DEPARTMENT OF STATISTICS				*CLASS: I M.Sc. Statistics*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Major Core – 2	21P1SMC2	Distribution Theory	4	5	25	75	100

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

Course Objectives:

1. To equip the students with knowledge of various probability distributions
2. Create and apply customized probability distributions

Unit	Description	Hours	K-level	CLO(s)
I	(*Basic probability distributions – Binomial, Poisson, negative binomial, hypergeometric, multinomial, normal, uniform – **Only for introduction purpose not for examination***) Gamma, Beta distributions and their applications. Logarithmic and power series distributions – compound distribution – compound Binomial and compound Poisson distributions – Lognormal distribution – Cauchy distribution.	19	K2	1
II	Truncated distributions – left truncated binomial – left truncated Poisson – left and right truncated Normal distributions –Non-central *Student's t,* χ^2 and F distributions.	16	K3	2
III	Bivariate Normal distribution – Moment generating function – marginal and conditional distributions. Moments – Distribution of correlation coefficient when population correlation coefficient is equal to zero – Distribution of Regression coefficients.	13	K4	3
IV	Distributions of order statistics - median, range and mid-range. Distribution of Quantiles– Sample cumulative distribution function and its properties.	13	K3	4
V	Distribution of quadratic forms in normal random variables, their mean and variance, independence of quadratic forms, independence of linear and quadratic forms, Fisher-Cochran's theorem.	14	K4	5

Books for Reference:

1. Rohatgi, V.K. and Saleh, A.K.MD.E. (2011) An Introduction to Probability and Statistics, Wiley, New Delhi.
2. Johnson, N. L., Kemp, A.W., and Kotz, S. (2005). Univariate Discrete Distributions, Third Edition, John Wiley and Sons, New York.

3. Johnson, N. L., Kotz, S., and Balakrishnan, N. (2004).Continuous Univariate Distributions.Vol.I, John Wiley and Sons (Asia), Singapore.
4. Johnson, N.L Kotz, S. and Balakrishnan, N. (2014) Continuous Univariate Distributions, Vol. II.Wiley , Singapore.
5. Mukhopadhyay, P, (2002), Mathematical Statistics, Book and Allied Publishers, New Delhi.
6. David, H.A. (1971): Order Statistics, Wiley ,New York.
7. Bhuyan, K. C (2010), Probability Distribution Theory and Statistical Inference, New Central Book agency private ltd, Reprint, 2015
8. Mood, A.M., Graybill, F.A., and Boes, D.C, (1974), Introduction to the Theory of Statistics, Third Edition, McGraw-Hill International Edition.
9. Dudewicz, E.J., and Mishra, S. N. (1988).Modern Mathematical Statistics, John Wiley & Sons, New York.
10. Rao, C. R. (2009). Linear Statistical Inference and Its Applications, Second Edition, John Wiley and Sons, New York.
11. Karian, Z.A., and Dudewicz, E.J. (2011).Handbook of Fitting Statistical Distributions with R, Chapman and Hall.

Web references:

1. Basic probability distributions
   https://www.cse.iitk.ac.in/users/piyush/courses/pml_fall17/material/probabilty_tutorial.pdf
   https://www.colorado.edu/amath/sites/default/files/attached-files/lesson3_probdistns.pdf
   http://www.ams.sunysb.edu/~linli/teaching/ams-310/lecture-notes-3.pdf
2. Continuous Distribution
   http://www.utstat.utoronto.ca/~radford/sta247.F11/IPSUR6.pdf
   https://www.patnauniversity.ac.in/e-content/science/stat/MScStatistics7.pdf
3. Truncated Distribution
   http://parker.ad.siu.edu/Olive/ch4.pdf
4. Non-central distribution
   http://pages.stat.wisc.edu/~shao/stat609/stat609-13.pdf
5. Bivariate Normal distribution
   https://www.bauer.uh.edu/rsusmel/phd/sR-5.pdf
   http://www1.maths.leeds.ac.uk/~sta6ajb/math2715/lec19-20.pdf
6. Order Statistics
   https://www2.stat.duke.edu/courses/Spring12/sta104.1/Lectures/Lec15.pdf
   http://www.math.ntu.edu.tw/~hchen/teaching/LargeSample/notes/noteorder.pdf
7. Distribution of quadratic forms
   http://www.math.louisville.edu/~rsgill01/668/Ch_5_Notes.html
   http://users.stat.umn.edu/~sandy/courses/8311/handouts/ch05.pdf

Rationale for Nature of the course

This course facilitates the student to identify the nature of data and suitable distribution to be fitted. Student is able to apply the real time data by fitting a suitable distribution.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Exercise problems on distributions given on realtime situations

Pedagogy

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

Lecture Schedule

Unit	Topics	Hours	Mode
I	Basic probability distributions – Binomial, Poisson, negative binomial, hypergeometric, multinomial, normal, uniform	6	PPT, Chalk and Talk and Assignments
	Gamma, Beta distributions and their applications	4	
	Logarithmic and power series distributions	4	
	Compound distribution – compound Binomial and compound Poisson distributions	3	
	Lognormal distribution – Cauchy distribution	2	
II	Truncated distributions – left truncated binomial – left truncated Poisson	5	PPT, Chalk and Talk and Assignments
	left and right truncated Normal distributions	4	
	Non-central *Student's t*, χ^2 and F distributions.	7	
III	Bivariate Normal distribution – Moment generating function – marginal and conditional distributions. Moments	5	PPT, Chalk and Talk, Assignments and seminar
	Distribution of correlation coefficient when population correlation coefficient is equal to zero	4	
	Distribution of Regression coefficients	4	
IV	Distributions of order statistics - median, range and mid-range	7	PPT, Chalk andTalk, Assignments and seminar
	Distribution of Quantiles– Sample cumulative distribution function and its properties.	6	
V	Distribution of quadratic forms in normal random variables, their mean and variance,	5	PPT, Chalk and Talk, Assignments and seminar
	independence of quadratic forms, independence of linear and quadratic forms	5	
	Fisher-Cochran's theorem	4	

Course Learning Outcomes

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

CLO's	Course Learning Outcomes	Knowledge Level
CLO-1	Identify the type of statistical situation to which different distributions can be applied.	Up to K2
CLO-2	Acquire knowledge of various discrete and continuous probability distributions and their applications in real life problems.	Up to K3
CLO-3	Develop the properties of bivariate probability distributions	Up to K4
CLO-4	Define order statistics and obtain their sampling distributions	Up to K3
CLO-5	Use distribution of quadratic forms to solve statistical problems.	Up to K4

MAPPING CLOs WITH PSOs

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

Advance application – 3; Intermediate level – 2; Basic level – 1

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 , K1	2	K1,K1	1	K2
2	CLO 2	Up to K3	3	K2, K2,K3	2	K2,K2	2	K3, 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-I :: Distribution of section wise marks with K levels.

K Levels	**Section B (Short Answers)**	**Section C (Either/ or)**	**Section D (Open choice)**	**Total marks**	**% of marks without choice**	**Consolidated**
K1	4	10	-	14	23.33	63.33%
K2	4	10	10	24	40.00	
K3	2	-	20	22	36.67	36.67%
K4	-	-	-	-	-	-
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 K4	3	K1,K2, K3	2	K3, K4	2	K3, K4
2	CLO 4	Up to K3	2	K1, K2	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 B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	4	-	-	4	6.67	13.34%
K2	4	-	-	4	6.67	
K3	2	10	20	32	53.33	53.33%
K4	-	10	10	20	33.33	33.33%
K5	-	-	-	-	-	-
Total marks	10	20	30	60	100	100

Summative Examination -Blue Print

S. No.	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 K3	2	K2 & K3	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K4	2	K3 & K4	1	K3	2(K4 & K4)	1(K4)
4	CLO 4	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
5	CLO 5	Up to K4	2	K3 & K4	1	K2	2(K4 & K4)	1(K4)
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	
K2	2	4	10	10	26	21.67	35%
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

Course Designers:

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