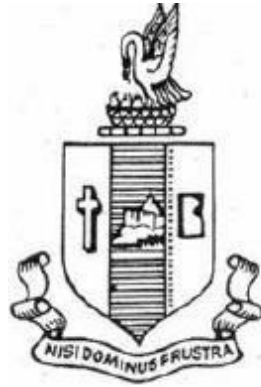


# **M.Sc. ACTUARIAL SCIENCE SYLLABUS**

(Under Choice Based Credit System)

(For the Students admitted in the academic year 2022-23)



**PG DEPARTMENT OF ACTUARIAL SCIENCE**

**BISHOP HEBER COLLEGE (AUTONOMOUS)**

**(Nationally Reaccredited with A+ Grade by NAAC)**

**Tiruchirappalli– 620017**

## **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	
					<b>Sem I Credits:</b>	<b>22</b>			
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	P22VLO21 P22VLO22	2	2	25	75	100	
					<b>Sem II Credits:</b>	<b>24</b>			
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	P22AS3:3	5	4	25	75	100	
	Generic Course	Entrepreneurship	P22AS3G1	1	1	100	--	100	
	ELECTIVE IV	Advanced MS-EXCEL	P19AS3:P	6	4	40	60	100	
					<b>Sem III Credits:</b>	<b>23</b>			
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	
					<b>Sem IV Credits:</b>	<b>21</b>			
					Total Credits:	90			
CORE Theory: 15    CORE Project: 1    ELECTIVE :5    Value Education: 1						Total:		23	
Generic Course :1									

**Self – study Course for III<sup>rd</sup> Semester :**

1. Time Series for Actuaries
2. Financial decision Making
3. Fund management in banking and Insurance Sector.

## ROGRAMME 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.	Programm ing 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	P22AS3:3	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

Code: P19AS101

Credits: 5

Hours/Week: 6

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### 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	<a href="https://youtu.be/VoOPzXPYzBo">https://youtu.be/VoOPzXPYzBo</a>
2	Joint distribution	<a href="https://youtu.be/3bvIrlmOMg">https://youtu.be/3bvIrlmOMg</a>
3	Conditional Expectations	<a href="https://youtu.be/7On58EASoRw">https://youtu.be/7On58EASoRw</a>
4	Sampling Inference	<a href="https://youtu.be/eaqMBXnf4yo">https://youtu.be/eaqMBXnf4yo</a>

**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.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

#### **4. 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

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### 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**

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

**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. 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

### 4. 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	<a href="http://users.stat.ufl.edu/~rrandles/sta4930/4930lectures/chapter3/chapter3R.pdf">http://users.stat.ufl.edu/~rrandles/sta4930/4930lectures/chapter3/chapter3R.pdf</a>
2	Annuity	<a href="https://www.youtube.com/watch?v=UHdsZhbG5vo">https://www.youtube.com/watch?v=UHdsZhbG5vo</a>
3	Assurance	<a href="https://www.youtube.com/watch?v=nUCFjW3LpaE">https://www.youtube.com/watch?v=nUCFjW3LpaE</a>
4	Gross Premium	<a href="http://www.actuariesindia.org/2.A. SYLLABUS/2019/CM1.pdf">http://www.actuariesindia.org/2.A. SYLLABUS/2019/CM1.pdf</a>

**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.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

### 4.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

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### 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

(12Hours)

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

(12Hours)

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  $S = \{\dots - 2, -1, 0, 1, 2, \dots\}$  - Simple random walk on  $\{0, 1, 2, \dots, b\}$  - 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	<a href="https://youtu.be/Llf78-XbLTo">https://youtu.be/Llf78-XbLTo</a>
2	Markov chains	<a href="https://youtu.be/i3AkTO9HLXo">https://youtu.be/i3AkTO9HLXo</a>
3	The two-state Markov model	<a href="https://youtu.be/sZms_73V6bU">https://youtu.be/sZms_73V6bU</a>
4	Time-homogeneous Markov jump processes	<a href="https://youtu.be/KZOoEu3rucY">https://youtu.be/KZOoEu3rucY</a>

### 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.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

#### **4. 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

Code: P19AS1:1

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	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	<a href="https://rgare.com/knowledge-center/media/articles/the-underwriter-s-role-in-the-product-development-process">https://rgare.com/knowledge-center/media/articles/the-underwriter-s-role-in-the-product-development-process</a>
2	New product development in insurance	<a href="https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/">https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/</a>
3	New technology to adopt identifying the risk	<a href="https://www.networkcomputing.com/networking/reducing-risks-new-technology-adoption">https://www.networkcomputing.com/networking/reducing-risks-new-technology-adoption</a>
4	Technology development in Marketing	<a href="https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/">https://www.mantralabsglobal.com/blog/new-product-development-in-insurance-actuary/</a>

**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. 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

#### **4.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	<a href="https://youtu.be/gVNXSbFL8HE">https://youtu.be/gVNXSbFL8HE</a>
2	Genialized linear model	<a href="https://youtu.be/7jacFFYWVxA">https://youtu.be/7jacFFYWVxA</a>
3	Bayesian credibility	<a href="https://youtu.be/Sui3mZdfM00">https://youtu.be/Sui3mZdfM00</a>
4	Statistical methods	<a href="https://youtu.be/ydcr3CZ8xJk">https://youtu.be/ydcr3CZ8xJk</a>

## 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. 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

#### **4. 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	<a href="http://actuaries.cirgahosting.com/HeritageScripts">http://actuaries.cirgahosting.com/HeritageScripts</a>
2.	Survival distributions and life tables	<a href="http://actuaries.cirgahosting.com/HeritageScripts">http://actuaries.cirgahosting.com/HeritageScripts</a>
3.	Term Life insurance --Life annuities--Benefit premiums	<a href="http://actuaries.cirgahosting.com/HeritageScripts">http://actuaries.cirgahosting.com/HeritageScripts</a>
4.	Multiple life functions--Multiple decrement models--Collective risk models for a single period	<a href="http://actuaries.cirgahosting.com/HeritageScripts">http://actuaries.cirgahosting.com/HeritageScripts</a>

**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. 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

### 4. 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

<b>CO. No</b>	<b>Course Outcomes</b>	<b>Level</b>	<b>Unit Covered</b>
<b>CO1</b>	Make use of different situations of policies.	K3	I
<b>CO2</b>	Construct the premium & reserve table.	K4	II
<b>CO3</b>	Measures the relations between assurance and annuity factors using equation of value, and their select and continuous equivalents	K4	II
<b>CO4</b>	Explain the relations between annuities payable in advance and in arrears, and between temporary, deferred and whole life annuities	K5	III
<b>CO5</b>	Solve the gross premiums and reserves of assurance and annuity contracts	K5	IV
<b>CO6</b>	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	<a href="http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf">http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf</a>
2	ULIP	<a href="http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf">http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf</a>
3	Reserve	<a href="http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf">http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf</a>
4	Profit Testing	<a href="http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf">http://www.actuariesindia.org/2.A.SYLLABUS/2019/CM1.pdf</a>

**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. 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

### 4. 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**

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### 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	<a href="https://youtu.be/zIBsEAwU6nU">https://youtu.be/zIBsEAwU6nU</a>
2	Proportional hazards models	<a href="https://youtu.be/ZlclG7Ttcl0">https://youtu.be/ZlclG7Ttcl0</a>
3	Exposed to risk	<a href="https://youtu.be/SyliL7z2e-o">https://youtu.be/SyliL7z2e-o</a>
4	Graduation	<a href="https://youtu.be/rVvDQjs5_5Y">https://youtu.be/rVvDQjs5_5Y</a>

**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. 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

### 4.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

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### 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	<a href="https://www.researchgate.net/post/What-are-the-weaknesses-of-time-series-model-and-how-could-it-be-improved">https://www.researchgate.net/post/What-are-the-weaknesses-of-time-series-model-and-how-could-it-be-improved</a>
2	Alternative approach to find the extreme value theory	<a href="https://www.tandfonline.com/doi/pdf/10.1080/07055900.1991.9649412">https://www.tandfonline.com/doi/pdf/10.1080/07055900.1991.9649412</a>
3	Reducing the limitation of collective and individual risk model	<a href="https://openacttexts.github.io/Loss-Data-Analytics/C-AggLossModels.html">https://openacttexts.github.io/Loss-Data-Analytics/C-AggLossModels.html</a>
4	New method of reinsurance arrangement	<a href="https://en.wikipedia.org/wiki/Reinsurance">https://en.wikipedia.org/wiki/Reinsurance</a>

**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; Zehnwrith, 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. 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

### 4. 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  
Credits: 2

Code: P19AS2:P  
Hours/Week: 3

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### 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	<a href="https://youtu.be/8AbAFLI_B0c">https://youtu.be/8AbAFLI_B0c</a>
2	R for Actuarial Applications	<a href="https://youtu.be/3aQYEnLWIBE">https://youtu.be/3aQYEnLWIBE</a>
3	R for CS1 and CS2	<a href="https://youtu.be/QRLJRWfgBZM">https://youtu.be/QRLJRWfgBZM</a>
4	R for Actuaries	<a href="https://youtu.be/CjH9BphpzM4">https://youtu.be/CjH9BphpzM4</a>

### 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. 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

#### **4.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	<a href="https://youtu.be/k62eauSYchE">https://youtu.be/k62eauSYchE</a>
2	Equilibrium Price & Output	<a href="http://www.investopedia.com">www.investopedia.com</a>
3	Marginal Utility & Indifference Curve Analysis	<a href="http://www.economicshelp.org">www.economicshelp.org</a> <a href="http://www.economics.utoronto.ca">www.economics.utoronto.ca</a>
4	Game Theory	<a href="https://plato.stanford.edu/entries/game-theory/">https://plato.stanford.edu/entries/game-theory/</a>

## 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.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

#### **4. 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

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### 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	<a href="http://actuaries.cirgahosting.com/">http://actuaries.cirgahosting.com/</a>
2	Finance, Capital Management	<a href="http://actuaries.cirgahosting.com/">http://actuaries.cirgahosting.com/</a>
3	Management Accounting for Decision makers	<a href="http://actuaries.cirgahosting.com/">http://actuaries.cirgahosting.com/</a>
4	Analysis of Financial Statement	<a href="http://actuaries.cirgahosting.com/">http://actuaries.cirgahosting.com/</a>

### 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. 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

### 4. 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

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### 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	<a href="https://www.ortecfinance.com/en/insights/blog/advancements-in-modern-portfolio-theory">https://www.ortecfinance.com/en/insights/blog/advancements-in-modern-portfolio-theory</a>
2	New method of constructing utility function	<a href="https://link.springer.com/article/10.1007/s10198-018-0993-z">https://link.springer.com/article/10.1007/s10198-018-0993-z</a>
3	Advance method of identifying best investment returns	<a href="https://www.sec.gov/investor/pubs/tenthingstoconsider.htm">https://www.sec.gov/investor/pubs/tenthingstoconsider.htm</a>
4	Alternative tool to reduce the variance	<a href="https://en.wikipedia.org/wiki/Variance_reduction">https://en.wikipedia.org/wiki/Variance_reduction</a>

**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. 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**

#### **4. 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: 4

Code: P22AS3:3  
Hours/Week: 5

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### 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-CP1, combined material from IFOA, UK

**D. REFERENCES**

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

**B. TOPICS FOR SELF-STUDY**

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

### 3. 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

### 4. 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.**

## GENERIC COURSE - ENTREPRENEURSHIP

Semester: III

Credits : 1

Course Code : P22AS3G1

Total Hours: 1

### 1. COURSE OUTCOMES

On completion of the course, the student will be able to:

SI.NO	Course outcomes	Level	Unit
1	Describe Entrepreneurship Characteristics	K1	I
2	Identify opportunities for Entrepreneurship	K2	II
3	Describe the different supporting systems available to Entrepreneurship	K3	III
4	Apply the principles of project Formulation to design a project	K4	III
5	Describe new generations of entrepreneurial practices	K5	IV

#### Unit I: Introduction

3 Hrs

Entrepreneur – Definition – Concept – Characteristics – Functions – Difference between Entrepreneur and ;Enterprises, Entrepreneur and; Manager, Entrepreneur and Intra-preneurs – Types of Entrepreneurs –Factors affecting Entrepreneurship growth – Barriers to Entrepreneurship.

#### Unit II: Project Identification

3 Hrs

Project identification and classification – Project Formulation – Project design and network and PERT, CPM – project Appraisal- concept – methods – social cost benefit analysis.

#### Unit III: Financial Support to Entrepreneur

3 Hrs

Financial Institution Assisting Entrepreneurs – DICs, SIDCO, NSIC, SISI, SIPCOT, TIIC, KVIC, TCO,ITCOT, -Commercial banks.

#### UNIT IV: Support to Entrepreneurs

3 Hrs

Financing to Enterprise – institutional finance support to entrepreneurs – Angel Investing – Venture Finance – Managing Cash flow – Tax benefits to MSME

#### UNIT V : New Generations of Entrepreneurship

3 Hrs

Social Entrepreneurship – Edu Entrepreneurship- Eco-preneur – Self Help Groups – Health Entrepreneurship- Tourism Entrepreneurship – Women Entrepreneurship.



**REFERENCE BOOKS:**

C.B. GUPTA AND SRINIVASAN(2018), Entrepreneurial Development , Sultan Chand & Company Private Limited , New Delhi

Hisrich Entrepreneurship, Edition 9, Tata McGraw Hill, New Delhi - 2014

## 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	<a href="https://youtu.be/-ujVQzTtxSg">https://youtu.be/-ujVQzTtxSg</a>
2	Working with functions and Formula	<a href="https://youtu.be/4rjOtiZGTM4">https://youtu.be/4rjOtiZGTM4</a>
3	Working with data	<a href="https://youtu.be/nMxl1_NAcxc">https://youtu.be/nMxl1_NAcxc</a>
4	Working with macro.	<a href="https://youtu.be/ItcpaHdXUrU">https://youtu.be/ItcpaHdXUrU</a>

## 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. 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

#### **4. 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 Gnaiaiah,  
Course Coordinator.**

# **SEMESTER IV**

## CORE XIII: BUSINESS ECONOMICS – II

**Semester: IV**

**Code: P19AS413**

**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 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	<a href="https://youtu.be/oLhohwfwf_U">https://youtu.be/oLhohwfwf_U</a> (Khan Academy)
3	Nations GDP & GNP	<a href="http://www.investopeia.com">www.investopeia.com</a>
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. 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

### 4.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	<a href="http://actuaries.cirqaosting.com/">http://actuaries.cirqaosting.com/</a>
2	<u>Finance</u> , Capital Management	<a href="http://actuaries.cirqaosting.com/">http://actuaries.cirqaosting.com/</a>
3	Management accounting for decision makers	<a href="http://actuaries.cirqaosting.com/">http://actuaries.cirqaosting.com/</a>
4	Analysis of Financial Statement	<a href="http://actuaries.cirqaosting.com/">http://actuaries.cirqaosting.com/</a>

**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. 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

#### **4. 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**

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### 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	<a href="https://www.actuaries.org.uk/documents/claims-reserving-manual-vol1-section-2-introduction-reserving">https://www.actuaries.org.uk/documents/claims-reserving-manual-vol1-section-2-introduction-reserving</a>
2	New statistical method to identify the probability of ruin of insurance company	<a href="http://iase-web.org/documents/papers/icots7/5G1_BOLA.pdf?1402524965">http://iase-web.org/documents/papers/icots7/5G1_BOLA.pdf?1402524965</a>
3	New technology adoption of CAPM	<a href="https://faculty.fuqua.duke.edu/assetpricing/documents/2018/Xiaoji-Lin.pdf">https://faculty.fuqua.duke.edu/assetpricing/documents/2018/Xiaoji-Lin.pdf</a>
4	Alternative method to find the forward contract price	<a href="https://www.investopedia.com/terms/f/forwardprice.asp">https://www.investopedia.com/terms/f/forwardprice.asp</a>

## 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. 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

#### **4. 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

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### 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	<a href="https://www.programiz.com/python-programming/for-loop">https://www.programiz.com/python-programming/for-loop</a>
2	Strings	<a href="https://www.youtube.com/watch?v=eUj2DkOMfnA">https://www.youtube.com/watch?v=eUj2DkOMfnA</a>
3	Operators	<a href="https://www.youtube.com/watch?v=TlzCuz3aU8Y">https://www.youtube.com/watch?v=TlzCuz3aU8Y</a>
4	List	<a href="https://www.youtube.com/watch?v=7S64RPx8RUc">https://www.youtube.com/watch?v=7S64RPx8RUc</a>

## C. TEXTBOOK

Learning python by Mark Lutz Second Edition

## D. REFERENCE

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

### 3. 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

#### **4. 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.**