effective web page. 10) Become familiar with the database like MySql via interacting with the XAMPP and WAMP server.		
Unit I	Data analysis Use appropriate tools for cleaning, restructuring and transforming data to make it suitable for analysis. Summarise data using appropriate analysis, descriptive statistics and graphical representation. Select and carry out appropriate statistical tests of reasonableness. Make appropriate assumptions about the data provided. Repair corrupt or missing data.	12L
Unit II	Model development and documentation Plan and produce a spreadsheet model to solve a specified problem. Document the results of the model including justification of key assumptions, detailing the methodology adopted, an appropriate level of reasonableness checks, sensitivities and limitations. Produce and audit trail enabling detailed checking and high-level scrutiny of the model by a fellow student and a senior actuary.	12L
Unit III	Methods and model outputs Perform checks on the results of a model, including applying sensitivity and/or scenario tests. Comment on the reasonableness of the results under different scenarios	12L
Unit IV	Application and interpretation of results Apply the results to the problem set, suggesting solutions. Summarise the results using appropriate charts and tables. Consider possible next steps. Communication Plan and draft a summary document to cover the data, approach, assumptions, results, conclusions and suggested next steps for presentation to a senior actuary. Create appropriate data visualisations to communicate the key conclusions of an analysis.	12L

Text books and References:

1. How to solve it: a new aspect of mathematical method. Polya, G. Penguin, new ed, 1990
2. Mastering financial mathematics in Microsoft Excel: a practical guide for business calculations. 2nd ed. Day, A. Financial Times-Prentice Hall, 2010.
3. Spreadsheet check and control: 47 key practices to detect and prevent errors. O'Beirne, P. Systems Publishing, 2005.
4. Successful ICT projects in Excel. 3rd ed. Heathcote, P. M. Payne-Gallway, 2002.

Course: PUSASQF 5.5A	Statistical and risk modelling - 3 (Credits: 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation.		
Expected Learning Outcomes: At end of the course, students will be able to: 9) Estimate the values based on various forms of data available. 10) Assume the probability and statistical value of the data. 11) Perform basic Linear regression and programming based on unknown dataset. 12) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Loss distributions in insurance risk management Calculate the basic distributional quantities and generating functions Describe how changes in parameters affect these distributions. Recognize classes of distributions and their relationships. Understand various loss distributions for statistical distributions which are suitable for modelling individual and aggregate losses. Identify the applications in which each distribution is used and reasons why. Apply the distribution to an application, given the parameters. Parameter estimation of these loss distribution using various methods of estimation including the situation where data is censored or truncated using MLE. Performing goodness of fit tests Application of compound distribution in risk modelling Discuss the models for short term insurance contracts Define collective and individual risk models and calculate their expectation and variance. Define the distribution and derive the moments for compound poisson, binomial and negative binomial distribution. Understand the concept of parameter variability and uncertainty. Use the normal distribution to approximate the aggregate distribution. Calculate the expected aggregate payments in the presence of an aggregate deductible. Compute aggregate claims distributions Reinsurance arrangements in insurance risk management Understand the role, functions, types, purpose and need of reinsurance. Describe the various types and methods of reinsurance. Evaluate the impacts of coverage modifications: Deductibles, Limits and Coinsurance Derive the distribution and corresponding moments of the claim amounts paid by the insurer and the reinsurer in the presence of excesses (deductibles) and reinsurance. Estimate parameters for censored and truncated data using MLE. Evaluate effects of inflation on losses.	15L

Unit II	Applied Bayesian Modelling and Credibility Theory Perform Bayesian analysis using both discrete and continuous models. Apply conjugate priors in Bayesian analysis and in particular the normal-normal model and Binomial-beta model. Apply empirical Bayesian methods in the nonparametric and semiparametric cases.	15L
Unit III	Risk and ruin theory Understand the concept of ruin and associated basic notations for model building. Describe the aggregate claims process and the surplus process for a risk. Evaluate Poisson process and waiting time distributions between inter events. Define a compound poisson process and calculate the probabilities using simulation. Define the probability of ruin in infinite/finite and continuous/discrete time and state and explain relationships between the different probabilities of ruin. Describe the effect of changing parameter values on ruin probabilities Calculate the adjustment coefficient and state Lundberg's inequality. Study the effect of reinsurance on ruin probabilities Theory of decision making Explain the concepts of decision theory and apply them	15L
Unit IV	Methods and models of loss reserving Explain the role of rating factors and exposure. Describe the different forms of experience rating. Describe and apply techniques for estimating unpaid losses from a run-off triangle, using the following methods: Chain ladder, Average cost per claim and Bornhuetter Ferguson Describe the underlying statistical models for the above-mentioned methods Calculate premiums using the pure premium and loss ratio methods.	15L

Text books and References:

1. An introduction to statistical modelling. Dobson, A. J. Chapman & Hall, 1983
2. Introductory statistics with applications in general insurance. Hossack, I. B.; Pollard, J. H.; Zehnworth, B. 2nd ed. Cambridge University Press, 1999
3. Loss models: from data to decisions. Klugman, S. A.; Panjer, H. H.; Willmot, G. E. 4th. ed. John Wiley, 2012.
4. Non-life actuarial models: theory, methods and evaluation. Tse, Y-K. Cambridge University Press, 2009.
5. Risk modelling in general insurance: from principles to practice. Gray, R.J.; Pitts, S.M. Cambridge University Press, 2012

Course: PUSASQF 5.6A	Pricing and Reserving for Life Insurance Products – 1 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to encourage optimal usage of hardware and software resources, and to spread awareness regarding the hazardous effects of the resources being over utilized or underutilized. It also aims to focus on efficient power consumption, recycling of products and building infrastructures to curb the environmental damage caused due to the increase in requirement of computing and data processing.		
Expected Learning Outcomes: At end of the course, students will be able to: 10) Understand the mechanism and the key factors involved in data center designing. 11) Gain an insight into the standards introduced worldwide. 12) Perform basic calculations and also understand the assessment pro cess for greening the information systems.		
Unit I	Introduction to life table functions Understand the life table functions and notations. Use the table functions to calculate various survival and mortality probabilities Understand and apply approximate methods for fractional ages based on uniform distribution of deaths or constant force of mortality Evaluation of life assurance and annuities Understand, derive and interpret formulas for mean and variances of the payments under various assurance and annuity products Derive and use the relation between the assurance and annuity functions	15L
Unit II	Equation of value Understand and use the relations between assurance and annuity factors using equation of value Net premiums and Reserving Define net premiums Calculate and use probabilities, means and variance of random variables associated with premium Calculate net premiums using various methods: equivalence principle and percentile premium method Extend the concept of net premiums to net reserving through prospective and retrospective approaches Calculate and use probabilities, means, variances, and percentiles of random variables associated with these reserves, including future-loss random variables Calculate and interpret mortality profit for the defined products	15L
Unit III	Gross premiums and Reserving – 1 (Level Benefits) Define gross premiums Calculate and use probabilities, means and variance of random variables associated with premium	15L

	Calculate gross premiums using various methods: equivalence principle and percentile premium method Extend the concept of net premiums to net reserving through prospective and retrospective approaches Calculate and use probabilities, means, variances, and percentiles of random variables associated with these reserves, including future-loss random variables Calculate and interpret mortality profit for the defined products	
Unit IV	Multiple life models Extend the concepts of pricing and reserving of life assurance and annuity products involving 2 lives.	15L
Text books and References: 1. Actuarial mathematics. 2nd ed. Bowers, N. L.; Gerber, H. U.; Hickman, J. C. et al. Society of Actuaries, 1997 2. Actuarial mathematics for life contingent risks. 2nd ed. Dickson, D.C.M.; Hardy, M.R.; Waters, H.R. Cambridge University Press, 2013 3. The analysis of mortality and other actuarial statistics. 3rd ed. Benjamin, B.; Pollard, J. H. Institute and Faculty of Actuaries, 1993 4. Fundamentals of actuarial mathematics. 3rd ed. Promislow, D. John Wiley, 2015. 5. Life assurance mathematics. Scott, W. F. Heriot-Watt University, 1999. 6. Life contingencies. Neill, A. Heinemann, 1977		

Course: PUSASQF 5.5B	Risk Management and Investment Management – 1 (Credits: 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation.		
Expected Learning Outcomes: At end of the course, students will be able to: 13) Estimate the values based on various forms of data available. 14) Assume the probability and statistical value of the data. 15) Perform basic Linear regression and programming based on unknown dataset. 16) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Risk Management: Overview Explain the concept of risk and compare risk management with risk taking. Describe the risk management process and identify problems and challenges that can arise in the risk management process. Evaluate and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative assessment, and enterprise risk management. Distinguish between expected loss and unexpected loss, and provide examples of each. Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management. Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization. Corporate Risk Management: Introduction Evaluate some advantages and disadvantages of hedging risk exposures. Apply appropriate methods to hedge operational and financial risks, including pricing, foreign currency, and interest rate risk. Explain how a company can determine whether to hedge specific risk factors, including the role of the board of directors and the process of mapping risks. Assess the impact of risk management instruments.	15L
Unit II	Enterprise Risk Management – Introduction Describe Enterprise Risk Management (ERM) and compare and contrast differing definitions of ERM. Compare the benefits and costs of ERM and describe the motivations for a firm to adopt an ERM initiative. Describe the role and responsibilities of a Chief Risk Officer (CRO) and assess how the CRO should interact with other senior management. Describe the key components of an ERM program Risk Management, Governance, Culture and Risk taking in Banks	15L

Unit III	Case studies - Financial Disasters Chase Manhattan and their involvement with Drysdale Securities, Kidder Peabody, Barings, Metallgesellschaft, Bankers Trust, JPMorgan, Citigroup, and Enron, Harshad Mehta Scam, Ketan Parekh Scam, PNB Scam, PMC Bank Scam (HDIL), NSEL Scam Deciphering the Liquidity and Credit Crunch 2007—2008 Describe the key factors that contributed to the lending boom and housing frenzy. Explain the banking industry trends leading up to the financial crisis and assess the triggers for the liquidity crisis. Describe how securitized and structured products were used by investor groups and describe the consequences of their increased use. Describe the economic mechanisms through which the mortgage crisis amplified into a financial crisis. Distinguish between funding liquidity and market liquidity and explain how the evaporation of liquidity can lead to a financial crisis. Analyze how an increase in counterparty credit risk can generate additional funding needs and possible systemic risk. Getting Up to Speed on the Financial Crisis Describe the historical background and provide an overview of the 2007–2009 financial crisis. Describe the build-up to the financial crisis and the factors that played an important role. Assess the consequences of the Lehman failure on the global financial markets. Describe the historical background leading to the recent financial crisis. Distinguish between the two main panic periods of the financial crisis and describe the state of the markets during each. Assess the governmental policy responses to the financial crisis and review their short-term impact. Describe the global effects of the financial crisis on firms and the real sector of the economy.	15L
Unit IV	Decoding risk management failures Explain how a large financial loss may not necessarily be evidence of a risk management failure. Analyze and identify instances of risk management failure. Explain how risk management failures can arise in the following areas: measurement of known risk exposures, identification of risk exposures, communication of risks, and monitoring of risks. Evaluate the role of risk metrics and analyze the shortcomings of existing risk metrics.	15L

Text books and References:

1. Risk Management and Financial Institutions (Wiley Finance) by John C. Hull
2. The Essentials of Risk Management by Michel Crouhy (Author), Dan Galai (Author), Robert Mark (Author)

Course: PUSASQF 5.6B	Financial Engineering - 2 (Credits: 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation.		
Expected Learning Outcomes: At end of the course, students will be able to: 17) Estimate the values based on various forms of data available. 18) Assume the probability and statistical value of the data. 19) Perform basic Linear regression and programming based on unknown dataset. 20) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Interest rate derivatives and hedging – 1 Define and describe the following interest rate derivatives: Forward rate agreements, Interest rate futures, Treasury bond futures, Interest rate swaps, European swap options (swaptions), Caps and caplets, Floors and floorlets and Bermudan swaptions Exotic options Define and contrast exotic derivatives and plain vanilla derivatives. Describe some of the factors that drive the development of exotic products. Identify and describe the characteristics and pay-off structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, shout, Asian, exchange, rainbow, and basket options	15L
Unit II	Black model Describe how the Black model is used to value European options on futures Describe how the Black model is used to value European interest rate options and European swaption Interest rate derivatives and hedging – 2 Describe the hedging of interest rate derivatives with respect to the underlying parameters (the Greeks)	15L
Unit III	Models for term structure of interest rates Construct and describe effectiveness of short-term interest rates assuming normally distributed rates both with and without drift Compare and contrast major theories for term structure of interest rates Apply risk neutral probability to calculate discounted value of a zero-coupon	15L

Unit IV	Structured derivatives and synthetic securities Describe securitization and discuss the cashflows in the securitization structure Explain the risk factors that impact structured products (including default risk and default correlation) Describe a simulation approach to calculating credit losses for different tranches in a securitization. Analyze the differences in the mechanics of issuing securitized products using a trust versus a special purpose vehicle (SPV) Define and calculate the delinquency ratio, default ratio, monthly payment rate (MPR), debt service coverage ratio (DSCR), the weighted average coupon (WAC), the weighted average maturity (WAM), and the weighted average life (WAL) for relevant securitized structures. Explain the prepayment forecasting methodologies and calculate the constant prepayment rate (CPR) and the Public Securities Association (PSA) rate. Credit risk analytics Define credit risk and explain how it arises using examples. Explain the components of credit risk evaluation. Describe the role of ratings in credit risk management. Describe classifications of credit risk and their correlation with other financial risks. Define default risk, recovery risk, exposure risk and calculate exposure at default. Explain expected loss, unexpected loss, VaR, and concentration risk, and describe the differences among them. Define risk-adjusted pricing and determine risk-adjusted return on risk-adjusted capital (RARORAC). Apply the Merton model to calculate default probability and the distance to default and describe the limitations of using the Merton model. Apply the two-state model to calculate default probability and extend it to multiple states.	15L
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Text books and References:

1. Options, futures and other derivatives: global edition. 9th ed. Hull, J. C. Prentice Hall, 2017.
2. Financial calculus: an introduction to derivative pricing. Baxter, M.; Rennie, A. CUP, 1996
3. Derivatives: practices and principles. Group of Thirty Global Derivatives Study Group. July 1993
4. Enhancing financial stability and resilience: macroprudential policy, tools and systems for the future. Group of Thirty Macroprudential Working Group; Ferguson, R.W., Jr. 2010.

SEMESTER VI

Course: PUSASQF 6.1	Psychology of human behaviour at work (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to implement object oriented concepts like inheritance, data hiding and polymorphism in programming to help optimization of codes by reducing the lines of code and applying maximum features. This course also aims to understand implementation of classes, objects and methods.		
Expected Learning Outcomes: At end of the course, students will be able to: 11) Use the characteristics of an object oriented programming language in a program. 12) Use the basic object-oriented design principles in computer problem solving. 13) Identify and handle exceptions and that occur in the programs.		
Unit I	Organizational Behaviour - Introduction Understand the importance of interpersonal skills Explain what managers do - management functions, roles, and skills Defining organizational behaviour, disciplines that contribute to the OB field Understand challenges and opportunities for OB - Responding to globalization, managing work force diversity, coping with “temporariness”, helping employees balance work–life conflicts, creating a positive work environment and improving ethical behaviour Attitudes and Job Satisfaction a) Attitudes - Main components of attitudes and major job attitudes b) Job Satisfaction - Measuring job satisfaction. What causes job satisfaction? The impact of satisfied and dissatisfied employees on the workplace	12L
Unit II	Motivation Concepts Defining Motivation and early theories of motivation Also, explain contemporary theories of motivation - goal setting theory, equity theory/ organizational Justice and expectancy theory Leadership Define and explain leadership Understand various trait theories, behavioural theories and the contingency Theory – The Fiedler Model Understand key characteristics of a charismatic leader, transactional leaders, and transformational leaders Describe mentoring in detail	12L
Unit III	Work Teams Understanding differences between groups and teams. Evaluate different types of teams and creating effective teams Conflict and Negotiation Defining Conflict and understand transitions in conflict thought Explain the Conflict Process Describe various bargaining strategies and explain the negotiation process	12L

Unit IV	Emotions Define emotions and moods. Understand the basic emotions and various sources of emotions and moods Understand the concept of emotional intelligence Apply the concept of emotions and moods in organisational behaviour Organizational Change and Stress Management Understand the forces for change and its implication Define, understand in detail and manage work stress	12L
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Text books and References:

1. Aquinas, P. G. (2013). Organisational Behavior Concepts Realities Application and Challenges
2. Greenberg, J. (2013). Behaviour in organizations (10th ed.)
3. Baltus, R. (2012). Personal psychology for work and life. Tata McGraw Hill
4. McShane, S. L., Glinow, M. A., Sharma, R. R. (2012) Organisational behavior. (5th ed.): Tata McGraw Hill
5. Schultz, D. & Schultz, S. (2013). Psychology and work today. Pearson
6. Pareek, U. & Khanna, S. (2011). Understanding organizational behavior. Oxford University Press

Course: PUSASQF 6.2	Predictive Analytics and Machine Learning (Credits : 3 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of an in-depth understanding of the Intel 8085 architecture and programming model. Also to enhance their skills to write assembly level programs and to do efficient I/O and memory management.		
Expected Learning Outcomes: At end of the course, students will be able to: 16) Describe the general architecture of a microcomputer system and 8085 Microprocessor, along with its organization. 17) Understand and realize the interfacing of memory & various I/O devices with 8085 microprocessor. 18) Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming. 19) Understand the architecture and operation of programmable interface devices and realize the programming and interfacing of it with 8085 microprocessor. 20) Understand multi core processor and its advantages.		
Unit I	Issues with big data Describe the issues unique to big datasets. Explain and assess different tools and techniques for manipulating and analyzing big data. Examine the areas for collaboration between econometrics and machine learning.	12L
Unit II	Machine learning – 1 Describe the process of machine learning and compare machine learning approaches. Describe the application of machine learning approaches within the financial services sector and the types of problems to which they can be applied. Analyze the application of machine learning in three use cases: Credit risk and revenue modelling, Fraud, Surveillance of conduct and market abuse in trading Machine learning – 2 Explain and apply high-level concepts relevant to learning from data. Describe and give examples of key supervised and unsupervised machine learning techniques, explaining the difference between regression and classification and between generative and discriminative models. Explain in detail and use appropriate software to apply machine learning techniques (eg 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. Describe the use of AI and machine learning in the following cases: customer-focused uses, operations-focused uses, trading and portfolio management in financial markets, uses for regulatory compliance Describe the possible effects and potential benefits and risks of AI and machine learning on financial markets and how they may affect financial stability.	12L

Unit III	Algorithmic trading and high frequency trading Define algorithmic trading and distinguish between execution algorithms and high-frequency trading algorithms Describe types of execution algorithms and high- frequency trading algorithms Explain market fragmentation and its effects on how trades are placed Describe the use of technology in risk management and regulatory oversight Understand the issues and concerns related to the impact of algorithmic and high-frequency trading on securities markets.	12L
Unit IV	Fintech: Introduction Describe “fintech” Describe Big Data, artificial intelligence, and machine learning; Describe fintech applications to investment management; Describe financial applications of distributed ledger technology. Fintech: Application Describe how fintech is changing operations management in financial services. Explain how fintech innovations have impacted lending and deposit services. Describe how fintech innovations have begun to leverage the execution and stakeholder value associated with payments settlement, cryptocurrencies, blockchain technologies, and cross-border payment services. Examine the issues with respect to investments, financial markets, trading, risk management, robo-advisory, and related services that are influenced by blockchain and fintech innovations	12L
Text books and References: 1. Mathematics for Machine Learning By Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong 2. Feature Engineering and Selection: A Practical Approach for Predictive Models by Max Kuhn and Kjell Johnson 3. Artificial Intellingence: A modern Approach by Stuart Russell and Peter Norvig 4. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani and Jerome Friedman 5. Machine learning with R: expert techniques for predictive modeling to solve all your data analysis problems. Lantz, B. - Packt Publishing, 2013.		

Course: PUSASQF 6.5A	Statistical and risk modelling - 4 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the concept of developing and implementing solutions to problems encountered in all phases of the design process, creating dynamic web pages through JavaScript programming and understanding the interactions between client-side and server-side applications.		
Expected Learning Outcomes: At end of the course, students will be able to: 11)Learn the language of the web: HTML and CSS. 12)Understand the principles of creating an effective web page. 13)Become familiar with the database like MySql via interacting with the XAMPP and WAMP server.		
Unit I	Copulas and its application Define copula and describe the key properties of copulas and copula correlation. Describe how a copula can be characterized as a multivariate distribution function which is a function of the marginal distribution functions of its variates, and explain how this allows the marginal distributions to be investigated separately from the dependency between them Explain association, concordance, correlation and tail dependence. Describe fundamental copulas, implicit and explicit copulas, Archimedean family of copulas, multivariate copula, form of gaussian copula and its properties. Explain the purpose of copula functions and the translation of the copula equation. Describe the Gaussian copula and explain how to use it to derive the joint probability of default of two assets. Summarize the process of finding the default time of an asset correlated to all other assets in a portfolio using the Gaussian copula.	15L
Unit II	Extreme value theory Introduction to extreme events to understand the behaviour of the tails of financial series. Understand the extreme value theory and it's usage to compute tail risk measures and the related confidence intervals to model the distribution of the severity of loss and their relationship. Examine a few theoretical results: block maxima and peak over threshold approach. Understand the application of GEV distribution and generalised pareto distribution. Calculate various measures of tail weight and interpret the results to compare the tail weights	15L
Unit III	Time series models, analysis and forecasting – 1 Stochastic process and its main characteristics, time series as a discrete stochastic process, Stationarity, main characteristics of stochastic processes (means, autocovariance and autocorrelation functions), stationary stochastic processes, stationarity as the main characteristic of stochastic component of time series, lag operator, markov property Autoregressive- moving average models ARMA (p,q) Moving average models MA(q), conditions of invertibility, autoregressive models AR(p), yule-walker equations, stationary conditions, autoregressive moving average models ARMA (p,q)	15L

	Non – stationary time series Time series with non-stationary variance/mean, ARIMA (p,d,q) models, the unit root problem, spurious trends and regression, unit roots tests, PP test Markov Property Show that certain univariate time series models have the markov property and describe how to rearrange a univariate time series model as a multivariate markov model	
Unit IV	Time series models, analysis and forecasting – 2 Detrending and De-seasonalizing a non-stationary data set Learn various method of removing non stationarity from data sets and explain the concept and general properties of stationary, I(0) integrated, I(1), univariate time series. Also, understand the use of box-jenkins methodology to determine the order of integration. Forecasting, Parameter estimation in ARMA (p,q) processes and diagnostic checking in the framework of box-jenkins model Box-jenkins approach of coefficients estimation in autoregressive models, AIC information criterion, ‘Portmonteau test’, box-jenkins methodology to identification of stationary time series models, forecasting, trend and seasonality in box-jenkins model and exponential smoothening Multivariate models Vector autoregression model and co-integration. Describe briefly othe non stationary, non-linear time series models	15L
Text books and References: 1. Forecasting: Principles and Practices 2. Principles of Business forecasting 3. Time series analysis: Forecasting and control		

Course: PUSASQF 6.6A	Pricing and Reserving for Life Insurance Products – 2 (Credits: 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation. Expected Learning Outcomes: At end of the course, students will be able to: 21) Estimate the values based on various forms of data available. 22) Assume the probability and statistical value of the data. 23) Perform basic Linear regression and programming based on unknown dataset. 24) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Transition intensities and multiple decrement model Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events. Understand the basic two state (Alive – Dead) model and calculate the probability values using it. Extend the concept to multiple states and explain how a cashflow, contingent upon multiple transition events, may be valued using a multiple-state Markov Model, in terms of the forces and probabilities of transition. Construct formulae for the expected present values of cashflows that are contingent upon multiple transition events Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events. Construct and use of multiple decrement tables. Understand dependent and independent probabilities for a multiple decrement model given constant forces of transition over year of age and vice versa	15L
Unit II	Gross premium and reserving - 2 (Variable benefits and with profit contracts) Define bonuses, types of it and understand the impact of it on pricing and reserving. Calculate and use probabilities, means and variance of random variables associated with premium Calculate gross premiums using various methods: equivalence principle and percentile premium method Extend the concept of net premiums to net reserving through prospective and retrospective approaches Calculate and use probabilities, means, variances, and percentiles of random variables associated with these reserves, including future-loss random variables Calculate and interpret mortality profit for the defined products	15L

Unit III	Profit testing Describe and apply projected cash flow techniques in pricing, reserving, and assessing profitability of contracts for contingent payments with appropriate allowance for expenses. Also, incorporating multiple decrement models. Understand and use the following terms: profit vector, the profit signature, the net present value, and the profit margin	15L
Unit IV	Profit testing Understand and use the concept of zeroization i.e. establishing non unit reserves eliminating the future negative cashflows using a profit test model.	15L

Text books and References:

1. Actuarial mathematics. 2nd ed. Bowers, N. L.; Gerber, H. U.; Hickman, J. C. et al. Society of Actuaries, 1997
2. Actuarial mathematics for life contingent risks. 2nd ed. Dickson, D.C.M.; Hardy, M.R.; Waters, H.R. Cambridge University Press, 2013
3. The analysis of mortality and other actuarial statistics. 3rd ed. Benjamin, B.; Pollard, J. H. Institute and Faculty of Actuaries, 1993
4. Fundamentals of actuarial mathematics. 3rd ed. Promislow, D. John Wiley, 2015.
5. Life assurance mathematics. Scott, W. F. Heriot-Watt University, 1999.
6. Life contingencies. Neill, A. Heinemann, 1977

Course: PUSASQF 6.5A	Risk Management and Investment Management – 2 (Credits : 4 Lectures/Week : 5)	
Objectives: The objective of introducing this course is to encourage optimal usage of hardware and software resources, and to spread awareness regarding the hazardous effects of the resources being over utilized or underutilized. It also aims to focus on efficient power consumption, recycling of products and building infrastructures to curb the environmental damage caused due to the increase in requirement of computing and data processing.		
Expected Learning Outcomes: At end of the course, students will be able to: 13) Understand the mechanism and the key factors involved in data center designing. 14) Gain an insight into the standards introduced worldwide. 15) Perform basic calculations and also understand the assessment process for greening the information systems.		
Unit I	Portfolio Risk: Analytical methods Understand and calculate various VaR measures. Also, understand usefulness of VaR measures and its importance in portfolio construction VaR and risk budgeting Understand various risks and risk budgeting Risk budgeting and management process in investment management industry	15L
Unit II	Portfolio construction Construction of portfolio considering VaR, tracking error and risk budgets Investment strategies Understand and develop various appropriate investment strategy.	15L
Unit III	Investment indices Describe the construction of investment indices Portfolio performance measurement Assess the performance of the portfolio relative to market index and benchmark portfolio Understand various risk adjusted performance measures	15L
Unit IV	Hedge funds Understand the hedge fund industry and its evolution Also, understand various concepts and terms pertaining to hedge fund industry Due Diligence Understand model risk and fraud risk with its assessment Also, explain the due diligence process used to assess investment managers	15L

Text books and References:

1. Asset pricing. Cochrane, J. H. Rev. ed. and earlier Princeton University Press, 2005
2. Principles of corporate finance. Brealey, R. A.; Myers, S. C.; Allen, F. 10th ed. and earlier McGraw-Hill, 2010.
3. The monetary and financial system. Goacher, D. 4th ed. Chartered Institute of Banking, 1999

Course: PUSASQF 6.6B	BASEL (Credits: 4 Lectures/Week : 5)	
Objectives: The objective of this course is to introduce the basic statistical techniques that are to be implemented in real world scenarios as per industry standards and also gives a general overview on approximation.		
Expected Learning Outcomes: At end of the course, students will be able to: 25) Estimate the values based on various forms of data available. 26) Assume the probability and statistical value of the data. 27) Perform basic Linear regression and programming based on unknown dataset. 28) Students will be able to gain theoretical knowledge for solving simple problems.		
Unit I	Operational risk and principles of sound management Understand operational risk and the guidelines provided by the basel committee on banking supervision publication, June 2011 Basel regulation: Overview Understand the motivation for introducing basel norms, including key risks exposures addressed and explain the reasons for revision to Basel regulation over time	15L
Unit II	Basel 1 Calculate risk weighted assets and capital requirement as per the Basel 1 guidelines Market, Credit and Operational risk capital Calculate market, credit and operational risk capital using various approaches Also, understand and contrast between various approaches to calculate risk capital	15L
Unit III	Basel 2 Understand the key elements and context of basel 2 SCR and MCR (Solvency capital requirements and Minimum capital requirement) Understand solvency 2 framework and compare various approach for calculating SCR Basel 2.5 Understand the key elements and context of basel 2.5	15L
Unit IV	Basel 3 Understand the motivation for and calculate the buffers introduced in basel 3 Also, understand and calculate ratios intended to improve the management of liquidity risk Money laundering and financial terrorism Understand the best practices recommended by basel committee on money laundering and financial terrorism Understand anti-money laundering act guidelines applicable in India Also, explain practices for managing MLFT risks and due diligence process that a bank should follow	15L

Text books and References:

1. Banking Risk Management with Basel Capital Adequacy Norms: With Case Studies to gauge the Impact on Indian Banks by Swapna Samantha
2. Basel committee on banking supervision (All papers)

