

DEPARTMENT OF STATISTICS				CLASS: <i>I M.Sc. Statistics</i>				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	C Elective – 2 (A)	21P1SME1 (A)	Actuarial Statistics	4	5	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented			Entrepreneurship oriented

### Course Objectives:

- To impart basic concepts and terminologies related to actuarial studies
- To develop a greater understanding of statistical principles and their application in actuarial science.

Unit	Description	Hours	K-level	CLO(s)
I	Measures of Mortality:- Life tables and its relation with survival function - life table function at non integer age (fractional ages) – analytical laws of mortality - Gompertz and Makeham’s laws of mortality – Select, ultimate and aggregate mortality tables.	16	K2	1
II	Abridged life tables – construction of abridged life tables – methods by Read and Merrell, Greville’s, Kings and JIA method. Utility Theory – Insurance and Utility Theory.	16	K4	2
III	Models for individual claims and their sums – multiple life function – joint life status and last survival status.	15	K3	3
IV	Policy Values: Nature of reserve - prospective and retrospective reserves - fractional premiums and fractional durations - modified reserves - Continuous reserves - Surrender values and paid up policies - Industrial assurance - Children's deferred assurances - Joint life and last survivorship.	16	K4	4
V	Pension Funds: Capital sums on retirement and death- widow's pensions - Sickness benefits - Benefits dependent on marriage.	12	K3	5

### Books for Reference

1. Barclay G.W. (1970) Techniques of Population Analysis, Wiley, New York.
2. Borowiak, D.S. and Shapiro, A.F. (2013) Financial and Actuarial Statistics: An Introduction, CRC Press, London.
3. Donald, D.W.A. (1970) Compound Interest and Annuities-certain, For The Institute of Actuaries and the Faculty of Actuaries at the University Press.
4. Spurgeon, E.T. (2011) Life Contingencies, Cambridge University Press, Cambridge.
5. Hooker, P.F. Longley, L.H Cook (1957) Life and other contingencies, Cambridge.
6. Alistair Neill (1977) Life contingencies, Heinemann Professional Publishing, Portsmouth.
7. Hossack, I.B. Pollard, J.H. and Zehnwith, B.(1999) Introductory statistics with

**Web references:**

1. Measure of Mortality: Life tables  
[https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235577Anupama\\_Singh\\_Mortality\\_and\\_its\\_measures.pdf](https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235577Anupama_Singh_Mortality_and_its_measures.pdf)
2. Gompertz and Makeham's laws of mortality  
[https://en.wikipedia.org/wiki/Gompertz%E2%80%93Makeham\\_law\\_of\\_mortality](https://en.wikipedia.org/wiki/Gompertz%E2%80%93Makeham_law_of_mortality)  
<https://web.stanford.edu/~jhj1/teachingdocs/Jones-mortmodel2005.pdf>
3. Abridged life tables – construction of abridged life tables  
[https://www.cdc.gov/nchs/data/series/sr\\_02/sr02\\_004.pdf](https://www.cdc.gov/nchs/data/series/sr_02/sr02_004.pdf)  
[https://www.statsdirect.com/help/survival\\_analysis/abridged\\_life\\_table.htm](https://www.statsdirect.com/help/survival_analysis/abridged_life_table.htm)
4. Policy Values  
<https://www.math.umd.edu/~slud/s470/BookChaps/01Book.pdf>
5. [https://www.actuariayfinanzas.net/images/sampleddata/FundamentalsofActuarialMathematics\\_S.DavidPromislow2015.pdf](https://www.actuariayfinanzas.net/images/sampleddata/FundamentalsofActuarialMathematics_S.DavidPromislow2015.pdf)

**Rationale for Nature of the course**

Provides a grounding in mathematical and statistical methods it equips with knowledge of statistical distributions and methods to summarize data.

**Activities having direct bearing on Skill development / Employability / Entrepreneurship**

Problem solving on Life tables & premium of insurance

**Pedagogy**

Chalk and Talk, PPT, Seminar, Interaction, Problem solving.

### Lecture Schedule

Unit	Topics	Hours	Mode
I	Measures of Mortality:- Life tables and its relation with survival function - life table function at non integer age.	5	PPT, Chalk and Talk and Assignments
	analytical laws of mortality	6	
	Gompertz and Makeham's laws of mortality – Select, ultimate and aggregate mortality tables.	5	
II	Abridged life tables – construction of abridged life tables	5	PPT, Chalk and Talk and Assignments
	Methods by Read and Merrell, Greville's, Kings and JIA method.	6	
	Utility Theory – Insurance and Utility Theory.	5	
III	Models for individual claims and their sums	5	PPT, Chalk and Talk, Assignments and seminar
	Multiple life function	5	
	Joint life status and last survival status.	5	
IV	Policy Values: Nature of reserve - prospective and retrospective reserves - fractional premiums and fractional durations - modified reserves - Continuous reserves	4	PPT, Chalk andTalk, Assignments and seminar
	Surrender values and paid up policies	4	
	Industrial assurance	4	
	Children's deferred assurances - Joint life and last survivorship.	4	
V	Pension Funds: Capital sums on retirement and death	6	PPT, Chalk and Talk, Assignments and seminar
	widow's pensions - Sickness benefits - Benefits dependent on marriage.	6	

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO's	Course Learning Outcomes	Knowledge Level
CLO-1	Acquire the knowledge of different lifetime random variables.	Up to K2
CLO-2	Know how to construct life tables and understand different types of insurances.	Up to K4
CLO-3	Knowledge about models for individual claims and their sums.	Up to K3
CLO-4	Calculate quantities such as premiums and reserves using actuarial techniques	Up to K4
CLO-5	Describe, explain and apply the fundamental theories of actuarial science as they apply in pension funds	Up to K3

### MAPPING CLOs WITH PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO-1			3		3	2	1
CLO-2		2			3	3	
CLO-3	2		2		3		2
CLO-4		2	2		3		
CLO-5	2	2			2	3	

### CIA I – Blue Print

Units	CLOs	K- Level	Section A		Section B		Section C	
			Short Answers		(Either/or Choice)		(Open Choice)	
			No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
1	CLO 1	Up to K2	2	K1 & K2	2	K2,K2	1	K2
2	CLO 2	Up to K4	3	K1 ,K2, K3	2	K3, K4	2	K3,K4
No. of Questions to be asked			5		4		3	
No. of Questions to be answered			5		2		2	
Marks for each question			2		5		10	
Total Marks for each section			10		10		20	

### CIA-I :: Distribution of Section-wise Marks with K levels

K Levels	Section A (No choice)	Section B (Either/or)	Section C (Open choice)	Total marks	% of marks without choice	Consolidated
K1	4	-	-	4	6.67	46.67%
K2	4	10	10	24	40	
K3	2	5	10	17	28.33	28.33%
K4	-	5	10	15	25	25%
K5	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100%

**CIA II – Blue Print**

Units	CLOs	K- Level	Section A		Section B		Section C	
			Short Answers		(Either/or Choice)		(Open Choice)	
			No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
1	CLO 3	Up to K3	3	K1,K1, K2	2	K2,K3	2	K2, K3
2	CLO 4	Up to K4	2	K2, K3	2	K3, K4	1	K3
No. of Questions to be asked			5		4		3	
No. of Questions to be answered			5		2		2	
Marks for each question			2		5		10	
Total Marks for each section			10		10		20	

**CIA-II :: Distribution of Section-wise Marks with K levels**

K Levels	Section A (No choice)	Section B (Either/or)	Section C (Open choice)	Total marks	% of marks without choice	Consolidated
K1	4	-	-	4	6.67	38.34%
K2	4	5	10	19	31.67	
K3	2	10	20	32	53.33	53.33%
K4	-	5	-	5	8.33	8.33%
K5	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100%

**Summative Examination– Blue Print**

Unit	CLOs	K Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of questions	K Level	No. of questions	K level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2(K1 & K1)	1(K2)
2	CLO 2	Up to K4	2	K3 & K4	1	K2	2(K4 & K4)	1(K4)
3	CLO 3	Up to K3	2	K2 & K3	1	K1	2(K2 & K2)	1(K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K3	2(K4 & K4)	1(K4)
5	CLO 5	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

**Distribution of section wise marks with K levels for Summative Examination**

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

**Course Designers:**

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