

M.Sc. ACTUARIAL SCIENCE SYLLABUS

(Under Choice Based Credit System)
(For the Students admitted in the academic year 2021-22)



PG DEPARTMENT OF ACTUARIAL SCIENCE

BISHOP HEBER COLLEGE (AUTONOMOUS)

(Nationally Reaccredited with A+ Grade by NAAC)

Tiruchirappalli– 620017

Vision

Building a centre of excellence in actuarial and current business trends to sort after professionals who develop and communicate solutions for complex financial issues of nation and also inculcating values in order to address the problems of humanity.

Mission

1. Our curriculum includes a capstone course that integrates education in professional standards, ethics and practical application of actuarial theory with commonly used actuarial models, software and technologies.
2. Providing multiple areas of concentration for actuarial science majors such as life, health, property, casualty or enterprise risk management.
3. Enable the students to become well-educated graduates who can make significant contributions to the financial security of individuals, corporate organizations and society through the ability to identify, quantify, assess and manage risk and uncertainty.

PROGRAMME OUTCOMES

KNOWLEDGE (PG)

PO1: Ability to apply the actuarial concepts and models for life risk management.

PO2: Familiarize with the role of insurance in society, basic economic theory and the basics of how insurance and financial market operates.

PO3: Attain a high level of proficiency in research methodology and computer technology towards actuarial aspects.

SKILLS (PG)

PO4: Formulate practical problems in actuarial terms and design an appropriate actuarial model for solutions.

PO5: Demonstrate ability to conduct quantitative risk analysis to identify consequences of events in actuarial profession.

PO6: Express familiarity with several technical tools, statistical software packages used for actuaries' application.

ATTITUDES (PG)

PO7: Inculcate lifelong learning through continuous professional development.

PO8: Attain critical thinking to make decisions and able to apply at life risk situations.

ETHICS AND SOCIAL VALUES (PG)

PO9: Recognize and appreciate importance of ethical stand in professional work.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Analyze the important issues of industries including insurance, government, business and academic research with suitable approach for solutions.

PSO2: Predict uncertain events for insurance policy income, pension scheme pay-outs and stock market performance.

PSO3: Demonstrate to provide professional solutions at risk situations.

PSO4: Design and analyze the insurance schemes based on the public interest and the regulation of the insurance industry.

Sem.	Course	Course Title	Course Code	Hours / week	Credits	Marks			
						CIA	ESE	Total	
I	CORE I	Actuarial Statistics – I	P19AS101	6	5	25	75	100	
	CORE II	Actuarial Mathematics – I	P19AS102	6	5	25	75	100	
	CORE III	Actuarial Mathematics – II	P19AS103	6	4	25	75	100	
	CORE IV	Survival Analysis –I	P19AS104	6	4	25	75	100	
	ELECTIVE I	Principles of Insurance	P19AS1:1	6	4	25	75	100	
					Sem I Credits:	22			
II	CORE V	Actuarial Statistics – II	P19AS205	5	4	25	75	100	
	CORE VI	Actuarial Mathematics – III	P19AS206	5	4	25	75	100	
	CORE VII	Actuarial Mathematics – IV	P19AS207	5	4	25	75	100	
	CORE VIII	Survival Analysis –II	P19AS208	5	4	25	75	100	
	CORE IX	Risk Modelling	P19AS209	5	4	25	75	100	
	ELECTIVE II	Programming Using R	P19AS2:P	3	2	40	60	100	
	VLO	RI/MI	P17VL2:1/ P17VL2:2	2	2	25	75	100	
					Sem II Credits:	24			
III	CORE X	Business Economics – I	P19AS310	6	4	25	75	100	
	CORE XI	Business Finance – I	P19AS311	6	5	25	75	100	
	CORE XII	Financial Engineering – I	P19AS312	6	5	25	75	100	
	ELECTIVE III	Actuarial Practice	P20AS3:3	6	5	25	75	100	
	ELECTIVE IV	Advanced MS-EXCEL	P19AS3:P	6	4	40	60	100	
					Sem III Credits:	23			
IV	CORE XIII	Business Economics – II	P19AS413	6	4	25	75	100	
	CORE XIV	Business Finance – II	P19AS414	6	4	25	75	100	
	CORE XV	Financial Engineering – II	P19AS415	6	4	25	75	100	
	ELECTIVE V	Python Programming Language	P19AS4:P	6	4	40	60	100	
	CORE Project	Project	P19AS4PJ	6	5	--	--	100	
					Sem IV Credits:	21			
					Total Credits:	90			
CORE Theory: 15 CORE Project: 1 ELECTIVE :5 Value Education: 1						Total:	22		

PROGRAMME ARTICULATION MATRIX

S. No	COURSE NAME	COURSE CODE	CORRELATION WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES												
			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
1.	Actuarial Statistics – I	P19AS101	H	H	H	H	M	L	L	L	-	H	M	L	-
2.	Actuarial Mathematics – I	P19AS102	H	M	H	H	M	M	M	M	M	H	M	L	-
3.	Actuarial Mathematics – II	P19AS103	H	M	M	H	M	L	L	-	-	H	L	M	-
4.	Survival Analysis – I	P19AS104	H	M	M	M	L	L	M	M	-	M	M	M	-
5	Principles of Insurance	P19AS1:1	H	H	H	M	M	L	L	L	L	H	M	L	-
6.	Actuarial Statistics – II	P19AS205	H	M	M	M	L	M	L	M	L	H	M	M	L
7.	Actuarial Mathematics – III	P19AS206	H	M	L	M	M	L	M	M	L	H	M	L	L
8.	Actuarial Mathematics – IV	P19AS207	H	M	H	M	L	L	-	L	M	H	M	L	L
9.	Survival Analysis – II	P19AS208	H	M	H	M	M	H	M	-	L	M	M	M	-
10.	Risk Modelling	P19AS209	H	M	M	M	M	M	-	-	-	M	L	-	-
11.	Programming Using R	P19AS2:P	M	M	M	-	L	L	-	M	-	M	-	L	-
12.	Business Economics – I	P19AS310	H	M	M	H	L	M	-	-	H	M	-	-	H
13.	Business Finance – I	P19AS311	H	M	M	M	M	L	L	M	L	M	M	-	L
14.	Financial Engineering – I	P19AS312	H	H	H	M	M	M	-	-	M	M	L	-	-
15.	Actuarial Practice	P20AS3:3	H	H	H	M	M	M	M	L	L	L	-	M	L

16.	Advanced MS-EXCEL	P19AS3:P	M	M	M	-	L	L	-	M	-	M	-	L	-
17.	Business Economics – II	P19AS413	H	M	L	M	M	L	-	M	M	H	L	-	L
18.	Business Finance – II	P19AS414	H	M	L	H	M	L	M	M	M	M	M	L	L
19.	Financial Engineering – II	P19AS415	H	H	H	M	M	M	-	-	-	L	L	M	-
20.	Python Programming Language	P19AS4:P	M	M	M	-	L	L	-	M	-	M	-	L	-

SEMESTER-I

CORE I: ACTUARIAL STATISTICS – I

Semester: I
Credits: 5

Code: P19AS101
Hours/Week: 6

1. COURSE OUTCOMES

At the end of the course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Demonstrate problem-solving techniques needed to accurately calculate probabilities.	K2	I
CO2	Identify then different types of distribution to fitting model	K3	II
CO3	Apply problem-solving techniques to solving in Actuarial Field	K3	II, III
CO4	Examine the analysis of derived statistics in Actuarial field	K4	IV
CO5	Choose problem solving techniques in testing of Hypothesis	K5	V
CO6	Test simulated data from the given distributions and compare with normal distribution	K6	V

2.A. SYLLABUS

UNIT I: Probability distributions & Generating functions

(10 Hours)

Introduction- Important discrete distributions- Important continuous distributions- The Poisson process - Monte Carlo simulation - Generating functions Introduction - Moment generating functions - Cumulant generating functions – Definition- Calculating moments - Linear functions - Further applications of generating functions.

UNIT II: Joint distributions

(14 Hours)

Introduction - Joint distributions - Joint probability (density) functions - Conditional probability (density) functions - Independence of random variables - Expectations of functions of two variables – Convolutions - Moments of linear combinations of random variables - Using generating functions to derive distributions of linear combinations of independent random variables - Moment generating functions - Using MGFs to derive relationships among variables

UNIT III: Conditional expectation & The Central Limit Theorem

(12 Hours)

The conditional expectation $E[Y | X = x]$ - The random variable $E[Y | X]$ - The random variable $\text{var}[Y | X]$ and the ' $E[V] \text{var}[E]$ ' result - The Central Limit Theorem - Normal approximations - The continuity correction - Comparing simulated samples.

UNIT IV: Sampling and statistical Inference & Point estimation: (12 Hours)

Introduction - Basic definitions - Moments of the sample mean and variance - Sampling distributions for the normal - The t result - The F result for variance ratios - The method of moments - The method of maximum likelihood – Unbiasedness - Mean square error - Asymptotic distribution of MLEs - Comparing the method of moments with MLE - The bootstrap method

UNIT V: Confidence intervals & Hypothesis testing (12 Hours)

Introduction - Confidence intervals in general - Derivation of confidence intervals - Confidence intervals for the normal distribution - Confidence intervals for binomial & Poisson parameters - Confidence intervals for two-sample problems - Paired data - Hypotheses, test statistics, decisions and errors - Classical testing, significance and p-values - Basic tests – single samples - Basic tests – two independent samples - Basic test – paired data - Tests and confidence intervals - Non-parametric tests - Chi-square tests.

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	Probability and its distribution	https://youtu.be/VoOPzXPYzBo
2	Joint distribution	https://youtu.be/3bvlrplmOMg
3	Conditional Expectations	https://youtu.be/7On58EASoRw
4	Sampling Inference	https://youtu.be/eaqMBXnf4yo

C. TEXTBOOK

1. Acted Study Material: Subject –CS1 A

D. REFERENCES

1. Mathematical statistics. Freund, John E f - 6th ed. - Prentice Hall International, 1999, ISBN: 0 13 974155 0.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course contents	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	Probability distributions & Generating functions		
1.1	Introduction- Important discrete distributions- Important continuous distributions- The	Explain the probabilities and quantiles associated with	K2

	Poisson process - Monte Carlo simulation	discrete probability distributions	
1.2	Generating functions Introduction - Moment generating functions – Cumulant generating functions – Definition- Calculating moments - Linear functions - Further applications of generating functions.	Apply the generating moments and cumulants for various discrete distributions	K3
II	Joint Distribution		
2.1	Introduction - Joint distributions - Joint probability (density) functions - Conditional probability (density) functions - Independence of random variables - Expectations of functions of two variables – Convolutions	Make use of the concept of , what is meant by jointly distributed random variables, marginal distributions and conditional distributions.	K3
2.2	Moments of linear combinations of random variables - Using generating functions to derive distributions of linear combinations of independent random variables - Moment generating functions - Using MGFs to derive relationships among variables	Apply the concept to generate Moments and functions and able to find the relationship between variables	K3
III	Expectation & CLT		
3.1	The conditional expectation $E [Y X = x]$ - The random variable $E [Y X]$ - The random variable $\text{var} [Y X]$ and the ‘ $E [V]$ $\text{var}[E]$ ’ result - The Central Limit Theorem - Normal approximations - The continuity correction - Comparing simulated samples.	Expectations, conditional expectations Define the conditional expectation of one random variable given the value of another random variable, and calculate such a quantity.	K3
IV	Statistical Inference		
4.1	Introduction - Basic definitions - Moments of the sample mean and variance - Sampling distributions for the normal - The	Explain various types of sampling and the relationship between	K2

	t result - The F result for variance ratios - The method of moments -	various sampling distributions	
4.2	The method of maximum likelihood – Unbiasedness - Mean square error - Asymptotic distribution of MLEs - Comparing the method of moments with MLE - The bootstrap method	Inference the method of moments for constructing estimators of population parameters.	K4
V	Confidence Interval		
5.1	Introduction - Confidence intervals in general - Derivation of confidence intervals - Confidence intervals for the normal distribution - Confidence intervals for binomial & Poisson parameters - Confidence intervals for two-sample problems - Paired data - Hypotheses, test statistics, decisions and errors -	Choose the confidence interval for distributions	K5
5.2	Significance and p-values - Basic tests – single samples - Basic tests – two independent samples - Basic test – paired data - Tests and confidence intervals - Non-parametric tests - Chi-square tests.	Develop the test for hypothesis in various situation and conclude	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO2	PSO3	PSO4
CO1	H	H	H	H	M	L	-	-	-	H	M	-	-
CO2	H	M	M	M	-	M	L	L	-	H	M	L	-
CO3	H	M	M	M	-	M	L	L	-	H	M	L	-
CO4	H	H	H	M	M	L	L	L	-	H	M	L	-
CO5	-	H	H	H	M	L	-	L	L	H	-	M	-
CO6	-	H	H	H	M	L	-	L	L	H	-	M	-

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Mr. Y. Franklin Gnanaiah
Course Coordinator

CORE II: ACTUARIAL MATHEMATICS - I

Semester: I
Credits: 5

Code: P19AS102
Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Understand the different types of cash flow models	K2	I
CO2	Build the model to handle different situations of compound interest problems in banking and financial sectors	K3	II
CO3	Apply the different types of interest rates	K3	III
CO4	Categorize various models related to interest Rates	K4	IV
CO5	Assess to identify and classify the varying annuities on the basis of cash flows.	K5	IV
CO6	Develop to analyze different types of annuities and to know, how to handle that.	K6	V

2.A. SYLLABUS

UNIT I: Data analysis

(12 Hours)

Introduction - Aims of a data analysis - The data analysis process - Data sources - Reproducible research - Principles of actuarial modelling – Introduction – Models - Modelling – the benefits and limitations - Stochastic and deterministic models - Discrete and continuous state spaces and time sets - Scenario-based and proxy models - Suitability of a model - Short-term and long-term properties of a model - Analyzing the output of a model - Sensitivity testing - Communication of the results – Cash flow models - Cash flow process - Examples of cash flow scenarios - Insurance contracts.

UNIT II: The time value of money

(12 Hours)

Introduction – Interest - Present values - Discount rates - Effective rates of interest and discount - Equivalent rates - Interest rates - Nominal rates of interest and discount - The force of interest - Relationships between effective, nominal and force of interest - Force of interest as a function of time.

UNIT III: Real and money interest rates

(12 Hours)

Introduction - Definition of real and money interest rates - Deflationary conditions - Usefulness of real and money interest rates - Discounting and accumulating - Present values of cash flows - Valuing cash flows - Interest income.

UNIT IV: Level annuities (12 Hours)

Introduction - Present values – Accumulations - Continuously payable annuities - Annuities payable monthly - Non-integer values of n – Perpetuities - Deferred annuities.

UNIT V: Increasing annuities (12 Hours)

Introduction - Varying annuities - Annual payments - Continuously payable annuities - Decreasing payments - Special cases - Irregular payments - Compound increasing annuities.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1.	Individual risk models for a short - Benefit reserves--Analysis of benefit reserves	http://actuaries.cirgahosting.com/HeritageScripts
2.	Survival distributions and life tables	http://actuaries.cirgahosting.com/HeritageScripts
3.	Term Life insurance --Life annuities--Benefit premiums	http://actuaries.cirgahosting.com/HeritageScripts
4.	Multiple life functions—Multiple decrement models--Collective risk models for a single period	http://actuaries.cirgahosting.com/HeritageScripts

C. TEXTBOOK

1. Actuarial Mathematics – CM1, Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. McCutcheon, John J; Scott, William F. London: **An introduction to the mathematics of finance.** Heinemann, 1986. 463 pages. ISBN: 0 434 91228 x.
2. Butcher, M V; Nesbitt, Cecil J. **Mathematics of compound interest.** Ulrich's Books, 1971. 324 pages.
3. Ingersoll, Jonathan E. Rowman & Littlefield, **Theory of financial decision making.** 1987. 474 pages. ISBN: 0 8476 7359 6.
4. Kellison, Stephen G. **The theory of interest.** 2nd ed. Irwin, 1991. 446 pages. ISBN: 0 256 09150 1. Available from the publication's Unit.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	Data analysis		
1	Data analysis: Introduction, Aims of a data analysis, The data analysis process.	Explain the concept of Data analysis, handling data, purpose of data collection.	K2
1.2	Introduction Models, Modelling - The benefits and limitations	Know about modelling the data, applying the model, Reproducible research,	K2
1.3	Stochastic and deterministic models, Discrete and Continuous state spaces and time sets, Scenario-based and proxy models, Suitability of a model, Short-term and long-term properties of a model, Analysing the output of a model, Sensitivity Testing, Communication of the results	Know about different model with its application Analyse the different model to choose the best model on the basis of duration.	K3
1.4	Cash flow process, Examples of Cash flow scenarios, A Zero-coupon Bond, A fixed interest security, an index linked security, Cash on deposit, An Equity, Annuity certain, An interest only loan A repayment loan, insurance contracts.	Know about cash flow structures and different types of cash flows.	K3
II	Time value of money		
2.1	Introduction, Interest Present values, Discount rates, Effective rates of interest and discount, Equivalent rates Interest rates, Nominal rates	Time value of money, real value of money, effective rate of interest Know about Nominal Interest Rate, force of	K3

	of interest, Nominal rates of discount, The force of interest, Relationships between effective, Nominal and force of interest, Force of interest as a function of time	Interest	
III	Real and money interest rates		
3.1	Introduction, Definition of real and money interest rates, Deflationary conditions, Usefulness of real and money interest rates.	Real and money Rate of interest rate and learn about the usefulness of real and money rate of interest.	K3
3.2	Present values of cash flows, valuing cash flows, Interest income.	Know to calculate the present value and accumulation value of a cash flows	K3
IV	Level annuities		
4.1	Introduction, Present values, Accumulations, Continuously payable, Annuities, Annuities payable Pthly, Non-integer values of n, Perpetuities, Deferred annuities.	Analyze the different types of Annuities	K4
V	Increasing annuities		
5.1	Introduction, Varying annuities, Annual payments, Continuously Payable annuities, decreasing payments, Special cases, Irregular payments, Compound Increasing annuities.	Formulate the new equations for Increasing annuities	K6

4. Mapping Scheme for the PO, PSOS & COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	M	L	-	-	-	H	M	-	-
CO2	H	M	M	M	-	M	M	L	-	H	M	L	-
CO3	H	M	M	M	-	M	M	L	-	H	M	L	-
CO4	H	M	H	M	M	M	M	L	-	H	M	L	M
CO5	-	M	H	H	M	L	-	L	L	H	-	M	-
CO6	H	H	H	H	M	L	-	L	L	H	-	M	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. D. Hebsiba Beula
Course Coordinator

CORE III: ACTUARIAL MATHEMATICS - II

Semester: I

Credits: 4

Code: P19AS103

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Outline and illustrate the life table functions for the concept of life assurance policies and its benefits.	K2	I
CO2	Outline and illustrate the life table functions for the concept of life annuities and its benefits.	K2	II
CO3	Apply the concept of equation of value to find variable benefits for with-profit policies.	K3	III
CO4	Evaluate gross premiums under different payment periods	K5	IV
CO5	Estimate gross future loss random variables	K5	IV
CO6	Formulate gross premium prospective and retrospective reserves using recursive relation	K6	V

2.A. SYLLABUS

UNIT I: The life table & Life assurance contracts (12 Hours)

Introduction - Present values of payments under life insurance and annuity contracts - The life table - Life table functions at non-integer ages- Evaluating probabilities without use of the life table - Select mortality - Whole life assurance contracts - Term assurance contracts - Pure endowment contracts - Endowment assurance contracts - Deferred assurance benefits - Benefits payable immediately on death - Evaluating means and variances using select mortality.

UNIT II: Life annuity contracts & Evaluation of assurances and annuities (12 Hours)

Life annuity contracts - Whole life annuities payable annually in arrears - Whole life annuities payable annually in advance - Temporary annuities payable annually in arrears - Temporary annuities payable annually in advance - Deferred annuities - Deferred annuities-due - Guaranteed annuities payable annually in advance - Guaranteed annuities payable annually in arrears - Continuous annuities - Evaluating means and variances using select mortality - Evaluating assurance benefits - Evaluating annuity benefits - Premium conversion formulae - Expected present values of annuities payable m times each year - Expected present values under a constant force of mortality.

UNIT III: Variable benefits and conventional with-profits policies (12 Hours)

Variable payments - Payments varying at a constant compound rate - Payments varying by a constant monetary amount - Whole life assurance - Term assurance - Endowment

assurance - Decreasing term assurance - Increasing assurances payable immediately on death - Whole life annuity payable annually in arrears - Whole life annuity payable annually in advance - Temporary annuities - Annuities payable continuously - Conventional with-profits contracts - Types of bonus.

UNIT IV: Gross premiums (12 Hours)

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

UNIT V: Gross premium reserves (12 Hours)

Introduction - Why hold reserves? - Prospective reserves - Retrospective reserves - Equality of prospective and retrospective reserves - Recursive relationship between reserves for annual premium contracts - Net premium reserves for conventional without profit contracts.

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	Life Table	http://users.stat.ufl.edu/~rrandles/sta4930/4930lectures/chapter3/chapter3R.pdf
2	Annuity	https://www.youtube.com/watch?v=UHdsZhbG5vo
3	Assurance	https://www.youtube.com/watch?v=nUCFjW3LpaE
4	Gross Premium	http://www.actuariesindia.org/2.A. SYLLABUS/2019/CM1.pdf

C. TEXTBOOK

1. Actuarial Mathematics – CM2, Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. McCutcheon, John J; Scott, William F. London: An introduction to the mathematics of finance. Heinemann, 1986. 463 pages. ISBN: 0 434 91228 x.
2. Butcher, M V; Nesbitt, Cecil J. Mathematics of compound interest. Ulrich's Books, 1971. 324 pages.
3. Ingersoll, Jonathan E. Rowman & Littlefield, Theory of financial decision making. 1987. 474 pages. ISBN: 0 8476 7359 6.
4. Kellison, Stephen G. The theory of interest. 2nd ed. Irwin, 1991. 446 pages. ISBN: 0 256 09150 1. Available from the publication's Unit.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	The life table & Life assurance contracts		
1.1	Present values of future payments using different interest rates, mortality rates, evaluating the probabilities	Outline the calculation of present values, usage of mortality tables, applying appropriate probabilities	K2
1.2	Annuities and assurances, Different types of life insurance contracts.	Summarize the basics of different types of annuities and assurances which will come in different types of life insurance contracts.	K2
1.3	Deferred payments, payments paid immediate on events, means and variances of select mortality	Relate the deferred payments using interest rate, and mortality. Calculations of means and variances for select Mortality	K2
II	Life annuity contracts & Evaluation of assurances and annuities		
2.1	Whole life annuity, deferred annuity, temporary annuity	Identify the different types of annuities and valuating the future payments. Using different formula for various types of annuities.	K3
2.2	Increasing and decreasing annuities,	Understanding the functions of different	K3

	annuity certain, continuous annuity, guaranteed annuity.	annuities, and their applications in real time insurance products.	
2.3	Conventional with profit contracts, types of bonuses, Premium conversion formula	Evaluate the profit distribution, premium loading, continuous and discrete distribution.	K3
III	Variable benefits and conventional with-profits policies		
3.1	Variable benefits and conventional with profit contracts, inflation eroded benefits, guaranteed certain benefits, impact of interest rate in benefits and premiums	Understanding the variable benefits under with profit contracts, inflation adjusted payments, variable benefits according to variable interest rates.	K4
IV	Gross premiums		
4.1	Gross premium, future loss random variable, premium payment structures, annual premium, net premium reserves, principles of equivalence, expenses loading in premium	Assess the gross and net premium, different methods of premium payment mode, equating the cash inflow and cash outflow, spreading the cost in premium.	K5
V	Gross premium reserves		
5.1	Reserve calculation, prospective and retrospective reserve, recursive relationship between reserves for annual premium calculation, net	Estimate the reserves by prospective and retrospective method, reserves at different time period, loading the premium in accordance with reserves, able to use	K6

	premium reserves for conventional without profit contracts.	appropriate formula for with and without profit contracts.	
--	---	--	--

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	M	L	-	-	-	H	M	-	-
CO2	H	M	M	M	-	M	L	L	-	H	M	L	-
CO3	H	M	M	M	-	M	L	L	-	H	L	L	-
CO4	H	M	M	M	M	L	L	L	-	H	L	L	-
CO5	-	H	H	H	M	L	-	L	L	H	-	M	-
CO6	-	H	H	H	M	L	-	L	L	H	-	M	-

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
2. Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
3. Pre/Post Test, Viva, Report for each Exercise.
4. Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. P. Nithya
Course Coordinator

CORE IV: SURVIVAL ANALYSIS -I

Semester: I

Code: P19AS104

Credits: 4

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Illustrate the real time application of stochastic process.	K2	I
CO2	Identify the methods of stochastic process.	K3	I
CO3	Identify the different kinds of Markov Chains.	K3	II
CO4	Examine the two-state Markov model and the Poisson model.	K4	III
CO5	Determine the Time-homogeneous Markov jump processes.	K5	IV
CO6	Estimate the Time-inhomogeneous Markov jump processes.	K6	V

2.A. SYLLABUS

UNIT I: Stochastic processes

(12 Hours)

Types of stochastic processes - Discrete state space with discrete time changes - Discrete state space with continuous time changes - Continuous state space - Displaying observed data - Processes of mixed type - Counting processes - Defining a stochastic process - Sample paths – Stationarity – Increments - The Markov property – Filtrations - White noise - General random walk - Poisson process - Compound Poisson process-Time series.

UNIT II: Markov chains

(12 Hours)

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

UNIT III: The two-state Markov model and the Poisson model (12 Hours)

Introduction - The two-state Markov model - Assumptions underlying the model - Comparison with other models - Survival probabilities – Statistics – Definitions - Joint density function - The maximum likelihood estimator - Maximizing the likelihood function - Properties of the maximum likelihood estimator - Alternative method of obtaining the asymptotic distribution - The Poisson model - The Poisson distribution - The Poisson model of mortality - Estimating the underlying force of mortality - Links to the two-state Markov model - Estimating death probabilities - Comment on application.

UNIT IV: Time-homogeneous Markov jump processes (12 Hours)

Notation - The Poisson process - Sums of independent Poisson processes - Thinning of Poisson processes - Inter-event times - Features of time-homogeneous Markov jump processes - The Chapman-Kolmogorov equations - The transition matrix - Transition rates - The time-homogeneous health-sickness- death model - Kolmogorov’s forward differential equations - Kolmogorov’s backward differential equations - The Poisson process revisited - Holding times and occupancy probabilities - Expected time to reach state k starting from state I - The jump chain - Solutions of Kolmogorov equation in elementary cases - The maximum likelihood estimator in the general model - Maximum likelihood estimators - Properties of the estimators - Calculating the total waiting time.

UNIT V: Time-inhomogeneous Markov jump processes (12 Hours)

Features of time-inhomogeneous Markov jump processes - Kolmogorov’s forward differential equations - Occupancy probabilities - Kolmogorov’s backward differential equations - Example – a two-state model - Residual holding times - Integrated form of the Kolmogorov backward equations - Integrated form of the Kolmogorov forward equations – Applications - Modelling and simulation.

B. TOPICS FOR SELF STUDY

Sl. No.	Topics	Reference
1	Stochastic processes	https://youtu.be/Llf78-XbLTo
2	Markov chains	https://youtu.be/i3AkTO9HLXo
3	The two-state Markov model	https://youtu.be/sZms_73V6bU
4	Time-homogeneous Markov jump processes	https://youtu.be/KZOoEu3rucY

C. TEXTBOOK

1. Actuarial Statistics – CS2, Institute and faculty of Actuaries, UK (IFOA), 2019

D. REFERENCES

1. Basic stochastic processes; A course through exercises. – Brzezniak, Zdzislaw; Zastawniak, Tomasz. – Springer, 1998. – x, 225 pages. – ISBN: 3 540 76175 6. Available from the Publications Unit.
2. Modeling, analysis, design, and control of stochastic systems. – Kulkarni, Vidyadhar G. Springer, 1999. – xiv, 374 pages. – ISBN: 0 387 98725 8.
3. Probability and random processes. – Grimmett, Geoffrey; Stirzaker, David. – 3rd ed. – Oxford University Press, 2001. – xii, 596 pages. – ISBN: 0 19 857222 0

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course Content	Learning outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Stochastic processes		
1.1	Types of stochastic process, Discrete state space with discrete time changes, Discrete state space with continuous time changes.	Explain the concepts of principles of stochastic processes, and their classification.	K2
1.2	Continuous state space, displaying observed data, Processes of mixed type, Counting processes.	Outline the possible applications of mixed processes	K2
1.3	Defining a stochastic process, Sample paths, Stationarity, Increments, The Markov property, Filtrations, White noise, General random walk, Poisson process, Compound Poisson process.	Summarize the Markov property in the context of a stochastic process and in terms of filtrations.	K3
II	Markov chains		
2.1	The Chapman-Kolmogorov equations, Time-homogeneous Markov chains, Time-inhomogeneous Markov chains.	Apply the essential features of a Markov model.	K3

2.2	A model of a no claims discount policy, another model of NCD, the long-term distribution of a Markov chain, the stationary probability distribution, the long-term behavior of Markov chains, Modelling using Markov chains, estimating transition probabilities, Assessing the fit.	Solve the problems of the stationary distribution for a Markov chain in simple cases.	K3
III	The two-state Markov model and the Poisson model		
3.1	Comparison with models, Joint density function, the maximum likelihood estimator, Maximizing the likelihood function, Properties of the maximum likelihood estimator, Alternative derivation, Application of μ_x , The central exposed to risk.	Examine the two-state model of a single decrement and compare its assumptions with those of the random lifetime model.	K4
3.2	The Poisson Model, The Poisson distribution, The Poisson Model of Mortality, Estimating the underlying force of Mortality, Links to the two states Markov Model, Estimating death Probabilities.	Examine the Poisson approximation to the estimator in the case of a single decrement.	K4
IV	Time-homogeneous Markov jump processes		
4.1	Features of time-homogeneous Markov jump processes, Kolmogorov's backward differential equations, The Poisson process revisited, holding times and occupancy probabilities, expected time to reach state k starting from state i, The jump chain.	Analyze the Kolmogorov equations for a Markov process with time independent transition intensities.	K4
4.2	The maximum likelihood estimator in the general model, Maximum likelihood estimators, Properties of the estimators, Calculating the total waiting time.	Test the Kolmogorov equations in simple cases.	K4
V	Time-inhomogeneous Markov jump processes		

5.1	Features of time-inhomogeneous Markov jump processes, Kolmogorov's forward differential equations, Occupancy probabilities, Kolmogorov's backward differential equations, and Residual holding times.	Defend the Kolmogorov equations for a Markov process with time/age dependent transition intensities.	K5
5.2	Integrated form of the Kolmogorov backward equations, Integrated form of the Kolmogorov forward equations, Applications, Modeling and Simulation.	Estimate the Kolmogorov equations in simple cases.	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H	-	L	L	M	-	L	M	-	M	-
CO2	H	-	H	L	M	L	L	-	-	M	L	M	L
CO3	H	-	M	M	L	-	M	-	-	-	-	L	L
CO4	H	L	M	-	-	-	L	M	L		H	M	-
CO5	H	M	-	L	L	L	-	M	L	M	M	-	-
CO6	H	M	L	M	M	M	M	-	-	H	M	-	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

**Mr. J. Leo,
Course Coordinator**

ELECTIVE I: PRINCIPLES OF INSURANCE

Semester: I

Credits: 4

Code: P19AS1:1

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Units Covered
CO1	Recall the historical development of insurance.	K1	I
CO2	Classify the components of general insurance and its salient features	K2	II
CO3	Make use of IRDAI 's regulations and its functions to enhance the insurance business	K3	III
CO4	Strengthening the relationship between insured and insurers	K4	IV
CO5	Analyze the stages involved in claim settlement process both in life and general insurance	K4	IV
CO6	Adapt the different tax systems that come under insurance business	K6	V

2.A. SYLLABUS

UNIT I: Introduction to Insurance

(12 Hours)

Definitions of insurance –Origin and History - Significance of insurance – Tax benefits –Factors influencing on insurance products – Features of insurance company – Nature of insurance – Reforms in insurance sector – Recent developments – Fundamental principles of insurance – Comparison of reinsurance and double insurance – Classification of insurance – Coinsurance – Doctrine of reinstatement – Types of life insurance policies.

UNIT II: Introduction of General Insurance

(12Hours)

The origin of insurance - Indian general insurance market - Historical milestone - The structure of Indian general insurance market - Classification of general insurance companies - Salient features of Indian general insurance market.

UNIT III: IRDAI functions and Insurance Councils

(12Hours)

Definition of insurance-Insurance Regulatory and Development Authority of India (IRDAI) - Purpose of forming the IRDAI- Duties, powers and functions of the IRDAI - Regulations issued by IRDAI.

UNIT IV: Protection of Policyholder's Interest

(12Hours)

Introduction - Introduced to stages of insurance policy - Discuss the pre-sale stages of insurance policy - Discuss the post-sale stage of insurance policy - Understand grievance redressal complaint handling and policyholder's servicing procedures - Understand claim procedures and settlement in respect of insurance policies - Life general and health - known about the key feature document.

UNIT V: Taxation of Insurance**(12Hours)**

Details and Income tax act 80C,80CC, 80D and 80DD

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1	New development in underwriting process	https://rgare.com/knowledge-center/media/articles/the-underwriter-s-role-in-the-product-development-process
2	New product development in insurance	https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/
3	New technology to adopt identifying the risk	https://www.networkcomputing.com/networking/reducing-risks-new-technology-adoption
4	Technology development in Marketing	https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/

C. TEXTBOOK

Unit 1: Dr.E. Dharmaraj – “Elements of Insurance” –SIMRES Publications, first edition, 2009 – ISBN 978-81-909568-5-7

Unit 2 & 3: IC 11 - PRACTICE OF GENERAL INSURANCE

Unit 4: IC 14 - REGULATIONS OF INSURANCE BUSINESS

Unit 5: IC 24 - LEGAL ASPECTS OF LIFE INSURANCE

D. REFERENCES

Principles of insurance –IC01-III

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Contents	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	Introduction to Insurance		
1.1	Definitions of insurance Origin and History Significance of insurance Tax benefits Factors influencing on insurance products	Recall the insurance mechanism. Describe the insurance contracts and their various types.	K1

	Features of insurance company Nature of insurance Reforms in insurance sector Recent developments		
1.2	Fundamental principles of insurance Comparison of reinsurance and double insurance Classification of insurance Coinsurance Doctrine of reinstatement Types of life insurance policies.	Define the reinsurance mechanism. Describe the reinsurance contracts and their various types.	K1
II	Introduction of General Insurance		
2.1	The origin of insurance Indian general insurance market Historical milestone The structure of Indian general insurance market	Explain the general insurance market mechanism. Describe the general insurance contracts and their various types.	K2
2.2	Classification of general insurance companies Salient features of Indian general insurance market.	Explain the general insurance contract	K2
III	IRDAI functions and Insurance Councils		
3.1	Definition of insurance-Insurance Regulatory and Development Authority of India (IRDAI) Purpose of forming the IRDAI	Utilize the information for forming IRDAI	K3
3.2	Duties, powers and functions of the IRDAI Regulation issued by IRDAI.	Make use of the Importance of IRDAI roles and responsibilities	K3
IV	Protection of Policyholder's Interest		

4.1	Be introduced to stages of insurance policy Discuss the pre-sale stages of insurance Policy Discuss the past-sale stage of insurance policy	Strengthening the relationship between insured and insurers	K4
4.2	Understand grievance redressal complaint handling and policyholder's servicing procedures Understand claim procedures and settlement in respect of insurance policies Life general and health known about the key feature document.	Analyze the stages involved in claim settlement process both in life and general insurance	K4
V	Taxation of Insurance		
5.1	Details and Income tax act 80C,80CC, 80D and 80DD	Adapt the tax exemptions from insurance products	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO3	PSO4
CO1	H	H	H	H	M	L	-	-	-	H	M	-	-
CO2	H	M	M	M	-	M	L	L	-	H	M	L	-
CO3	H	M	M	M	-	M	L	L	-	H	M	L	-
CO4	H	H	H	M	M	L	L	L	-	H	M	L	-
CO5	-	H	H	H	M	L	-	L	L	H	-	M	-
CO6	-	H	H	H	M	L	-	L	L	H	-	M	-

L-Low

M-Moderate

H- High

5.COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Dr. G. Sreearthi
Course Coordinator

SEMESTER II

CORE V: ACTUARIAL STATISTICS – II

Semester: II

Code: P19AS205

Credit: 4

Hours/Week: 5

1. COURSE OUTCOMES

At the end of the course the students will able to,

CO. No	Course Outcomes	Level	Unit Covered
CO1	Develop the ability to find the relationship between variables and predicting using model	K3	I
CO2	Build the regression model	K3	II
CO3	Apply Bayesian Statistics to estimate the posterior distribution	K4	III
CO4	Evaluate the risk premium for insurance company	K5	IV
CO5	Evaluate the premium rate to the insurance company	K5	IV
CO6	Estimate the risk premium of general insurance company	K6	V

2.A. SYLLABUS

UNIT I: Data Analysis

(10 Hours)

Introduction- Bivariate correlation analysis - Data visualization - Sample correlation coefficients - Spearman's rank correlation coefficient - The Kendall rank correlation coefficient – Inference - Inference under Pearson's correlation - Result 1- Inference under Spearman's rank correlation - Inference under Kendall's rank correlation - Multivariate correlation analysis - Data visualization - Sample correlation coefficient matrix – Inference - Principal component analysis.

UNIT II: Linear regression & Multiple linear regression

(10 Hours)

Introduction - The simple bivariate linear model - The full normal model and inference - The multiple linear regression model - The full normal model and inference.

UNIT III: Generalized linear models

(10 Hours)

Introduction - Generalized linear models - Exponential family - Linear predictor - Link functions - Model fitting and comparison - Residuals analysis and assessment of model fit.

UNIT IV: Bayesian statistics & Credibility theory

(10 Hours)

Introduction - Bayes' theorem - Prior and posterior distributions - The loss function - Some Bayesian posterior distributions - Credibility theory – Introduction - Recap of conditional expectation results – Credibility - Bayesian credibility.

UNIT V: Empirical Bayes Credibility theory

(10 Hours)

Introduction - Empirical Bayes Credibility Theory: Model 1 – Introduction -Risk parameter - Conditional claim distribution - Credibility formula - Model 1: specification Assumptions for

EBCT Model 1 - Model 1: the credibility premium - Model 1: parameter estimation - Example: Credibility premium using Model 1 - Empirical Bayes Credibility Theory: Model 2 – Introduction - Model 2: specification Assumptions for EBCT Model 2 - Model 2: the credibility premium - Model 2: parameter estimation - Example: Credibility premium using Model 2.

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	Correlation and Regression	https://youtu.be/gVNXSbFL8HE
2	Genialized linear model	https://youtu.be/7jacFFYWVxA
3	Bayesian credibility	https://youtu.be/Sui3mZdfM00
4	Statistical methods	https://youtu.be/ydcr3CZ8xJk

C. TEXTBOOK

ActEd Study Material: Subject –CS1

D. REFERENCES

Mathematical statistics. Freund, John E f - 6th ed. - Prentice Hall International, 1999, ISBN: 0 13 974155 0.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of transaction
I	Introduction to Data analysis – Correlation		
1.1	Introduction Bivariate correlation analysis Data visualization Sample correlation coefficients	Explain the bivariate random variables	K2

<p>1.2</p>	<p>Spearman's rank correlation coefficient The Kendall rank correlation coefficient Inference Inference under Pearson's correlation .</p>	<p>Choose the method to find the relationship between two random variables</p>	<p>K3</p>
<p>1.3</p>	<p>Inference under Spearman's rank correlation Inference under Kendall's rank correlation multivariate correlation analysis Data visualization Sample correlation coefficient matrix Inference Principal component analysis</p>	<p>Develop the concept of multivariate correlation analysis</p>	<p>K3</p>

II	Regression Analysis		
2.1	Introduction The simple bivariate linear model	Explain what is meant by response and explanatory variables.	K1
2.2	State the simple regression model (with a single explanatory variable). Derive the least squares estimates of the slope and intercept parameters in a simple linear regression model	To apply the full normal model and inference	K3
2.3	The multiple linear regression model	To construct the regression model	K3
III	Generalized linear models		
3.1	Introduction - Generalized linear models - Exponential family - Linear predictor - Link functions - Model fitting and comparison - Residuals analysis and assessment of model fit.	Analyse the deviance and scaled deviance and state how the parameters of a GLM may be estimated. and Describe how a suitable model may be chosen by using an analysis of deviance and by examining the.	K4
IV	Bayesian statistics		
4.1	Introduction to Bayesian Statistics Bayes' theorem, Prior and Posterior distributions The loss function	Analyze the Bayesian statistics and use these concepts to calculate Bayesian estimates. Use Bayes' theorem to calculate simple conditional probabilities.	K4

4.2	Introduction to Credibility theory Recap- Conditional expectation results, Introduction Credibility Bayesian credibility	Estimate the Credibility theory and Explain what is meant by the credibility premium formula and describe the role played by the credibility factor. And explain the Bayesian approach to credibility theory and use it to derive credibility premiums in simple cases.	K5
V	Credibility theory		
5.1	Introduction to Empirical Bayes Credibility theory Introduction -Risk parameter Conditional claim distribution Credibility formula Specification Assumptions for EBCT Model 1 .The credibility premium Parameter estimation Example: Credibility premium using Model 1	Estimate Empirical Bayes Credibility theory and Explain the empirical Bayes approach to credibility theory and use it to derive credibility premiums in simple cases.	K5
5.2	Introduction specification Assumptions for EBCT Model 2 The credibility premium Parameter estimation Example: Credibility premium using Model 2	Estimate the differences between the two approaches (ie the Bayesian approach and the empirical Bayes approach) and state the assumptions underlying each of them.	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	L	L	L	L	-	H	M	M	-
CO2	H	-	H	M	-	M	-	M	-	H	-	-	L
CO3	-	M	-	M	L	M	L	M	L	H	-	M	-
CO4	H	M	M	M	L	L	L	L	-	-	M	M	L
CO5	H	M	M	-	-	L	M	M	L	H	M	-	L
CO6	H	H	H	M	L	M	L	-	L	H	-	M	M

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
- 2) Open Book Test.
- 3) Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
- 4) Pre-Semester & End Semester Theory Examination

INDIRECT

- 1) Course end survey (Feedback)

Mrs. S. Babylatha,

Course Coordinator.

CORE VI - ACTUARIAL MATHEMATICS - III

Semester: II
Credits: 4

Code: P19AS206
Hours/Week: 5

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Apply the concepts relating to functions and Annuities	K3	I
CO2	Analyze the theoretical concept and find the solution for unknown quantity	K4	II
CO3	Categorize the skills, how to apply the equations of value in loan repayment Process	K4	III
CO4	Evaluate the skill related to APR	K5	IV
CO5	Evaluate the different situations of financial projects	K5	IV
CO6	Build the different types of term structure of interest rates.	K6	V

2.A. SYLLABUS

UNIT I: Equations of value

(10 Hours)

Introduction - The equation of value and the yield on a transaction - The theory - Solving for an unknown quantity - Security S - Solving for the timing of a payment (n) - Solving for the interest rate (i) - Estimating an unknown interest rate using linear interpolation - Example applications - Uncertain payment or receipt - probability of cashflow - Higher discount rate.

UNIT II: Loan schedules

(10 Hours)

Introduction - An example - Calculating the capital outstanding – Introduction - The theory - Prospective loan calculation - Retrospective loan calculation - Calculating the interest and capital elements - The loan schedule - Instalments payable more frequently than annually - Capital and interest elements - Consumer credit: APR.

UNIT III: Project Appraisal

(10 Hours)

Introduction - Estimating cashflows - Fixed interest rates - Accumulated value - Net present values - Internal rate of return - The comparison of two investment projects – Different interest rates for lending and borrowing - Payback periods - Other considerations.

UNIT IV: Bonds, equity and property

(10 Hours)

Introduction - Fixed-interest securities - Calculating the price and yield - No tax - Income tax - Capital gains tax - Capital gains test - Finding the yield when there is capital gains tax - Optional redemption dates - Uncertain income securities – Equities – Property - Real rates of interest - Inflation-adjusted cashflows - Calculating real yields using an inflation index - Calculating real yields given constant inflation assumptions - Payments related to the rate of inflation - The effects of inflation - Index-linked bonds.

UNIT V: Term structure of interest rates**(10 Hours)**

Introduction - Discrete-time rates - Discrete-time spot rates - Discrete-time forward rates - Continuous-time rates - Continuous-time spot rates - Continuous-time forward rates - Instantaneous forward rates - Theories of the term structure of interest rates - Why interest rates vary over time - Supply and demand - Base rates - Interest rates in other countries - Expected future inflation - Tax rates - Risk associated with changes in interest rates - The theories - Expectations theory - Liquidity preference - Market segmentation - Yields to maturity - Par yields - Duration, convexity and immunization - Interest rate risk - Effective duration – Duration – Convexity - Why is it called ‘convexity’? – Immunization - Redington’s conditions.

B. TOPICS FOR SELF-STUDY

SI. No	Topics	Reference
1.	Individual risk models for a short -- Benefit reserves--Analysis of benefit reserves	http://actuaries.cirgahosting.com/HeritageScripts
2.	Survival distributions and life tables	http://actuaries.cirgahosting.com/HeritageScripts
3.	Term Life insurance --Life annuities--Benefit premiums	http://actuaries.cirgahosting.com/HeritageScripts
4.	Multiple life functions--Multiple decrement models--Collective risk models for a single period	http://actuaries.cirgahosting.com/HeritageScripts

C. TEXTBOOK

1. CORE Mathematics 1(CM1), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. Actuarial mathematics. Bowers, Newton L et al. – 2nd ed. – Society of Actuaries, 1997. xxvi, 753 pages. ISBN: 0 938959 46 8.
2. An introduction to the mathematics of finance. McCutcheon, John J; Scott, William F. London: Heinemann, 1986. 463 pages. ISBN: 0 434 91228 x.
3. Mathematics of compound interest. Butcher, M V; Nesbitt, Cecil J. Ulrich's Books, 1971. 324 pages.
4. Theory of financial decision making. Ingersoll, Jonathan E. Rowman& Littlefield, 1987. 474 pages. ISBN: 0 8476 7359 6.usi
5. The theory of interest. Kellison, Stephen G. 2nd ed. Irwin, 1991. 446 pages. ISBN: 0 256 09150 1. Available from the publication’s Unit.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit /Section	Course content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Equations of value		
1.1	Introduction, the equation of value and the yield on a transaction, the theory Solving for an unknown quantity, Security, Solving for the timing of a payment (n)	To understand and analyse the value of equation.	K2
1.2	Solving for the interest rate (i) Estimating an unknown interest rate using linear, interpolation, Example applications, probability of cash flow, Higher discount rate.	Develop the equations to predict unknown values.	K3
II	Loan schedules		
2.1	Introduction, an example, Calculating the capital outstanding, The loan schedule.	Construct the Loan arrangements equations, and to know about the preparation of loan schedule.	.K3
2.2	Instalments payable more frequently than annually, Consumer Credit: APR	Analyze about consumer credit and APR	K4
III	Project Appraisal		
3.1	Introduction, estimating cash flows Fixed interest rates, Accumulated value, Net present values, Internal rate of return	Analyze financial projects for investments, on the basis of different methods.	K4
3.2	Investment projects, Different interest rates for lending and borrowing, Payback periods, Other considerations.	Learn about the function of DPP	K4
IV	Bonds, Equity and property		

4.1	Introduction, Fixed-interest securities, Calculating the price and yield, No tax, Income tax, Capital gains tax, Optional redemption dates, Uncertain income securities, Equities, Property	List out the Financial Instruments are treated in the case of taxable.	K4
4.2	Real rates of interest, Inflation adjusted cash flows, calculating real yields, using an inflation index, calculating real yields given constant inflation assumptions, Payments related to the rate of inflation, The effects of inflation Index-linked bonds	Estimate the calculation of real yield.	K5
V	Term structure of interest rates		
5.1	Introduction, Discrete-time rates, Discrete-time spot rates, Discrete-time forward rates, Continuous-time rates, Continuous-time spot rates, Continuous-time forward Rates	Determine about the Discrete time and Continuous time spot rate and forward rates.	K5
5.2	Instantaneous forward rates, Theories of the term structure of interest rates, why interest rates vary over time, the theories, Yields to maturity, Par yields, Duration, convexity and immunization, Interest rate risk, Effective duration, Duration, convexity, Immunization, Redington's conditions.	Discuss about Why interest rates vary over time	K6

4. Mapping Scheme for the POs, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	M	L	L	L	-	H	M	L	-
CO2	H	-	H	M	-	M	-	M	-	H	-	-	L
CO3	-	M	-	M	M	L	M	M	L	H	-	M	-
CO4	H	M	L	M	M	L	M	L	-	-	M	M	L
CO5	H	M	L	-	-	L	M	M	L	H	M	-	L
CO6	H	H	H	M	L	M	L	-	L	H	-	M	M

L - Low M - Moderate H - High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. D. Hebsiba Beula,
Course Coordinator.

CORE VII - ACTUARIAL MATHEMATICS - IV

Semester: II

Credits: 4

Code: P19AS207

Hours/Week: 5

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Make use of different situations of policies.	K3	I
CO2	Construct the premium & reserve table.	K4	II
CO3	Measures the relations between assurance and annuity factors using equation of value, and their select and continuous equivalents	K4	II
CO4	Explain the relations between annuities payable in advance and in arrears, and between temporary, deferred and whole life annuities	K5	III
CO5	Solve the gross premiums and reserves of assurance and annuity contracts	K5	IV
CO6	Develop various types of reserves	K6	V

2.A. SYLLABUS

UNIT I: Joint life and last survivor functions & Contingent and reversionary benefits (10 Hours)

Random variables to describe joint life functions - Simple probabilities involving two lives - Present values involving two lives - Calculations, premiums, reserves - Contingent probabilities of death - Contingent assurances - Reversionary annuities - Joint life functions dependent on term - Expected present value of annuities payable m times a year - Further aspects.

UNIT II: Mortality profit & Competing risks (10 Hours)

Mortality profit on a single policy - Mortality profit on a portfolio of policies - Allowing for death benefits payable immediately - Allowing for survival benefits - Allowing for different premium or annuity payment frequencies - Calculation of mortality profit for policies involving two lives - Health insurance contracts - Multiple state models - Multiple decrement models - Multiple decrement tables - Using multiple decrement tables to evaluate expected present values of cashflows.

UNIT III: Unit-linked and accumulating with-profits contracts (10 Hours)

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

UNIT IV: Profit testing**(10 Hours)**

Introduction - Evaluating expected cashflows for various contract types - Profit tests for annual premium contracts - Profit testing using the present value random variable - Pricing using a profit test.

UNIT V: Reserving aspects of profit testing**(10 Hours)**

Introduction - Pricing and reserving bases - Calculating reserves for Unit-linked contracts - Calculating reserves for conventional contracts using a profit test - Effect of pricing and reserving bases on a profit test - Setting out the calculations.

B. TOPICS FOR SELF-STUDY

S No.	Topics	Reference
1	Mortality Risk	http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf
2	ULIP	http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf
3	Reserve	http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf
4	Profit Testing	http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf

C. TEXTBOOK

CORE Mathematics -1 (CM1), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. An introduction to the mathematics of finance. McCutcheon, John J; Scott, William F. London: Heinemann, 1986. 463 pages. ISBN: 0 434 91228 x.
2. Mathematics of compound interest. Butcher, M V; Nesbitt, Cecil J. Ulrich's Books, 1971. 324 pages.
3. Theory of financial decision making. Ingersoll, Jonathan E. Rowman & Littlefield, 1987. 474 pages. ISBN: 0 8476 7359 6.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course Content	Learning Outcomes	Bloom's Taxonomic Levels of Transaction
I	Joint life and last survivor functions & Contingent and reversionary benefits		
1.1	Joint life and last survivor status, Contingent and reversionary benefits, probabilities involving two lives.	Explain the concept of joint life and last survivor status, dependent and independent mortality, applying different distributions for two life contracts.	K1
1.2	Contingent probabilities of death, Contingent assurance, reversionary annuities, joint life functions.	Understanding the concept of reversionary annuities, and contingent assurances, able to apply various functions to predict the probabilities.	K2
1.3	Random variables to describe joint life functions, Expected present values of annuities and assurances in joint life contracts.	Build the present values of annuities for joint life status, in accordance with the probability of mortality rates of two lives.	K3

II	Mortality profit & Competing risks		
2.1	Mortality profit and competing risks, mortality profit on single and portfolio of policies, survival benefits.	Understand the different types of portfolio, death strain at risk, incorporating the survival benefits.	K2
2.2	Different methods of premium payments mode, annuity payment frequencies.	Choose the different flexible mode of premium payments, continuous annuity after the joint life status.	K3
2.3	Multiple decrement models, health insurance contracts, present values for multiple decrement models.	Inference the mortality profit in multiple decrement models, evaluating the expected present values.	K4
III	Unit-linked and accumulating with-profits contracts		
3.1	Unit linked fund and accumulating the with profit contracts, non-Unit funds, Unitized contracts, charges and benefits under Unit linked with profit contracts.	Evaluate the variable benefits under with profit contracts, inflation adjusted payments, variable benefits according to variable interest rates.	K5

IV	Profit Testing		
4.1	Gross premium, future loss random variable, premium payment structures, annual premium, net premium reserves, principles of equivalence, expenses loading in premium	Assess to differentiate gross and net premium, different methods of premium payment mode, equating the cash inflow and cash outflow, spreading the cost in premium.	K5
V	Reserving aspects of profit testing		
5.1	Reserve calculation, prospective and retrospective reserve, recursive relationship between reserves for annual premium calculation, net premium reserves for conventional without profit contracts.	Estimate the reserves by prospective and retrospective method, reserves at different time period, loading the premium in accordance with reserves, able to use appropriate formula for with and without profit contracts.	K6

4. Mapping Scheme for the PO, PSOs and COs:

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	M	L	L	L	-	H	M	L	-
CO2	H	-	H	H	-	M	-	L	M	H	-	-	L
CO3	-	M	-	M	L	L	-	M	M	H	-	L	-
CO4	H	M	L	M	L	L	-	L	-	-	M	L	L
CO5	H	M	L	-	-	L	L	M	M	H	M	-	L
CO6	H	H	H	M	L	M	L	-	L	H	-	M	M

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
- 2) Open Book Test.
- 3) Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
- 4) Pre-Semester & End Semester Theory Examination

INDIRECT

- 1) Course end survey (Feedback)

Mr. K. Kapil Raj,
Course Coordinator.

CORE VIII: SURVIVAL ANALYSIS -II

Semester: II
Credits: 4

Code: P19AS208
Hours/Week: 5

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No.	Course Outcomes	Level	Unit Covered
CO1	Apply the real time application of Survival models.	K3	I
CO2	Examine the methods of Survival models.	K4	I
CO3	Evaluate the different kinds of lifetime distribution functions	K5	II
CO4	Analyze the Proportional hazard models.	K4	III
CO5	Classify the Graduation and Methods.	K4	IV
CO6	Estimate the Graduation and statistical tests	K6	V

2.A. SYLLABUS

UNIT I: Survival models (10 Hours)

Simple model of survival - Expected future lifetime - Some important formulae - Simple parametric survival models - The Gompertz and Makeham laws of mortality.

UNIT II: Estimating the lifetime distribution function (10 Hours)

Questions of inference - Censoring mechanisms - The Kaplan-Meier (product-limit) model - Comparing lifetime distributions - The Nelson-Aalen model - Parametric estimation of the survival function.

UNIT III: Proportional hazards models & Exposed to risk (10 Hours)

Covariates and proportional hazards models - Fully parametric models - The Cox proportional hazards model - Estimating the regression parameters - Model fitting - Calculating the exposed to risk – Homogeneity - The principle of correspondence - Exact calculation of the central exposed to risk - Census approximations to the central exposed to risk - Deaths classified using different definitions of age.

UNIT IV: Graduation and statistical tests (10 Hours)

Graduation of observed mortality rates - The underlying assumptions - Comparison with another experience – Graduation - Reasons for graduation - Desirable features of a graduation - Testing the smoothness of a graduation - Statistics refresher - Statistical tests of a mortality experience.

UNIT V: Methods of graduation & Mortality projection**(10 Hours)**

Graduation by parametric formula- Graduation by reference to a standard table - Graduation using spline functions - Comparison of different methods - Statistical tests of a graduation - The effect of duplicate policies - Methods based on expectation - Methods based on extrapolation - Methods based on explanation - Sources of error in mortality forecasts.

B. TOPICS FOR SELF STUDY

Sl. No.	Topics	Reference
1	Survival models	https://youtu.be/zIBsEAwU6nU
2	Proportional hazards models	https://youtu.be/ZlclG7Ttcl0
3	Exposed to risk	https://youtu.be/SyliL7z2e-o
4	Graduation	https://youtu.be/rVvDQjs5_5Y

C. TEXTBOOK

CORE Statistics – CS2, Institute and faculty of Actuaries, UK (IFOA),2019.

D. REFERENCES

1. Actuarial mathematics. - Bowers, Newton L; Gerber, Hans U; Hickman, James C; Jones, Donald A; Nesbitt, Cecil J. - 2nd ed. - Society of Actuaries, 1997. - xxvi, 753pages. - ISBN: 0 938959 468.
2. Actuarial models for disability insurance. – Haberman, Steven; Pitacco, Ermanno.– Chapman & Hall, 1999. – xviii, 280 pages. – ISBN: 0 8493 0389.
3. Analyzing survival data from clinical trials and observational studies. – Marubini, Ettore; Valsecchi, Maria Grazia. – John Wiley, 1995. – xvi, 414 pages. – ISBN: 0 471939870.
4. Life contingencies. – Neill, Alistair. – Heinemann, 1977. – vii, 452 pages. – ISBN: 0434 91440 1.
5. Life insurance mathematics. – Gerber, Hans U. – 3rd ed. – Springer. Swiss Association of Actuaries, 1997. – 217 pages. – ISBN: 3 540 62242 X.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course Content	Learning outcomes	Highest Blooms Taxonomi c Levels of Transaction
I	Survival models		
1.1	A Simple Model of Survival, Probabilities of Death and Survival, The Force of Mortality, Survival Probabilities, The Probability Density Function of T_x , Initial Rates And Central Rates of Mortality.	Explain the differentiation between the random variable representing lifetimes from different ages.	K2
1.2	Complete Expectation of Life, Curtate Expectation of Life, and Relationship between e^0_x & e_x , Future Lifetime & Variance, A formula for ${}_tq_x$, A formula for ${}_tp_x$.	Choose the different properties of complete & curtate future lifetime from age x and state its probability function.	K3
1.3	Gompertz' And Makeham's Laws, Calculating the Parameter Values, Survival Probabilities.	Apply the Gompertz' And Makeham's Laws of Mortality.	K3
II	Estimating the lifetime distribution function		
2.1	Censoring mechanisms.	Testing the to understand the various ways in which lifetime data might be censored.	K4
2.2	The Kaplan-Meier (product-limit) model, Comparing lifetime distributions, The Nelson-Aalen model, Parametric estimation of the survival function.	Estimate the problems of Kaplan-Meier (product-limit) model and Nelson-Aalen model.	K5
III	Proportional hazards models & Exposed to risk		

3.1	Fully Parametric Models, Parametric Models for The Hazard Function, Use of Parametric Models, The Cox proportional hazards Model, The Utility of The Cox Model, Estimating the Regression Parameters, Maximizing the Partial Likelihood.	Analyze the Cox model for proportional hazards for the partial likelihood estimate in the absence of ties.	K4
3.2	Calculating the Exposed to Risk, Working with Complete Data, Working with Incomplete Data, Census Approximations, Consistency Between Census Data and Death Data.	Examine the principle of correspondence and its fundamental importance in the estimation procedure.	K4
IV	Graduation and statistical tests		
4.1	Graduation of Observed Mortality Rates, Standard Tables, The Need for Graduation, Reasons for Graduation, The Practical Argument, Desirable Features of A Graduation, Smoothness Versus Adherence To Data, Suitability For Purpose In Hand.	Develop to understand the test for smoothness of a set of graduated estimates.	K3
4.2	Testing the Smoothness of a Graduation, Statistical Tests, and Continuity Correction, Chi-Square Test, Standardized Deviations Test, Signs Test, Cumulative Deviations, Grouping of Sign Test, Serial Corrections Tests, Testing Actual Versus Expected Rates.	Inference the test to describe the formulation of the hypothesis, the test statistic, the distribution of the test statistic using approximations.	K4

V	Methods of graduation & Mortality projection		
5.1	Graduation by Parametric Formula, Graduation by Reference to A Standard Table, Statistical Tests of a Graduation, The Effect of Duplicate Policies.	Testing the process of graduation by the parametric formula & standard table method.	K5
5.2	Methods based on expectation, Methods based on extrapolation, Methods based on explanation, Sources of error in mortality	Estimate the approaches to forecasting the future mortality.	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H	-	M	L	H	-	L	H	-	M	L
CO2	H	-	H	L	H	M	L	-	-	M	L	-	L
CO3	H	-	M	M	M	-	M	-	-	-	-	L	-
CO4	H	L	-	-	-	-	L	-	L		H	-	-
CO5	H	M	-	L	M	H	-	M	L	M	M	M	-
CO6	H	M	L	M	M	H	M	-	M	H	M	H	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

- 1) Course end survey (Feedback)

**Mr. J. Leo,
Course Coordinator.**

CORE IX: RISK MODELLING

Semester: II
Credits: 4

Code: P19AS209
Hours/Week: 5

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No.	Course Outcomes	Level	Unit Covered
CO1	Make use of the properties of Times series in actuarial calculation	K3	I &II
CO2	Application of loss distribution in Insurance sector.	K3	II
CO3	Testing the extreme value theory in General Insurance	K4	III
CO4	Assess the importance of reinsurance contract.	K5	IV
CO5	Estimate the value of general insurance contract by using statistical techniques	K5	V
CO6	Estimate the aggregate claims using risk models	K6	V

2.A. SYLLABUS

UNIT I: Time series 1 (10 Hours)

Properties of a univariate time series - Stationary random series - Main linear models of time series.

UNIT II: Time series 2 & Loss distributions (10 Hours)

Compensating for trend and seasonality - Identification of MA(q) and AR(p) models - Fitting a time series model using the Box-Jenkins methodology – Forecasting - Multivariate time series models - Some special non-stationary and non-linear time series models - Simple loss distributions - Other loss distributions – Estimation - Goodness-of-fit tests.

UNIT III: Extreme value theory & Copulas (10 Hours)

Extreme events and extreme value theory - Generalized extreme value (GEV) distribution - Generalized Pareto distribution (GPD) - Measures of tail weight - Marginal and joint distributions - Association, concordance, correlation and tail dependence – Copulas - Fundamental copulas - Explicit copulas (including Archimedean copulas) - Implicit copulas - Choosing and fitting a suitable copula function - Calculating probabilities using copulas.

UNIT IV: Reinsurance**(10 Hours)**

Proportional reinsurance - Non-proportional reinsurance - Reinsurance arrangements - Normal and lognormal distributions – Inflation – Estimation - Policy excess.

UNIT V: Risk models 1 & Risk models 2**(10 Hours)**

General features of a product - Models for short- term insurance contracts - The collective risk model - Aggregate claim distributions under proportional and individual excess of loss reinsurance - The individual risk model - Parameter variability / uncertainty.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1	Reducing the limitation of time series assumptions	https://www.researchgate.net/post/What-are-the-weaknesses-of-time-series-model-and-how-could-it-be-improved
2	Alternative approach to find the extreme value theory	https://www.tandfonline.com/doi/pdf/10.1080/07055900.1991.9649412
3	Reducing the limitation of collective and individual risk model	https://openacttexts.github.io/Loss-Data-Analytics/C-AggLossModels.html
4	New method of reinsurance arrangement	https://en.wikipedia.org/wiki/Reinsurance

C. TEXTBOOK

ActEd Study Material: Subject CS 2.

D. REFERENCES

1. An introduction to statistical modelling. - Dobson, Annette J. - Chapman & Hall, 1983.viii, 125 pages. - ISBN: 0 412 24860 3.
2. Introductory statistics with applications in general insurance. - Hossack, Ian B;Pollard, John H; Zehnirith, Benjamin. - 2nd ed. - Cambridge University Press, 1999.xi, 282 pages. - ISBN: 0 521 65534 X.
3. Loss models: from data to decisions. - Klugman, Stuart A; Panjer, Harry H; Willmot,Gordon E; Venter, Gary G. - John Wiley & Sons, 1998. - xiii, 644 pages. - ISBN: 0471 23884 8.
4. Practical risk theory for actuaries. - Daykin, Chris D; Pentikainen, Teivo; Pesonen,Martti. - Chapman & Hall, 1994. - 545 pages. - ISBN: 0 412 42850

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course Contents	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Time series 1		
1.1	Properties of a univariate time series	Distinguish univariate and multivariate times series process	K4
1.2	Stationary random series Main linear models of time series.	Analyze the stationary and non - stationary time series process	K4
II	Time series 2 & Loss distributions		
2.1	Compensating for trend and seasonality Identification of MA(q) and AR(p) models Fitting a time series model using the Box-Jenkins methodology Forecasting - Multivariate time series models Some special non-stationary and non-linear time series models	Identify MA and AR model Estimating the future values using time series model	K3
2.2	Simple loss distributions Other loss distributions Estimation Goodness-of-fit tests.	Analyze the different types of loss distributions using in insurance fields	K4
III	Extreme value theory & Copulas		
3.1	Extreme events and extreme value theory	Inference about the extreme value theory and Discuss in insurance	

	<p>Generalized extreme value (GEV) distribution</p> <p>Generalized Pareto distribution (GPD)</p> <p>Measures of tail weight</p> <p>Marginal and joint distributions</p> <p>Association, concordance, correlation and tail dependence</p>	Sector	K4
3.2	<p>Copulas</p> <p>Fundamental copulas</p> <p>Explicit copulas (including Archimedean copulas)</p> <p>Implicit copulas</p> <p>Choosing and fitting a suitable copula function</p> <p>Calculating probabilities using copulas.</p>	Function of the copulas and discuss the application in insurance sector	K4
IV	Reinsurance		
4.1	<p>Proportional reinsurance</p> <p>Non-proportional reinsurance</p> <p>Reinsurance arrangements</p>	Importance of reinsurance contract in insurance sectors.	K5
4.2	<p>Normal and lognormal distributions</p> <p>Inflation</p> <p>Estimation</p> <p>Policy excess</p>	Importance of the distributions applicable in reinsurance Contract.	K5
V	Risk models 1 & Risk models 2		
5.1	General features of a	Estimate the value of short-term insurance contract using collective	K6

	product Models for short-term insurance contracts The collective risk model	risk model	
5.2	Aggregate claim distributions under proportional and individual excess of loss reinsurance The individual risk model Parameter variability uncertainty.	Estimate the value of reinsurance contract by using individual risk model	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	M	M	M	L	L	M	M	L	L
CO2	H	H	M	M	M	-	-	-	-	L	H	M	L
CO3	M	M	M	M	M	M	L	L	L	H	-	-	-
CO4	H	H	M	M	M	M	-	-	-	M	L	-	-
CO5	M	M	L	L	-	-	L	L	L	-	-	L	-
CO6	M	M	M	L	-	-	L	M	M	-	-	L	-

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

2. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
3. Open Book Test.
4. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
5. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. P. Nithya,
Course Coordinator.

ELECTIVE II – PROGRAMMING USING R

Semester: II

Code: P19AS2:P

Credits: 2

Hours/Week: 3

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Understand the concept of R studio	K2	I
CO2	Make use of R expressions that involve variables, variable assignment, operators and functions	K3	II
CO3	Organize the data using R data types (character, double, integer and logical) diagrammatically	K3	II
CO4	Analyze the basic R data structures relevant to modern data analysis (atomic vectors and data frames)	K4	III
CO5	Determine the basic verbs of data transformation of actuarial data	K5	IV
CO6	Build statistical graphics with gg plot using R environment	K6	V

2.A. SYLLABUS

UNIT I: Introduction

(6 Hours)

Introduction to R – Introduction to R studio – Overview of R environment – R editor – Workspace – Data structures: vectors – matrices – lists and data frames – getting help and loading packages – Importing and exporting data – Accessing data – Manipulating data frames – Basic computational ideas – Merges in R.

UNIT II: Navigating the Software

(6 Hours)

Matrix determinants – Inverse – Transpose – Trace – Eigen values and Eigen Vectors (Application – Arrangements of data for calculation) - Graphics: Construction of Bar, Pie, Histogram, Stem-and-leaf, line chart, Box plot, Scatter plot (Application – Diagrams and graphical representation of data).

UNIT III: Data Structures

(6 Hours)

Grouping, loops and conditional execution - writing your own functions – Univariate data analysis – Bivariate data analysis – Outliers detection – Binomial and Normal distributions (Application – calculating average, dispersion and Model fitting of data).

UNIT IV: Parametric and Non parametric tests

(6 Hours)

Parametric and non-parametric testing of statistical hypothesis – One sample t test – Two group t test – Paired t test – One-way ANOVA – Two-way ANOVA – Post Hoc tests –

Sign test – Wilcoxon - Mann Whitney – Kruskal Wallis (Application – Testing of significance of data).

UNIT V: Linear Regression

(6 Hours)

Correlation – Pearson, Spearman and other correlation techniques – Linear regression – Multiple linear regression- Testing for overall significance – of model coefficients – Testing for individual regression coefficients (Application – Finding the relations between data and predicting future).

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	Programming using R – Financial Analysis	https://youtu.be/8AbAFLI_B0c
2	R for Actuarial Applications	https://youtu.be/3aQYEnLWIBE
3	R for CS1 and CS2	https://youtu.be/QRLJRWfgBZM
4	R for Actuaries	https://youtu.be/CjH9BphpzM4

C. TEXTBOOK

1. John Verzani, Using R for Introductory statistics, CRC Press, 2014, ISBN: 13:978-1-4665-9073-1

D. REFERENCES

1. The Art of R Programming A Tour of Statistical Software Design By [Norman Matloff](#), [Norman S. Matloff](#) · 2011

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Introduction		
	Introduction to R – Introduction to R studio – Overview of R environment – R editor – Workspace – Data structures: vectors – matrices – lists and data frames – getting help and loading packages – Importing and exporting data – Accessing data Manipulating data frames – Basic computational ideas – Merges in R	Demonstrate the R Studio & R console window to perform various calculations using different vectors of elements.	K2

II	Navigating the Software		
	Matrix determinants – Inverse – Transpose – Trace – Eigen values and Eigen Vectors (Application – Arrangements of data for calculation) - Graphics: Construction of Bar, Pie, Histogram, Stem-and-leaf, line chart, Box plot, Scatter plot (Application – Diagrams and graphical representation of data).	Organize the data using R data types in R environment .	K3
III	Data Structures		
	Grouping, loops and conditional execution - writing your own functions – Univariate data analysis – Bivariate data analysis – Outliers detection – Binomial and Normal distributions	Analyses in Bivariate data and discrete distribution	K4
IV	Parametric and Non parametric tests		
	Parametric and non-parametric testing of statistical hypothesis – One sample t test – Two group t test – Paired t test – One-way ANOVA – Two-way ANOVA – Post Hoc tests – Sign test – Wilcoxon - Mann Whitney – Kruskal Wallis	Assess the nonparametric test.	K5
V	Linear Regression		
	Correlation – Pearson, Spearman and other correlation techniques – Linear regression – Multiple linear regression- Testing for overall significance – of model coefficients Testing for individual regression coefficients	Build the linear relationship between the variables in R studio	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	-	M	L	-	L	L	-	M	L	H	H	-	M
CO2	H	-	M	M	L	M	L	L	L	H	H	-	M
CO3	H	M	-	L	L	L	-	L	L	M	M	-	-
CO4	-	M	M	L	-	L	L	M	L	H	H	H	M
CO5	H	H	M	M	L	L	L	-	L	-	-	M	L
CO6	H	H	M	M	M	L	L	L	L	-	M	M	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

- 1) Course end survey (Feedback)

Mr. K. Kapil Raj,

Course Coordinator.

SEMESTER III

CORE X: BUSINESS ECONOMICS – I

Semester: III

Code: P19AS310

Credits: 4

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Classify the economic system and its strands.	K2	I
CO2	Categorize the impact of changes in demand and supply	K4	II
CO3	Determine the risk and uncertainty about future market movements.	K5	III
CO4	Prioritize the different market structures and its applications	K5	IV
CO5	Determine the pricing strategies and product lifecycle.	K5	IV
CO6	Elaborate the objectives of Macro economy and estimation of National Income and Output	K6	V

2.A. SYLLABUS

UNIT I: Economic concepts and systems (8 Hours)

What economists' study - Different economic systems - Main strands of economic thinking.

UNIT II: Supply and demand (1) (13 Hours)

Demand – Supply - Price and output determination - Supply and demand (2) - Price elasticity of demand (PED) - Other elasticities - The time dimension - The control of prices - Indirect taxes and subsidies.

UNIT III: Background to demand (15 Hours)

Marginal utility theory - The timing of costs and benefits - Indifference curve analysis - Demand under conditions of risk and uncertainty - Behavioural economics - Background to supply - The short-run theory of production - Costs in the short run - The long-run theory of production - Costs in the long run – Revenue - Profit maximization.

UNIT IV: Perfect competition and monopoly (12 Hours)

Alternative market structures - Perfect competition – Monopoly - The theory of contestable markets - Monopolistic competition and oligopoly - Monopolistic competition – Oligopoly - Game theory - Pricing strategies - Cost-based pricing and limit pricing - Price discrimination - Multiple product pricing - Pricing and the product life cycle.

UNIT V: Market Failure and government intervention (12 Hours)

Efficiency under perfect competition - The case for government intervention - Forms of government intervention - Government failure and the case for the market - Competition policy –

Policies towards research and development (R&D) - The macroeconomic environment - An overview of key macroeconomic issues - The circular flow of income - Measuring national income and output - The AD-AS model - Macroeconomic objectives - The business cycle - Unemployment and the labour market - Inflation and the AD-AS model.

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	History of Economic Systems	https://youtu.be/k62eauSYchE
2	Equilibrium Price & Output	www.investopedia.com
3	Marginal Utility & Indifference Curve Analysis	www.economicshelp.org www.economics.utoronto.ca
4	Game Theory	https://plato.stanford.edu/entries/game-theory/

C. TEXTBOOK

CORE Business 2 (CB2), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. Economics, David Begg, Stanley Fisher and Rudiger Dorn Busch, 5th edition, McGraw Hill Economic Analysis by Dr. S. Sankaran
2. Economics. - Samuelson, Paul A; Nordhaus, William D. - 17th ed. - McGraw-Hill,2001. - xxiv, 792 pages. - ISBN: 0 07 118064 8.
3. Economics. - Wonnacott, Paul; Wonnacott, Ronald J. - 4th ed. - John Wiley, 1990. -xxix, 804 pages. - ISBN: 0 471 51737 2.
Principles of economics. - Lipsey, Richard G; Chrystal, K Alec. - 9th ed. – Oxford University Press, 1999. - xvi, 640 pages. - ISBN: 0 19 877588 1

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Economic concepts and systems		
1.1	What economists' study: Different Economic systems, Main strands of economic thinking.	Interpret the different economic strands of thinking's that was made in the past days	K2
II	Supply and demand (1)		

2.1	Demand – Supply - Price and output determination - Supply and demand	Analyze the concept of demand & supply I terms of equilibrium price and output determination.	K4
2.2	Price elasticity of demand (PED) - Other elasticity's - The time dimension - The control of prices - Indirect taxes and subsidies.	Analyze the elasticities of Demand by considering the determinants of demand and supply.	K4
3	Background to demand		
3.1	Marginal utility theory - The timing of costs and benefits - Indifference curve analysis - Demand under conditions of risk and uncertainty	Estimate the consumer equilibrium using indifference curves and a budget constraint recognize the law of diminishing	K5
3.2	Behavioral economics, Background to supply, The short-run theory of production, Costs in the short run,	Dissect the concepts of cost, nature of production and its relationship to Business operations.	K5
3.3	The long-run theory of production, Costs in the long run, Revenue, Profit maximization.	Analyze the profits and costs by comparing total revenue and total cost	K5
4	Perfect competition and monopoly		
4.1	Alternative market structures, Perfect competition, Monopoly, The theory of contestable markets,	Categorize the better market structures by comparing the inputs in the monopoly a perfectly competitive market.	K5

4.2	Monopolistic competition and oligopoly, Monopolistic competition, Oligopoly, Game theory	Deduct the characteristics of oligopoly and monopolistic competition	K5
4.3	Pricing strategies, Cost- based pricing and limit pricing, Price discrimination, Multiple product pricing, Pricing and the product life cycle	1. Examine the applications of price discrimination strategy in the competitive market.	K5
		2. Describe the objectives of businesses hope to achieve with product pricing.	K5
5	Market Failure and government intervention		
5.1	Market Failure and government intervention: Efficiency under perfect competition, The case for government intervention, Forms of government intervention.	Analyze the concept of Market Failure as the failure of the market to reach allocative efficiency resulting in an over/under allocation of resources to the production of a good	K6
5.2	Government failure and the case for the market, Competition policy, Policies towards research and development (R&D), The macroeconomic environment	1. Examine how macroeconomic indicators like GDP are used to assess the state of the economy	K6
		2. Understand that economic growth is a relatively recent phenomenon, and identify key institutional factors that contribute to economic growth	K6
5.3	An overview of key macroeconomic issues, the circular flow of income, Measuring national income and output, The AD-AS model macroeconomic	1. Able to create the income flow in all the relevant fields. Able to define National income accounting.	K6

5.4	Objectives, The business cycle, Unemployment and the labor market, Inflation and the AD-AS model.	1. Use the equation of exchange to explain what determines the inflation rate in the long run.	K6
		2. The efficiency wage theory and the predictions concerning cyclical unemployment is studied in detail	

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	-	L	L	-	M	L	H	H	H	M
CO2	H	H	M	M	L	M	L	L	L	H	H	H	M
CO3	H	M	-	M	L	L	-	L	L	H	M	H	-
CO4	H	M	M	M	-	L	L	L	L	H	H	H	M
CO5	H	H	M	M	L	L	L	L	L	H	M	M	L
CO6	H	H	M	M	M	L	L	L	L	H	M	M	L

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. S. Babylatha,
Course Coordinator.

CORE XI: BUSINESS FINANCE - I

Semester: III

Code: P19AS311

Credits: 5

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	understand the position of each stakeholder	K2	I
CO2	Examine the knowledge in capital market and analyze about the investments	K4	II
CO3	Estimate the different types of Business entity	K5	III
CO4	Determine to understand different types of issue of shares and shareholders	K5	IV
CO5	Evaluate the project with different stages by using probability trees	K5	IV
CO6	Estimate the position of debt and capital structure	K6	V

2.A. SYLLABUS

UNIT I: Key principles of finance and corporate governance (12 Hours)

Finance and real resources – Stakeholders - Capital markets and the maximization of shareholder's wealth - The value of a company - Regulating financial reporting - Corporate governance and organization - Business ownership - Types of business entity - Pros and cons of limited companies – Taxation - Personal taxation - Capital gains tax - Company taxation - Other taxes - Double taxation relief.

UNIT II: Long-term finance (12 Hours)

Loan capital (Debt) - Share capital - Other types of long-term finance - Winding up a company - Issue of shares - Obtaining a stock exchange quotation - Issues made by companies already quoted.

UNIT III: Short- and medium-term finance (12 Hours)

Medium-term company finance - Short-term company finance - Alternative sources of finance - Shadow banking - Project financing – Crowdfunding – Microfinance.

UNIT IV: Uses of derivatives (12 Hours)

Financial futures – Options - Interest rate and currency swaps - Weighted average cost of capital - Cost of equity - Cost of debt - Weighted average cost of capital.

UNIT V: Capital structure and dividend policy

(12 Hours)

Capital structure - Dividend – the shareholders' reward - Capital project appraisal (1) - Introduction to capital project appraisal - Methods of project evaluation - Results of the evaluation - Capital project appraisal (2) - Choice of discount rate - Risk analysis – an overview - Identification of risks - Analysis of risks - Obtaining a distribution of NPVs in practice - Risk mitigation - The investment submission.

TOPICS FOR SELF – STUDY

Sl. No	Topics	Reference
1	Accounting Procedures	http://actuaries.cirgahosting.com/
2	Finance, Capital Management	http://actuaries.cirgahosting.com/
3	Management Accounting for Decision makers	http://actuaries.cirgahosting.com/
4	Analysis of Financial Statement	http://actuaries.cirgahosting.com/

C. TEXTBOOK

CORE Business 1(CB1), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

- 1. Financial statement analysis in Europe.** - Samuels, J M; Brayshaw, R E; Craner, J M. - Chapman & Hall, 1995. 454 pages. - ISBN: 0 412 54450 4.
- 2. Fundamentals of financial management.** - Brigham, Eugene F; Houston, Joel F. - 9thed. - Harcourt Brace, 2000. 959 pages. - ISBN: 0 03 031461 5.
- 3. How to read the financial pages.** - Brett, M. 2nd ed. Random House Business Books,2003. 430 pages. ISBN: 0712662596.
- 4. Interpreting company reports and accounts.** - Holmes, Geoffrey; Sugden, Alan;Gee, Paul. - 8th ed. - Pearson Education, 2002. 298 pages. - ISBN: 0 273 65592 2.
- 5. Principles of corporate finance.** - Brealey, Richard A; Myers, Stewart C. - 7th ed. - McGraw-Hill, 2003. 1004 + appendices pages. - ISBN: 0 07 115144 3.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning outcomes	Highest Blooms Taxonomic levels of transaction
I	Key principles of finance and corporate governance		
1.1	Finance and real resources, Stakeholders, Capital markets and the maximisation of shareholder wealth, the value of a company, Regulating financial reporting, Corporate governance and organization	Introduction to finance, how to create a company, how to raise capital to the company, Roll of financial Manager, real source of the company, agency theory.	K1
1.2	Business ownership, Types of business entity, Pros and cons of limited companies, Taxation, Personal taxation, Capital gains tax, Company taxation, Other taxes, Double taxation relief.	Different types of business entity, Shareholders wealth, Structure of the Joint stock company, how to calculate the tax in different manner for different sector.	K2
II	Long-term finance		
2.1	Loan capital (Debt), Share capital, Other types of long-term finance, Winding up a company	Types of capital, share capital, debt capital, long term finances, process at the time of winding up.	K2
2.2	Issue of shares, obtaining a stock exchange quotation, Issues made by companies already quoted.	Know about the share capital, how to issue shares to the public, and how to raise the share capital.	K4
III	Short-and medium-term finance		
3.1	Medium-term company finance, Short-term company finance	Know about the share capital, how to issue shares to the public, and how to raise the share capital.	K4

3.2	Shadow banking, Crowd funding, Microfinance.	Other than the financial instruments, learn about alternative source of finance.	K5
IV	Use of derivatives		
4.1	Use of derivatives: Financial futures, Options, Interest rate and currency swaps	Introduction to Derivatives, learn about different types of derivatives.	K5
4.2	Weighted average cost of capital, Cost of equity - Cost of debt, Weighted average cost of capital.	Learn about WACC. And to learn about the weightage given to the share capital and debt capital.	K5
V	Capital structure and dividend policy		
5.1	Capital structure, Dividend, the shareholders' reward, Capital project appraisal (1), Introduction to capital project appraisal, Methods of project evaluation, Results of the evaluation	Know about to analyse the project by using different methods and find out the profitable project for investment.	K6
5.2	Capital project appraisal (2), Choice of discount rate, Risk analysis – an overview, Identification of risks, Analysis of risks, Obtaining a distribution of NPVs in practice, Risk mitigation, The investment submission.	Learn about to identify the risk, value the risk and mitigate the risk.	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	L	M	L	H	-	M	H	M	M	M
CO2	H	H	M	L	M	M	L	-	-	M	-	M	M
CO3	M	M	-	-	L	L	M	L	L	-	L	L	M
CO4	M	-	-	L	M	H	H	M	M	-	M	M	L
CO5	M	M	-	L	H	H	M	M	L	M	H	H	H
CO6	-	-	L	M	M	L	-	L	H	H	H	M	H

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. D. Hebsiba Beula,
Course Coordinator.

CORE XII: FINANCIAL ENGINEERING - I

Semester: III

Code: P19AS312

Credits: 5

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO No.	Course Outcomes	Level	Unit Covered
CO1	Apply utility function in insurance contract.	K3	I
CO2	Modelling of investment returns.	K3	II
CO3	Determine the operation of insurance and other financial systems.	K5	III
CO4	Analysis the best portfolio-based risk and return.	K4	IV
CO5	Evaluate the risk of the insurance company.	K5	V
CO6	Estimate the expected return from the investment portfolio.	K6	V

2.A. SYLLABUS

UNIT I: The Efficient Markets Hypothesis

(12 Hours)

Rational expectations theory – the three forms of the efficient markets hypothesis-The evidence for or against each form of the Efficient Markets Hypothesis- difficulties with testing the efficient market hypothesis-volatility tests- conclusion Utility theory - The expression of economic characteristics in terms of utility functions - Measuring risk aversion - Some commonly used utility functions - The variation of utility functions with wealth - Construction of utility functions - Maximizing utility through insurance-Limitations of utility theory.

UNIT II: Stochastic dominance and behavioural finance

(12 Hours)

Stochastic dominance – background-first order stochastic dominance-second order stochastic dominance- Behavioural finance – introduction-prospect theory critique of expected utility theory-heuristics and behavioural biases-a behavioural approach to the equity premium puzzle Measures of investment risk – introduction-variance of return-semi variance of return-short fall probabilities-tail value at risk and expected short fall-Relationship between risk measures and utility functions - Risk and insurance companies-introduction- what to insure-pooling resources-policy holder behavior.

UNIT III: Stochastic models of investment returns

(12 Hours)

Introduction-simple model- Fixed rate model – Varying rate model-Log normal distribution.

UNIT IV: Portfolio theory

(12 Hours)

Introduction – assumptions of mean and variance portfolio theory- specification of the opportunity set-choosing an efficient portfolio-Benefits of diversification.

UNIT V: Models of asset returns**(12 Hours)**

Multifactor models-definition-macroeconomic factor models-statistical factor models construction of models-Single index model- definition – results of the single index model-data requirements.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Web links
1	Advancement approach to identify better portfolio	https://www.ortecfinance.com/en/insights/blog/advancements-in-modern-portfolio-theory
2	New method of constructing utility function	https://link.springer.com/article/10.1007/s10198-018-0993-z
3	Advance method of identifying best investment returns	https://www.sec.gov/investor/pubs/tenthingstoconsider.htm
4	Alternative tool to reduce the variance	https://en.wikipedia.org/wiki/Variance_reduction

C. TEXTBOOK

ActEd Study Material CM 2

D. REFERENCES

1. Actuarial mathematics. Bowers, Newton L et al. – 2nd ed. – Society of Actuaries,1997. xxvi, 753 pages. ISBN: 0 938959 46 8.
2. Life insurance mathematics. Gerber, Hans U. – 3rd ed. – Springer. Swiss Association of Actuaries, 1997. 217 pages. ISBN 3 540 62242 X.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Contents	Learning Outcomes	Highest Blooms Taxonomic levels of transaction
I	The Efficient Markets Hypothesis and Utility theory		
1.1	Rational expectations theory The evidence for or against each form of the Efficient Markets Hypothesis	Apply the concept economic market and apply that techniques in any relevant field	K3

1.2	<p>The expression of economic characteristics in terms of utility functions</p> <p>Measuring risk aversion Some commonly used utility functions</p> <p>The variation of utility functions with wealth</p> <p>Construction of utility functions</p> <p>Maximizing utility through insurance</p> <p>Limitations of utility theory.</p>	Analyze utility concept in insurance sector and understand the limitation of utility theory	K4
II	Stochastic dominance and behavioural finance		
2.1	<p>Stochastic dominance</p> <p>Behavioral finance</p>	Bulid the concept of stochastic dominance and its application	K3
2.2	<p>Measures of risk</p> <p>Relationship between risk measures and utility functions</p> <p>Risk and insurance companies.</p>	How to measure the investment risk and apply what are risks covered in insurance products	K3
III	Stochastic models of investment returns		
3.1	<p>Simple models</p> <p>lognormal distribution</p> <p>Benefits of diversification.</p>	Application Stochastic interest rate model	K5
IV	Portfolio theory		
4.1	<p>Introduction</p> <p>assumptions of mean and variance portfolio theory</p> <p>specification of the opportunity set-choosing an efficient portfolio</p> <p>Benefits of diversification.</p>	Analyze the concept of assets and pricing model	K4
V	Models of asset returns		

5.1	<p>Multifactor models</p> <p>Definition</p> <p>macroeconomic factor models</p> <p>statistical factor models</p> <p>construction of models</p> <p>Single index model</p> <p>definition</p> <p>results of the single index model</p> <p>data requirements.</p>	<p>Estimate the expected investment return from the portfolio using statistical tool</p>	K6
-----	--	--	----

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO2	PSO3	PSO4
CO1	H	H	M	M	M	M	M	L	L	M	M	L	L
CO2	H	H	M	M	M	-	-	-	-	L	H	M	M
CO3	M	M	M	M	M	M	M	L	L	H	-	-	-
CO4	H	H	M	M	M	M	-	-	-	M	L	-	-
CO5	M	M	L	L	-	-	L	M	M	-	-	L	-
CO6	M	M	M	L	-	-	L	M	M	-	-	L	M

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. S. Babylatha
Course Coordinator.

ELECTIVE III: ACTUARIAL PRACTICE

Semester: III
Credits: 5

Code: P20AS3:3
Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Demonstrate the concept and implement the regulations of Actuarial Clients	K2	I
CO2	Application of Actuarial regulations	K3	II
CO3	Analyze the various investments choices available in the market	K4	III
CO4	Categorize the investment portfolio of general insurance business	K4	IV
CO5	Asses the investment return from different money market and bond market instruments.	K5	IV
CO6	Discuss the outcomes from property market and overseas investments	K6	V

2.A. SYLLABUS

UNIT I: Actuarial Advice and External Environment (12 Hours)

The clients actuaries advise-other stakeholders affected by actuarial advice given to clients-the interest and functions of the clients-information about the client-attitudes of clients and other stakeholders-advice and decisions-professional and technical standards-legislations and regulations -state benefits-tax-accounting standards-Risk management requirements, capital adequacy and solvency-corporate governance- corporate structure- competitive advantage and commercial requirements-other external issues.

UNIT II: Regulation, Financial Products and Customer Needs (12 Hours)

The aims of regulation-the cost of regulation-The need for regulation-The functions of a regulator-areas addressed by regulation-information asymmetry-areas addressed by regulation- maintaining confidence-Regulatory Regimes-Role of major financial institutions-types of provisions-social security benefits-financial products and contracts-pension schemes-investment schemes-derivatives-insurance principles-analyzing stakeholder's needs.

UNIT III: Providers of Benefits and Life Insurance Products (12 Hours)

An introduction to benefit schemes-benefits providers-the state-employers- individuals' financial institutions and other organizations -an overview of life insurance-life insurance products an overview-pure endowment and endowment assurance-whole life assurance-term assurance-convertible or renewable term assurance-immediate annuity-deferred annuity (including personal pensions)-income drawdown-investment bonds-income protection insurance-critical illness insurance-keyperson cover-long term care insurance-investment types.

UNIT IV: General Insurance Products, Bond and Money Markets (12 Hours)

An overview of general insurance-an introduction to general insurance products-liability insurance-property damage insurance-financial loss insurance-fixed benefits-cash on deposit-the money markets-characteristics of cash on deposit and money market instruments-attractions of cash on deposit and money market instruments-bond markets an introduction-fixed interest or conventional bonds-index linked bonds-comparison of fixed interest and index linked bonds.

UNIT V: Equity and Property Markets, Other Investment Classes (12 Hours)

Characteristics of ordinary shares (Equities)-Equity categorization-property investment-characteristics of direct property investments-freehold and leasehold property investment-indirect property investment-collective investment schemes-Differences between closed ended and open-ended CISs- CISs vs direct investment-Futures and options-Overseas Markets-Indirect overseas investment-Investing in emerging markets.

C. TEXTBOOK

ACTUARIAL PRACTICE-CPI, combined material from IFOA, UK

D. REFERENCES

Financial Enterprise Risk Management, Second Edition, 2017, Paul Sweeting

B. TOPICS FOR SELF-STUDY

Sl. NO	Topics	Reference
1	Actuarial Control Cycle	http://actuaries.cirqahosting.com/HeritageScripts/Hapi.dll/relatedsearch?
2	technical actuarial tools	http://actuaries.cirqahosting.com/HeritageScripts/Hapi.dll/relatedsearch?
3	Actuarial Practice and Control course provides a structured approach to understanding	http://actuaries.cirqahosting.com/HeritageScripts/Hapi.dll/relatedsearch?
4	A consequence is that the generic steps involved in applying the Actuarial Control Cycle	http://actuaries.cirqahosting.com/HeritageScripts/Hapi.dll/relatedsearch?

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Regulation, Financial Products and Customer Needs		
1.1	Actuarial advice and External Environment, information about the clients and attitudes of the same, advice and decision making in important situations, impact on stakeholders	Develop the working environment of the Actuaries, handling the clients in various situations, proper advice and leadership for better output.	K1
1.2	Professional and technical standards, legislations, and Regulations.	Build the ethical codes of this profession, maintaining the standard	K2
1.3	Taxations, accounting standards, risk management requirements, capital adequacy and solvency levels, corporate Governance	Understanding the taxations in the region, risk management tools for mitigating the risk, maintain the solvency position.	K2
II	Regulation, Financial Products and Customer Needs		
2.1	Financial products and customer needs, functions of a regulator, information asymmetry.	Evaluate the different types of financial products available in the market, observing the customer's need, information channels	K3

2.2	Role of Major financial institutions, types of provisions social security benefits,	Assess the role of institutions in financial markets, benefits to the consumers and clients,	K3
2.3	Pension Schemes, investment schemes, derivatives, insurance principles.	Estimate the available pension schemes, derivative products to mitigate the future risks, following the principles.	K3
III	Providers of Benefits and Life Insurance Products		
3.1	Providers of benefits and life insurance products, state, employers, and individuals and financial institutions, income protection, critical illness, permanent disability benefits.	Analyze the various life insurance products, contributions from state and employers, different disability benefits under group insurance plans, bonds and security investments.	K4
IV	General Insurance Products, Bond and Money Markets		
4.1	General insurance products, bond and money markets, liability insurance, property damage insurance, financial loss insurance, fixed benefits cash on deposits, money market instruments, conventional bonds and	Identify the various types of general insurance products, money market products, and its functions, able to understand the applications of conventional bonds and inflation eroding benefits under various schemes	K5

	index linked bonds.		
V	Equity and Property Markets, Other Investment Classes		
5.1	Equity and property markets, equity categorizations, property investments, freehold and leasehold property investments, collective investment schemes, close ended and open-ended CIS, futures and options, overseas investment.	Assume the functions of equity markets, analyzing the investment portfolio, minimizing the opportunity cost, various types of investment options both in domestic and overseas financial markets, forward contracts for hedging, arbitrage mitigation	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	L	H	-	M	L	M	L	M	H	M	M	L
CO2	M	L	L	M	L	M	L	H	-	M	M	M	H
CO3	H	L	M	L	H	M	M	L	L	-	L	L	M
CO4	M	M	H	L	M	H	M	M	L	-	L	M	H
CO5	M	M	-	-	H	L	M	M	L	H	M	H	M
CO6	-	L	L	M	M	-	L	-	H	H	H	M	M

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

**Mr. J A S Surendran,
Course Coordinator.**

ELECTIVE IV: ADVANCED MS-EXCEL

Semester: III

Credits: 4

Code: P19AS3:P

Hours/Week: 6

1. COURSE OUTCOMES

At the end of the course the students will able to,

CO. No	Course Outcomes	Level	Unit Covered
CO1	Evaluate the statistical terms and its measures	K5	I
CO2	Measure to recognize the applications of Statistical measure	K5	II
CO3	Compare using descriptive measures (Statistical Software and MS-Excel).	K5	III
CO4	Analysis the data relationship using correlation	K4	IV
CO5	Predict the variation using regression	K6	IV
CO6	Determine the procedure to compute statistical measure using statistical software tool	K5	V

2.A. SYLLABUS

UNIT I: Introduction to MS-Excel

(10 Hours)

Using Excel list – Creating a list – Sorting - Filtering Data – Totals and Sub totals – Splitting Windows – Freezing panes - Basis Functions - Uses of normal s/s – (Open/Create/Save s/s) - Cut/Copy/Paste /Delete/Sort/Find/Insert - Formatting/Merge and wrap – Conditional Formatting/Auto Fill.

UNIT II: Working with Graphs

(10 Hours)

Formulas - Arithmetic functions - Logical functions - Lookup & Reference functions - Date & Time functions - How to Evaluate Formulas - Use of Name manager in the Formulas.

UNIT III: Work with data

(10 Hours)

Retrieve Data for external Source - Text to Columns/Remove Duplicates / data validation - Grouping/ Ungrouping.

UNIT IV: Pivot tables and Macros

(15 Hours)

Developer Options - Record a Macro – Advance Marco.

UNIT V: Problem solving

(15 Hours)

Using MS-Excel – CT1, CT3, CT4, CT5 and CT6.

B. TOPICS FOR SELF-STUDY

Sl. No.	Topics	Reference
1	To know the basic on MS-Excel	https://youtu.be/-ujVQzTtxSg
2	Working with functions and Formula	https://youtu.be/4rjOtiZGTM4
3	Working with data	https://youtu.be/nMxl1_NAcxc
4	Working with macro.	https://youtu.be/ltcpaHdXUrU

C. TEXTBOOK

MS-Excel: “Microsoft Excel 2010 Data analysis and Business Modeling” By Wayne L. Winston

D. REFERENCE

Excel 2019 Bible Paperback – Illustrated, 4 December 2018

by [Michael Alexander](#) (Author), [Richard Kusleika](#) (Author), [John Walkenbach](#) (Author)

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	Introduction to MS-Excel		
1.1	Introduction to MS-Excel Using Excel list – Creating a list, Sorting, Filtering Data, Totals and Sub totals, Splitting Windows, freezing panes – Basis Functions, uses of normal s/s, (Open/Create/Saves/s), Cut/Copy/Paste Delete/Sort/Find/Insert, Formatting/Merge and wrap, Conditional Formatting/Auto Fill.	Solve to work with spread with various operations and functions.	K3
II	Working with graphs and Functions		

2.1	Working with Graphs, Formulas, Arithmetic functions, Logical functions, Lookup & Reference functions, Date & Time functions, How to Evaluate Formulas, Use of Name manager in the Formulas.	Evaluate the techniques of graphical representation and apply various formulas and application for given data	K5
III	Working with data		
3.1	Work with data – Retrieve Data for external Source, Text to Columns/Remove Duplicates / data validation, Grouping/ Ungrouping.	Analyze and apply to retrieve data from outsource and apply other applications to deal with data	K4
IV	Macro Writing		
4.1	Pivot tables, Macros, Developer Options, Record a Macro, Advance Marco.	Apply the macro and developer option for the given database	K3
V	Excel applications in Actuarial Concepts		
5.1	Problem solving Using MS-Excel CT1, CT3, CT4, CT5 and CT6.	Apply the excel function and solve problems on CORE technical papers	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	L	M	M	L	H	M	M	M	M	M	L	H
CO2	H	M	H	M	L	H	H	M	H	M	M	L	H
CO3	M	M	M	M	M	H	M	M	M	M	H	M	H
CO4	H	M	M	H	M	H	M	H	M	M	M	H	H
CO5	M	M	H	M	H	M	M	H	M	M	H	H	H
CO6	M	H	M	H	M	M	H	H	M	H	L	L	H

L-Low
M-

Moderate H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mr. Y. Franklin Gnanaiah,
Course Coordinator.

SEMESTER IV

CORE XIII: BUSINESS ECONOMICS – II

Semester: IV
Credits: 4

Code: P19AS413
Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Classify the international trade system and payments	K2	I
CO2	Apply the Keynesian classical theory in Philip's curve	K3	II
CO3	Analyze the effects of demand and supply side policies	K4	III
CO4	Determine the exchange rate and its implication	K5	IV
CO5	Influence of globalization and monetary systems in economy.	K5	V
CO6	Discuss the emerging financial crisis and the new consensus	K6	V

2.A. SYLLABUS

Unit I: International trade and payments

(12 Hours)

Globalization - setting the scene - The advantages of trade - Arguments for restricting trade - The open economy - The financial system and the money supply - The definition, role and evolution of financial systems - The history and consequences of banking crisis - The meaning and functions of money - The supply of money - The money market and monetary policy.

Unit II: Classical and Keynesian theory

(12 Hours)

Classical theory - The Keynesian revolution - Background to Keynesian theory - The determination of national income - The simple Keynesian analysis of unemployment and inflation - The Keynesian analysis of the business cycle - Monetarist and neo classical schools, and Keynesian responses - The monetarist school - The neo classical school - The expectations-augmented Phillips curve and the inflation-unemployment relationship - Inflation and unemployment: the monetarist perspective - The Keynesian response.

Unit III: Relationship between the goods and money markets

(12 Hours)

The effects of monetary changes on national income - The monetary effects of changes in the goods market - The IS-LM model - The IS-MP model - Supply-side policy - Approaches to supply-side policy - Supply-side policies in practice market-oriented policies - Supply-side policies in practice interventionist policies.

Unit IV: Demand-side policy**(12 Hours)**

Fiscal policy and the public finances - The use of fiscal policy - The policy-making environment - Exchange rate policy - Alternative exchange rate regimes - Fixed exchange rates – Free- floating exchange rates - Exchange rate systems in practice - The open economy and IS - LM analysis.

Unit V: Global harmonization and monetary union**(12 Hours)**

Globalization and the problem of instability - European economic and monetary union (EMU) - Summary of debates on theory and policy - A timeline – revisited - The macroeconomic environment and debates - An emerging consensus up to the crisis of 2008 - The financial crisis and the search for a new consensus.

B. TOPICS FOR SELF-STUDY

S No.	Topics	Reference
1	Main Strands of Economic Thinking	“Economics for Business” – John Sloman et_al
2	Aggregate Demand & Supply	https://youtu.be/oLhohwfwf_U (Khan Academy)
3	Nations GDP & GNP	www.investopedia.com
4	Macroeconomic Environment	Czech Journal of Economics and Finance, 2007, 57(1-2)

C. TEXTBOOK

CORE Business 2 (CB2), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

1. Economics, David Begg, Stanley Fisher and Rudiger Dorn Busch, 5th edition, McGraw Hill
2. Economic Analysis by Dr. S. Sankaran
3. Economics. - Samuelson, Paul A; Nordhaus, William D. - 17th ed. - McGraw-Hill,2001. - xxiv, 792 pages. - ISBN: 0 07 118064 8.
4. Economics. - Wonnacott, Paul; Wonnacott, Ronald J. - 4th ed. - John Wiley, 1990. -xxix, 804 pages. - ISBN: 0 471 51737 2.
5. Principles of economics. - Lipsey, Richard G; Chrystal, K Alec. - 9th ed. – OxfordUniversity Press, 1999. - xvi, 640 pages. - ISBN: 0 19 8775881.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	International trade and payments		
1.1	Globalization: setting the scene - The advantages of trade - Arguments for restricting trade - The open economy - The financial system and the money supply.	Cross compare & interrelate the trade theory with economic development.	K2
		Extend the measures of money supply in India	K2
1.2	The definition, role and evolution of financial systems – The history and consequences of banking crisis – The meaning and functions of money – The supply of money – The money market and monetary policy.	Classify the different types of Money structure.	K2
		Understand the per capita as an indicator economic welfare.	K2
		Illustrate the difference between fiscal policy & monetary policy.	K2
II	Classical and Keynesian theory		
2.1	Classical theory - The Keynesian revolution - Background to Keynesian theory – The determination of national income - The simple Keynesian analysis of unemployment and inflation	Understand the classical concepts of Keynesians thoughts by the means of equating AD & AS.	K3
		Examine the income-expenditure models to predict the periods of economic recession & Expansion	K3

2.2	The Keynesian analysis of the business cycle – Monetarist, and neoclassical schools, and Keynesian responses - The monetarist school - The neo classical school - The expectations-augmented Phillips curve and the inflation-unemployment relationship.	Able to examine the relationship between inflation rates & Unemployment rates The intervention of government and the competition of the markets encouraged can be examined	K3
			K3
2.3	Inflation and unemployment: the monetarist perspective - The Keynesian response.	Able to examine the relationship between inflation rates & Unemployment rates from the Keynesian point of view.	K3
III	Relationship between the goods and money markets		
3.1	The effects of monetary changes on national income - The monetary effects of changes in the goods market - The IS-LM model - The IS-MP model - Supply-side policy	The IS-LM curve model emphasizes the interaction between the goods and assets markets. Income determination model can be done by Keynesians thought which in turn determines GDP & GNP	K4
			K4
3.2	Approaches to supply-side policy - Supply-side policies in practice market-oriented policies - Supply-side policies in practice interventionist policies.	Able to seeks the productivity and the efficiency of the economy.	K4
IV	Demand-side policy		
4.1	Fiscal policy and the public finances - The	Interpret the types of market structure can be studies under	K5

	use of fiscal policy - The policy-making environment - Exchange rate policy	this. Importance of national income and economic welfare.	K5
4.2	Alternative exchange rate regimes - Fixed exchange rates – Free-floating exchange rates - Exchange rate systems in practice - The open economy and IS - LM analysis.	Able to know the per capita income as an indicator of economic welfare. Income determination model can be done by Keynesians thought which in turn determines GDP & GNP	K5
			K5
V	Global harmonization and monetary union		
5.1	Globalization and the problem of instability - European economic and monetary union (EMU) - Summary of debates on theory and policy - A timeline – revisited.	Elaborate the effective monetary policy for price stability Develop to coordinate the economic and fiscal policies in EU countries	K6
			K6
5.2	The macroeconomic environment and debates - An emerging consensus up to the crisis of 2008 - The financial crisis and the search for a new consensus	Adapt the different financial crises between systematic and the non-systematic Develop the causes of the financial crises	K6
			K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	-	L	L	-	M	L	H	H	H	M
CO2	H	H	M	M	L	M	L	L	L	H	H	H	M
CO3	H	M	-	M	L	L	-	M	L	H	M	H	-
CO4	H	M	M	M	-	L	L	M	L	H	H	H	M
CO5	H	H	M	M	L	L	L	M	L	H	M	M	L
CO6	H	H	M	M	M	L	L	L	L	H	M	M	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

**Mr. J A S Surendran,
Course Coordinator.**

CORE XIV: BUSINESS FINANCE - II

Semester: IV

Code: P19AS414

Credits: 4

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Analyze to understand the reason for preparing accounting statements	K4	I
CO2	Explain the accounting concepts, which followed by the company for preparing the accounting statements	K5	II
CO3	Assume the purpose for preparing and maintaining the statements.	K4	III
CO4	Analyze to handle the depreciation, which is treated in company accounts	K4	IV
CO5	Explain the basic construction of accounts of different types and the role and principal features of the accounts of a company	K5	IV
CO6	Estimate the policies for working capital management, including its individual elements	K6	V

2.A. SYLLABUS

UNIT I: Introduction to accounts & The main accounts (12 Hours)

The accounting framework - The International Accounting Standards Board (IASB) - Typical contents of an annual report - The auditors' report - Accounting concepts - The statement of financial position - The statement of comprehensive income - The cashflow statement - Statement of changes in equity - Notes to the accounts.

UNIT II: Depreciation and reserves (12 Hours)

Depreciation - Capital and reserves - Constructing accounts - The trial balance - Using the trial balance.

UNIT III: Group accounts and insurance company accounts (12 Hours)

Consolidated financial statements - Insurance companies - Interpretation of accounts - Measuring risk associated with loan capital - Ratios involving share information - Introduction to other accounting ratios - Profitability ratios - Liquidity ratios - Efficiency ratios.

UNIT IV: Limitations of accounts and alternative reporting (12 Hours)

The shortcomings of historical cost accounting - Limitations in the interpretation of accounts - Manipulation of reported figures - Reporting on environmental, social and economic sustainability - Evaluation of working capital - Working capital - Working capital management -

Sources of short-term finance - Managing cashflows - Cash, dividends and dividend sustainability.

UNIT V: Constructing management information (12 Hours)

The purpose of forecasts and budgets - Examples of forecasts and budgets - Growth and restructuring of companies - Motives for growth - The relationship between profit and growth - The constraints on growth - Methods of achieving growth - Mergers and acquisitions.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1	Accounting Procedures	http://actuaries.cirqaosting.com/
2	Finance, Capital Management	http://actuaries.cirqaosting.com/
3	Management accounting for decision makers	http://actuaries.cirqaosting.com/
4	Analysis of Financial Statement	http://actuaries.cirqaosting.com/

C. TEXTBOOK

CORE Business 1(CB1), Institute and faculty of Actuaries, UK (IFOA),2019

D. REFERENCES

- Financial statement analysis in Europe.** - Samuels, J M; Brayshaw, R E; Craner, J M. - Chapman & Hall, 1995. 454 pages. - ISBN: 0 412 54450 4.
- Fundamentals of financial management.** - Brigham, Eugene F; Houston, Joel F. - 9thed. - Harcourt Brace, 2000. 959 pages. - ISBN: 0 03 031461 5.
- How to read the financial pages.** - Brett, M. 2nd ed. Random House Business Books,2003. 430 pages. ISBN: 0712662596.
- Interpreting company reports and accounts.** - Holmes, Geoffrey; Sugden, Alan;Gee, Paul. - 8th ed. - Pearson Education, 2002. 298 pages. - ISBN: 0 273 65592 2.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Introduction to accounts		
1.1	The accounting framework The International Accounting Standards Board (IASB) Typical contents of an annual report. The auditors' report Accounting concepts	Analyze the concept of Accounts, Annual Reports, Fundamental Accounting Concept	K4

1.2	The statement of financial position the statement of comprehensive income The cash flow statement Statement of changes in equity notes to the accounts.	Analyze the main accounting statements.	K4
II	Depreciation		
2	Depreciation Capital and reserves the trial balance Using the trial balance.	Estimate the depreciation in different methods, and to calculate the trial balance.	K5
III	Group Accounts and Insurance company Account		
3.1	Group Accounts and Insurance company Account: Consolidated financial statements Insurance companies: Interpretation of accounts Measuring risk associated with loan capital	Classify the insurance company accounts	K4
3.2	Ratios involving share information Introduction to other accounting ratios Profitability ratios Liquidity ratios Efficiency ratios.	Analyze the different types of ratios	K4
IV	Limitations of accounts and alternative reporting:		
4.1	The shortcomings of historical cost accounting Limitations in the interpretation of accounts Reporting on environmental, social and economic sustainability	Estimate the Limitations of accounts, and alternative	K5

4.2	Evaluation of working capital Working capital management Sources of short-term finance Managing cashflows, Cash, dividends and dividend sustainability.	To analyse the working capital	K4
V	Constructing management information		
5.1	The purpose of forecasts and budgets. Examples of forecasts and budgets. Growth and restructuring of companies.	Plan the growth and restructuring of the companies budget	K6
5.2	Motives for growth The relationship between profit and growth The constraints on growth - Methods of achieving growth.	Estimate the profit and loss of the company's financial statement	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	-	L	L	-	M	L	H	H	H	M
CO2	H	H	M	M	L	M	L	L	L	H	H	H	M
CO3	H	M	-	M	L	L	-	L	L	H	M	H	-
CO4	H	M	M	M	-	L	L	L	L	H	H	H	M
CO5	H	H	M	M	L	L	L	L	L	H	M	M	L
CO6	H	H	M	M	M	L	L	L	L	H	M	M	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

**Mrs. D. Hebsiba Beula,
Course Coordinator.**

CORE XV: FINANCIAL ENGINEERING – II

Semester: IV
Credits: 4

Code: P19AS415
Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Utilizing the CAPM in insurance business	K3	I
CO2	Application of arbitrage concept and its development	K4	II
CO3	Estimate the credit risk using statistical tool	K5	III
CO4	Importance of surplus process	K5	IV
CO5	Estimate the insolvent position of general insurance company	K5	IV
CO6	Estimate the reserve in general insurance business	K6	V

2.A. SYLLABUS

UNIT I: Asset pricing models

(12 Hours)

The capital asset pricing model (CAPM) –introduction- assumptions-consequences of the extra assumptions-the separation theorem-the capital market line-the security market line- Limitations of CAPM – extension of the basic CAPM-Uses of CAPM - Estimating parameters for asset pricing model.

UNIT II: Characteristics of derivative securities

(12 Hours)

Arbitrage - Definition – the principle of no arbitrage-Preliminary concepts – notation – European call options-European put options- American options-other terminology- Factors affecting option prices – introduction- underlying share price- strike price-time to expiry – volatility of the underlying share-interest rates- income received on the underlying security-the Greeks and risk management- introduction- calculating the forward price for a security with no income- calculating the forward price for a security with fixed cash income- calculating the forward price for a security with known dividend yield- Bounds for option prices –lower bounds on option prices-upper bounds on option prices- Put-call parity.

UNIT III: Credit risk**(12 Hours)**

Introduction-Credit events and recovery rates - Approaches to modelling credit risk – structural models- reduced form models-intensity based models- The Merton model - Two-state models for credit risk – interest rates as hazards rates-incorporating recovery rates- The Jarrow - Lando-Turnbull (JLT) model - Stochastic transition probabilities.

UNIT IV: Ruin theory**(12 Hours)**

Introduction-Basic concepts – notation- the surplus process- the probability of ruin in continuous time- the probability of ruin in discrete time- The Poisson and compound Poisson processes – introduction- the Poisson process-the compound Poisson process- probability of ruin in the short term-premium security loadings- a technicality- The adjustment coefficient and Lundberg's inequality - the Lundberg's inequality –the adjustment coefficient – compound Poisson process-lower bound for R-the adjustment coefficient –general aggregate claims processes-The effect of changing parameter values on ruin probabilities - introduction -Reinsurance and ruin – introduction- proportional reinsurance-XOL reinsurance-maximizing the adjustment coefficient under proportional reinsurance- maximizing the adjustment coefficient under excess of loss reinsurance.

UNIT V: Run-off triangles**(12 Hours)**

Introduction - origins of run-off triangles –types of reserves- presentation of claims data-estimating future claims-other ways of recording data- Projections using development factors – run off patterns-the statistical model for run off triangles – the chain ladder method-model checking-other methods of deriving development factors- assumptions underlying the method-Adjusting for inflation – the inflation adjusted chain ladder method-The average cost per claim method – description of method-application of the method- assumption underlying method-Loss ratios - The BornHuetter-Ferguson method-concept of the BornHuetter Ferguson method-description of the method-application of the method-assumption underlying the method- grossing up factor versus development factors.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1	Advancement method of estimating reserve for general insurance company	https://www.actuaries.org.uk/documents/claims-reserving-manual-vol1-section-2-introduction-reserving
2	New statistical method to identify the probability of ruin of insurance company	http://iase-web.org/documents/papers/icots7/5G1_BOLA.pdf?1402524965
3	New technology adoption of CAPM	https://faculty.fuqua.duke.edu/assetpricing/documents/2018/Xiaoji-Lin.pdf
4	Alternative method to find the forward contract price	https://www.investopedia.com/terms/f/forwardprice.asp

C. TEXTBOOK

ActEd Study Material CM 2.

D. REFERENCES

1. Actuarial mathematics. Bowers, Newton L et al. – 2nd ed. – Society of Actuaries, 1997, xxvi, 753 pages. ISBN: 0 938959 46 8.
2. Life contingencies. Neill, Alistair. – Heinemann, 1977. VII, 452 pages. ISBN 0 43491440 1. Life Insurance Mathematics. Gerber, Hans U. – 3rd ed. – Springer. Swiss Association of Actuaries, 1997. 217 pages. ISBN 3 540 62242 X.
3. Modern actuarial theory and practice. Booth, Philip M et al. – Chapman & Hall, 1999. xiii, 716 pages. ISBN 0 8493 0388 5.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Contents	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
I	Asset pricing models		
1.1	The capital asset pricing model (CAPM) Introduction Assumptions consequences of the extra assumptions	The concept of CAPM and its application	K3

	<p>the separation theorem-</p> <p>the capitalmarket line</p> <p>the security market line</p> <p>Limitations of CAPM</p> <p>extension of the basic</p> <p>CAPM-Uses of CAPM</p> <p>Estimating parameters for asset pricing model.</p>		
II	Characteristics of derivative securities		
2.1	<p>Arbitrage</p> <p>Financial instruments</p> <p>Calculating forward price</p> <p>Calculating dividend yield</p> <p>Option prices</p>	<p>Application of arbitrage concept and its development</p>	K4
III	Credit risk		
3.1	<p>Introduction</p> <p>Credit events and recovery rates</p> <p>Approaches to modelling credit risk</p> <p>structural models</p> <p>reduced form models</p> <p>intensity based models</p> <p>The Merton models</p> <p>Two-state models for credit risk</p> <p>interest rates as hazards rates</p> <p>incorporating recovery rates</p> <p>The Jarrow - Lando-Turnbull (JLT) model</p> <p>Stochastic transition probabilities.</p>	<p>Estimate the credit risk using statistical tool</p>	K5
IV	Ruin theory		
4.1	<p>Surplus process</p> <p>Probability of ruin in discrete and continuous time</p>	<p>Estimate the probability of ruin in insurance and reinsurance contract</p>	

	Poisson process Lundberg's inequality Ruin in reinsurance contract		K5
V	Run-off triangles		
5.1	Run-off triangles The origins of run-off triangles Projections using development factors Adjusting for inflation The average cost per claim method Loss ratios The BornHuetter-Ferguson method	Estimate the outstanding claim reserve for general insurance business	K6

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	M	M	M	L	L	M	M	L	L
CO2	H	H	M	M	M	-	-	-	-	L	H	M	M
CO3	M	M	M	M	M	M	M	L	L	H	-	-	-
CO4	H	H	M	M	M	M	-	-	-	M	L	-	-
CO5	M	M	L	L	-	-	L	M	M	-	-	L	-
CO6	M	M	M	L	-	-	L	M	M	-	-	L	M

L-Low M-Moderate H-High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 2) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 3) Pre/Post Test, Viva, Report for each Exercise.
- 4) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

**Mrs. S. Babylatha,
Course Coordinator.**

ELECTIVE V: PYTHON PROGRAMMING LANGUAGE

Semester: IV

Code: P19AS4:P

Credits: 4

Hours/Week: 6

1. COURSE OUTCOMES

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit Covered
CO1	Analyze to build and package Python modules for reusability.	K4	I
CO2	Explain the read and write files in Python.	K5	II
CO3	Classify the object-oriented programs with Python classes.	K4	III
CO4	Importance of the Python applications for error handling.	K5	IV
CO5	Justify the indexing and slicing to access data in Python programs.	K5	IV
CO6	Formulate the Lists, tuples, and dictionaries in Python programs.	K6	V

2.A. SYLLABUS

UNIT I: Python Basics and Functions

(12 Hours)

Variables – Operators – statements – Getting in Puts – Boolean Conditions – Alternative, Chained and Nested Conditions – Catching Expectations – Function Calls – Built-in Functions – Type Conversion Function and Math Function – creating New Functions, Parameters and Arguments – Need for Functions.

UNIT II: Loops

(12 Hours)

While Statement – Infinite Loops – Continue Statement – For Loops – Counting and Summing Loops – Maximum and Minimum loops.

UNIT III: Strings

(12 Hours)

Traversal through Strings – String Slice – looping and Counting in Strings – The in Operator – String Comparison – String Methods – Parsing Strings – Format Operator.

UNIT IV: Files

(12 Hours)

Opening Files – Text Files – Reading Files – Searching Through Files – Selecting Files Names from User – Writing Files.

UNIT V: List Traversing

(12 Hours)

List – List Operations – List Slice – List Methods – Deleting elements – Built – in List functions – Objects, Value, Aliasing – List Arguments.

B. TOPICS FOR SELF-STUDY

Sl. No	Topics	Reference
1	Loops	https://www.programiz.com/python-programming/for-loop
2	Strings	https://www.youtube.com/watch?v=eUj2DkOMfnA
3	Operators	https://www.youtube.com/watch?v=TIzCuz3aU8Y
4	List	https://www.youtube.com/watch?v=7S64RPx8RUc

C. TEXTBOOK

Learning python by Mark Lutz Second Edition

D. REFERENCE

Nischay Kumar Hegde, Python Programming Fundamentals – A beginners Hand book, 2018.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Contents	Learning Outcomes	Highest Blooms Taxonomic Levels of Transaction
1	Python Basics and Functions		
1.1	Variables – Operators – statements – Getting in Puts – Boolean Conditions – Alternative, Chained and Nested Conditions	Explain the Math functions	K5
1.2	Catching Expectations – Function Calls – Built-in Functions	Assess the new parameters	K5
1.3	Type Conversion Function and Math Function – creating New Functions, Parameters and Arguments – Need for Functions	Classify the new function	K4
II	Loops		
2.1	While Statement – Infinite Loops – Continue Statement – For Loops – Counting and Summing Loops – Maximum and Minimum loops.	Explain loop statement	K5

III		Strings	
3.1	Traversal through Strings – String Slice – looping and Counting in Strings –	Justify a string	K5
3.2	The in Operator – String Comparison – String Methods – Parsing Strings – Format Operator.		
IV		Files	
4.1	Opening Files – Text Files – Reading Files – Searching Through Files – Selecting Files Names from User – Writing Files.	Deduct new files Searching new files	K5
V		List Traversing	
5.1	List – List Operations – List Slice – List Methods – Deleting elements – Built – in List functions	Formulate the list Assign the arguments	K6
5.2	Objects, Value, Aliasing – List Arguments.		

4. Mapping Scheme for the PO, PSOs and COs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	-	L	L	-	M	L	H	H	H	M
CO2	H	H	M	M	L	M	L	L	L	H	H	H	M
CO3	H	M	-	M	L	L	-	L	L	H	M	H	-
CO4	H	M	M	M	-	L	L	L	L	H	H	H	M
CO5	H	H	M	M	L	L	L	L	L	H	M	M	L
CO6	H	H	M	M	M	L	L	L	L	H	M	M	L

L-Low

M-Moderate

H- High

5. COURSE ASSESSMENT METHODS

DIRECT

- 1) Continuous Assessment Test: T1, T2 (Practical Components): Closed Book
- 1) Cooperative Learning Report, Assignment, Group Discussion, project Report, Field Visit Report, Seminar.
- 2) Pre/Post Test, Viva, Report for each Exercise.
- 3) Lab Model Examination & End Semester Practical Examination

INDIRECT

1. Course end survey (Feedback)

Mrs. P. Nithya,
Course Coordinator.