

Members of the Board of Studies (BOS)

1

S.No.	Name	Signature
1.	Prof. Garima Jain, Dean, Science Faculty	En 20/2/25
2.	Prof. Ram Kishan, Convenor, D.A.V. (P.G.) College, Muzaffarnagar	Rihan 20:02.25
3.	Prof. Hare Krishna, External Expert, C.C.S. University, Meerut	
4.	Prof. V.K. Tyagi, External Expert, M.M. (P.G.) College, Modinagar	120225
5.	Dr. S.K. Pandey, Member, R.K. College, Shamli	Slander 2012/25-

SUBJECT: STATISTICS

Semester-wise Titles of the Papers in FYUP (Statistics)

Program	Yeai	Sem.	Paper Code	Paper Title	Theory/ Practical	Credits
iptive bility		I	0120601	Descriptive Statistics (Univariate) and Theory of Probability	Theory	04
n Descri d Proba	I		0120680	Descriptive Data Analysis Lab (Univariate)	Practical	02
Certificate in Descriptive Statistics and Probability		п	0220601	Descriptive Statistics (Bivariate) and Probability Distributions	Theory	04
Cert			0220680	Descriptive Data Analysis Lab (Bivariate)	Practical	02
natical ss with ence		in.	0320601	Theory of Estimation and Sampling Survey	Theory	04
Diploma in Mathematical & Applied Statistics with Statistical Inference E			0320680	Sampling Survey Lab	Practical	02
ma in N plied St itistical	II	IV	0420601	Testing of Hypothesis and Applied Statistics	Theory	. 04
Diplo & Ap Sta			0420680	Test of Significance and Applied Statistics Lab	Practical	02
			0520601	Multivariate Analysis and Non- Parametric Methods	Theory	04
		V	0520602	Analysis of Variance and Design of Experiment	Theory	04
B.Sc.	ш		0520680	Non-parametric Methods and DOE Lab	Practical	02
)			0620601	Statistical Computing and Introduction to Statistical Software	Theory	04
		VI	0620602	Operations Research	Theory	04
			0620680	Operations Research and Statistical Computing Lab	Practical	02
(s			0720601	Population Studies	Theory	04
B.Sc. (Honours)	IV	VII	0720602	Distribution Theory	Theory	04
B.S (Hí			0720603	Survey Sampling	Theory	04

New 1

Page 3

	<u></u>	<u> </u>	T	· · · · · · · · · · · · · · · · · · ·		
			0720604	Programming with R	Theory	04
			0720680	Practical Lab	Theory	04
			0820601	Probability Theory	Theory	04
			0820602	Statistical Inference-I	Theory	04
		vш	0820603	Linear Models and Experimental Designs	Theory	04
			0820604	Statistical Quality Control and Reliability Theory	Theory	04
	. <u>.</u>		0820680	Practical Lab	Theory	04
	_			OR		<u> </u>
			0720601	Population Studies	Theory	04
			0720602	Distribution Theory	Theory	04
rrch)		' VII	0720603	Survey Sampling	Theory	04
(Honours with Research)	х — Е		0720680	Practical Lab	Practical	04
with			0720665	Research Project	Project	04
ours	IV		0820601	Probability Theory	Theory	04
(Hor			0820602	Statistical Inference-I	Theory	04
B.Sc.		VIII	0820603	Linear Models and Experimental Designs	Theory	04
			0820680	Practical Lab	Practical	04
			0820665	Research Project	Project	04

Slunder

Shew

::Subject Prerequisites::

To study this subject a student must have taken Mathematics in class 12th.

::Program Outcomes (POs)::

Students having Degree in B.Sc. (with Statistics) should have knowledge of different concepts and fundamentals of Statistics and ability to apply this knowledge in various fields of industry. They may pursue their future career in the field of Statistics and Research.

::Program Specific Outcomes (PSOs)::

After completing B.Sc. (with Statistics) the student should have:

- * Knowledge of different concepts, principles, methodologies and tools (skills) of Statistics.
- Ability to collect, tabulate, represent graphically, analyze and interpret data/information by using appropriate statistical tools.
- Ability to identify and solve a wide range of problems in real life/industry related to Statistics.
- Familiarity with computational techniques and statistical software including programming language (e.g., R) for mathematical and statistical computation.
- Capability to use appropriate statistical skills in interdisciplinary areas such as finance, health, agriculture, government, business, industry, telecommunication and bio-statistics.
- Ability to compete with industrial/private sector demand in the field of data analysis, marketing survey, etc. in professional manner and pursue their future career in the field of Statistics.
- Ability to develop original thinking for formulating newproblems and providing their solutions. As a result, they will be able to pursue higher studies or research in the field of Statistics.

Kshar/

Schauden

Program	Year	Semester		Course Title	Credits	Teaching Hours
			Theory (0120601): Descriptive Statistics	Part-A: Descriptive Statistics (Univariate)		
iptive bility		-First	(Univariate) and Theory of Probability	Part-B: Theory of Probability	04	60
n Descri d Proba	Certificate in Descriptive Statistics and Probability I		Practical (0120680): I	Descriptive Data Analysis Lab (Univariate)	02	60
ate i cs an	I		Theory (0220601): Descriptive Statistics	Part-A: Descriptive Statistics (Bivariate)		
Certific Statisti		Second	(Bivariate) and Probability Distributions	Part-B: Probability Distributions	04	60
			Practical (0220680): E	Descriptive Data Analysis Lab (Bivariate)	02	60
			Theory (0320601):	Part-A: Sampling Survey		
natical s with nce	-	Third	Theory of Estimation and Sampling Survey	Part-B: Sampling Distributions and Theory of Estimation	04	60
athen itistic nfere			Practical (0320608):	Sampling SurveyLab	02	60
Diploma in Mathematical & Applied Statistics with Statistical Inference	п	L L	I coung of mypomesist	Part-A: Testing of Hypothesis and Tests of Significance	04	60
Diplor & Apj Sta		Fourth	and Applied Statistics	Part-B: Applied Statistics		
			Practical (0420680): 7 Lab	Test of Significance and Applied Statistics	02	60
			Theory-I (0520601):] Methods	Multivariate Analysis and Non-parametric	04	60
ġ		BIEN	Theory-II (0520602): Experiment	Analysis of Variance and Design of	04	60
B.Sc.	. 11		Practical (0520680): N	on-parametric Methods and DOE Lab	02	60
		Sixth	Theory-I (0620601): Statistical Software	Statistical Computing and Introduction to	04	60
			Theory-II (0620602):	Operations Research	04	60

LIST OF ALL PAPERS IN ALL EIGHT SEMESTERS

Mr! Page 16 Stander Wy

Maa Shakumbhari University

			Practical (0620680): Operations Research and Statistical Computing Lab	02	60
			Theory-I (0720601): Population Studies	04	60
			Theory-II (0720602): Distribution Theory	04	60
	-	Seventh	Theory-III (0720603): Survey Sampling	04	60
rs)		Š	Theory-IV (0720604): Programming with R	04	60
B.Sc. (Honours)	T 7		Practical Lab (0720680)	04	60
E. S	IV	-	Theory-I (0820601): Probability Theory	04	60
m i i			Theory-II (0820602): Statistical Inference-I	04	60
		Eight	Theory-III (0820603): Linear Models and Experimental Designs	04	60
		H	Theory-IV (0820604): Statistical Quality Control and Reliability Theory	04	60
			Practical Lab (0820680)	04	60
			OR		
			Theory-I (0720601): Population Studies	04	60
a		th-	Theory-II (0720602): Distribution Theory	04	60
Research)		Seventh	Theory-III (0720603): Survey Sampling	04	60
			Practical Lab (0720680)	04	60
rs wi	īv		Research Project (0720665)	04	60
nou			Theory-I (0820601): Probability Theory	04	60
B.Sc. (Honours with		1	Theory-II (0820602): Statistical Inference-I	04	60
B.S.c		Eight	Theory-III (0820603): Linear Models and Experimental Designs	04	60
			Practical Lab (0820680)	04	60
			Research Project (0820665)	04	60

Slender Rshew

P a g e | 7

	Progra	m/Class: Certifi	cate	Year: I	First	Semester: Fi	rst
				Subject: SI	TATISTIC	S	
		e: 0120601	Cour Prob	se Title: Desci ability	riptive Stat	istics (Univariate) and '	Theory of
	irse out						
		eting this course,					
		edge of Statistics					
	types o	r data.				and difference between	
*	Knowle (such a	edge of methods i s boxplots, histog	for sur gram a	nmarizing data nd stem plots)	a sets, inclu . Interpret h	ding common graphical nistogram and boxplot.	tools
¢		to describe data				cy and measures of	
*	Ability signific	to understand me ance.	asures	s of skewness	and kurtosi	s and their utility and	
*	Ability probabi	to understand the lity.	conce	ept of probabil	ity along w	rith basic laws and axiom	s of
•	Ability	to understand the	terms	mutually exc	lusive and i	ndependence and their re	elevance.
		to apply basic pro					
	Ability		conce			screte and continuous), c	concept
		Cre	dits: 0	4		Core: Compu	lsory
		Max.Marl	cs: 25-	-75		Min. Passing Mark	
		Total No. of Lect	ures-7	Tutorials-Pract	ical (in hou	urs per week): 4-0-0.	<u>-</u>
J	Jnit						No. of Lecture
		Pa	rt-A:	Descriptive S	Statistics (U	Jnivariate)	
_	I	Statistics, Sco contribution of population, Att Different types Primary data-d	pe o India tribute of s esigni	f Statistics n Scholars in s and Varial scales–Nomina ng a question	in Indust Statistics. bles (Discr al, Ordinal naire and s	tistics, Importance of ry, Introduction and Concept of Statistical rete and Continuous), l, Ratio and Interval, schedule, collection of indary data.	6
		primary data, ch	IECK111			-	
	П	Graphical Repr Cumulative	data esenta reque Histo	Classification tion of Group ncy distribu	on, Tabulat bed data, F utions ar	tion, Diagrammatic & requency distributions, ad their graphical and Ogives, Stem and	8

Kshew,

Page 18 My

	Part-B: Theory of Probability	
v	Random experiment, Trial, Sample point and Sample space, Events, Operations of events, Concept of equally likely, mutually exclusive and Exhaustive events. Definition of Probability: Classical, Relative frequency and Axiomatic approaches.	4
VI	Discrete Probability Space, Properties of Probability under Set Theory Approach, Independence of Events, Conditional Probability, Total and Compound Probability theorems, Bayes theorem and its applications.	9
VII	RandomVariables–Discrete and Continuous, Probability Mass Function (p.m.f.) and Probability density function (pdf), Cumulative distribution function (c.d.f.). Joint distribution of two random variables, Marginal and Conditional distributions, Independence of random variables.	8
VIII	Expectation of a random variable and its properties, Expectation of sum of random variables and product of independent random variables, Conditional expectation and related problems. Moments, Moment generating function (m.g.f.) & their properties, Continuity theorem for m.g.f. (without proof). Chebyshev's inequality, Weak law of large numbers for a sequence of independently and identically distributed random variables and their applications (Statement only).	9

Part A:

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2011). Fundamental of Statistics, Vol II, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn, Sultan Chand and Sons.
- Hanagal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach.Narosa Publishing Comp., New Delhi.
- Miller, I. and Miller, M. (2006). John E. Freund's Mathematical Statistics with Applications, Pearson Education, Asia.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (2011). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.
- Weatherburn, C.E. (1961). A First Course in Mathematical Statistics, The English Lang. Book

Page 19

Society and Cambridge Univ. Press.

Part B:

- David, S. (1994): Elementary Probability, Cambridge University Press.Dudewicz, E.J. and Mishra, S.N. (2008). Modern Mathematics Statistics, Wiley.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- Hanagal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp., New Delhi.
- Johnson, S. and Kotz, S. (1972). Distribution in Statistics, Vol. I-II & III, Houghton and Mifflin.
- Lipschutz, S., Lipson, M. L. and Jain, K. (2010). Schaum's Outline of Probability, 2nd Edition. McGraw Hill Education Pvt. Ltd, New Delhi.
- Meyer, P. (2017). Introductory Probability and Statistical Applications, 2nd Edn.), New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd.
- Mood A.M., Graybill, F.A. and Boes D.C. (2007). Introduction to the Theory of Statistics, 3rd Edn, New Delhi, Tata McGraw Hill Publishing Co. Ltd.
- Mukhopadhyay, P. (1996). Mathematical Statistics, New Delhi, New Central Book Agency Pvt. Ltd.
- Parzen, E.S. (1992). Modern Probability Theory and its Applications. Wiley Interscience.
- Rao, C.R. (2009). Linear Statistical Inference and its Applications, 2nd Edition, Wiley Eastern.
- Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Suggested Online Links/Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=statistic shttps://nptel.ac.in/course.htmlhttps://www.edx.org/search?q=statisticshttps://www.coursera.org/searc h?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Course Prerequisite:

To study this course, student must have passed Mathematics in 12th.

-Steender Kshew

Page | 10

Progra	m/C	ass: Certificate	Year: Fi	irst	Semester	: First	
			Subject:	STATIST	ICS		
Paper Co	ode:	0120680	Course Title: D	escriptive	Data Analysis Lab (Univariate)	
Course of	utco	mes:	I				
After com	pleti	ing this course, a st	ident will have:				
includ	ling	•	tools (such as be		ng appropriate Graph stograms and stem pl		
tender	ncy		and need of the		y appropriate measu d draw meaningful		
as pe	r the	-	-		appropriate measure leaningful conclusio	-	
 Abilit 	y to	measure skewness	and kurtosis of d	ata and def	ine their significance		
Acqui	ire th	e knowledge to cor	npute conditiona	ıl probabili	ties based on Bayes I	Theorem.	
		Credits	02		Core: Cor	npulsory	
		Max. Marks: 1	25+75		Min. Passing I	g Marks:	
	Т	otal No. of Lecture		tical (in ho	urs per week): 0-0-4.	·	
			List of Practical			No. of Lectures	
	1.	Problems based Histogram, Freque Stem and Leaf Plo	ency polygons, fi	representat requency c	ion of data by urves and Ogives,		
	2.	Problems based Tendency.	on calculation	of Meas	sures of Central	60	
	3.	Problems based or	n calculation of N	Measures of	f Dispersion.		
	4.	Problems based Skewness and Ku		of Mome	nts, Measures of		
	5.	Computation of theorem	conditional pro	babilities	based on Bayes		

As suggested for Paper Code: 0120601.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Viva-voce.

and

Page | 11

l Li		a (
	ogram/C	lass: Certificat	e Year:	First	Semester: Second		
			Subjec	t: STATIST	ICS		
	r Code: 0		Course Title: Descr Distributions	iptive Stati	tics (Bivariate) and Probability		
	se outco						
After			a student will have				
*	Knowle experim the mod	iciliai dala willi	thod of least squar a function or equa	res for curvention and to f	e fitting to theoretically describe ind the parameter associated with		
*	Knowledge of the concepts of correlation and simple linear regression and Perform correlation and regression analysis.						
**	Ability	to interpret resu	lts from correlation	and regress	ion.		
**			interpret rank corre				
*			oncept of qualitativ		s analysis.		
*	Knowle binomia	dge of discret	e distributions. T	Discuss ann	opriate distribution like negative ation of discrete distribution models		
*	-						
	models (o solve problem	c.) while their properties.	erties and ap	plication of continuous distribution		
*	moucisi	to solve problen	ns.		plication of continuous distribution		
* *	Knowled	lge of the formation	as. al definition of orde	er statistics.			
	Knowled	dge of the formation of identify the approximation of the second se	as. al definition of orde	er statistics.	tistics in real life problems.		
	Knowled	dge of the formation of identify the approximation of the formation of the dentify the approximation of the dentify the dentif	as. al definition of orde oplication of theory its: 04	er statistics.	tistics in real life problems. Core: Compulsory		
	Knowled Ability t	lge of the formation of identify the approximation of the formation of the formation of the density of the dens	as. al definition of orde oplication of theory its: 04 s: 25+75	er statistics. 9 of order sta	tistics in real life problems. Core: Compulsory Min. Passing Marks:		
*	Knowlea Ability t	dge of the formation of identify the approved the descent of the formation of the descent of the	as. al definition of orde oplication of theory its: 04 s: 25+75 res-Tutorials-Pract	er statistics. 9 of order sta	tistics in real life problems. Core: Compulsory Min. Passing Marks: s per week): 4-0-0.		
*	Knowlea Ability t	lge of the formation of identify the approved the formation of the formati	as. al definition of orde oplication of theory its: 04 s: 25+75 tres-Tutorials-Pract	er statistics. 9 of order sta ical (in hour pics	tistics in real life problems. Core: Compulsory Min. Passing Marks: s per week): 4-0-0. No: of Lectures		
*	Knowlea Ability t To	lge of the forma o identify the aj Cred Max. Mark tal No. of Lectu Pa	ns. al definition of orde oplication of theory its: 04 s: 25+75 ures-Tutorials-Pract To rt-A: Descriptive	er statistics. 9 of order sta ical (in hour pics Statistics (B	tistics in real life problems. Core: Compulsory Min. Passing Marks: 5 per week): 4-0-0. S per week): 4-0-0. No. of Lectures		
*	To Inoters of Knowlea Ability t To Bi Ma log	a solve problem dge of the formation o identify the ap Cred Max. Mark tal No. of Lectur Pa variate data, P eaning of cur	al definition of order oplication of theory its: 04 s: 25+75 res-Tutorials-Pract rt-A: Descriptive rinciples of least rve fitting, Fittir	er statistics. of order statistics (In the second statistic))) and second statistics (In the second statistic) and statistics (In the second statistic)) and statistic) and second statistic) and statistics (In the second statistic) and statistic) and statistic) and statistic) and second statistic) and statistic) and second statistic) and	tistics in real life problems. Core: Compulsory Min. Passing Marks: s per week): 4-0-0. No: of Lectures		
÷	Knowlea Ability t To iit Bi Ma log Le Bi-	lge of the forma o identify the aj Cred Max. Mark tal No. of Lectu Pa variate data, P eaning of cur garithmic, powe ast squares.	al definition of order oplication of theory its: 04 s: 25+75 rres-Tutorials-Pract rt-A: Descriptive rinciples of least rve fitting, Fittir er curves and other	er statistics. y of order statistics of order statistics (in hour pics Statistics (B) squares, may ng of strait r simple form on, Types of	tistics in real life problems. Core: Compulsory Min. Passing Marks: S per week): 4-0-0. S per week): 4-0-0. No: of Lectures ivariate) Dest plausible values, ght line, parabola, ns by the method of relationships. Scatter		

.

shew!

Schunday Wy

IV	Attributes: Notion and Terminology, Contingency table, Class frequencies and Ultimate class frequencies, Consistency, Association of Attributes, Independence, Measures of association for 2×2 table, Chi-square and Karl Pearson's Coefficient of Association.	6
	Part-B: Probability Distributions	
v	Discrete Probability Distributions: Binomial distribution, Poisson distribution (as limiting case of Binomial distribution) and their properties in detail. Introduction to Geometric, Negative Binomial, Hypergeometric, and Uniform distributions.	10
VI	Continuous Probability Distributions: Exponential, Gamma, Beta and Cauchy distributions with their basic properties.	6
VII	Normal distribution and its properties, Standard Normal variate, Normal distribution as limiting case of Binomial distribution.	8
νш	Fitting of Binomial and Poisson distributions. Introduction to Order Statistics, Distributions of minimum and maximum order statistics.	6

Part A:

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2011). Fundamental of Statistics, Vol II, World Press, Kolkata.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn., Sultan Chand and Sons.
- Hanagal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp., New Delhi.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (2011). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw Hill Pub. Co. Ltd.
- Weatherburn, C.E. (1961). A First Course in Mathematical Statistics, The English Lang. Book Society and Cambridge Univ. Press.

Part B:

- David, S. (1994). Elementary Probability, Cambridge University Press. David, H.A. (1981).
 Order Statistics, 2nd Edn., New York, John Wiley.
- Dudewicz, E.J. and Mishra, S.N. (2008). Modern Mathematics Statistics, Wiley.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn., Sultan Chand and Sons.
- Hanagal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp., New Delhi.
- Johnson, S. and Kotz, S. (1972). Distribution in Statistics Vol. I, II & III.
- Meyer, P. (2017). Introductory Probability and Statistical Applications, 2nd Edn., New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd.

Page 13 Jundar

- Mood, A.M., Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics, 3rd Edn., New Delhi, Tata McGraw Hill Publishing Co. Ltd.
- Mukhopadhyay, P. (1996). Mathematical Statistics, New Delhi, New Central Book Agency Pvt. Ltd.
- Parzen, E.S. (1992). Modern Probability Theory and its Applications. Wiley Interscience.
- Pitman, J. (1993). Probability. Narosa Publishing House.
- Rao, C.R. (2009). Linear Statistical Inference and its Applications, 2nd Edition, Wiley Eastern.
- Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=statist icshttps://nptel.ac.in/course.htmlhttps://www.edx.org/search?q=statisticshttps://www.coursera.org/se arch?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc.

Course Prerequisite:

To study this course, student must have passed Semester I.

Stender

Program/Class: Certificate	Year: 1	First	Semester	r: Second				
	Subject	STATISTIC	S					
Paper Code: 0220680	Course Title: Des	criptive Data	Analysis Lab (Biv	ariate)				
Course Outcomes:								
After completing this course, a	student will have:							
 Ability to deal with the p. e.g., fitting of straight line 	oblems based on f	itting of curves ynomial, powe	s by the Method of er curve, exponenti	Least squares, al curve etc				
 Ability to deal with prob Correlation coefficient-g 	lems based on dete	mination of R	egression lines and	l calculation of				
 Ability to deal with the p 	roblems based on c	letermination of	of Rankcorrelation.					
 Ability to fit Binomial ar 	d Poisson distribut	ion for given d	lata.					
Credi	ts: 02		Core: Comp	ulsory				
Max. Marks	: 25+75		Min. Passing Marks:					
Total No. of Lectur	es-Tutorials-Practi	cal (in hours p	er week): 0-0-4.					
1. Problems based of	n fitting of curves ight-line, second-c	ics.		No. of Lectures				
 Problems based o of Correlation coe 								
3. Problems based of	n determination of	Rank correlation	on.					
4. Fitting of Binomia	l and Poisson distr	ibution						

As suggested for Paper Code: 0220601.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Vivavoce.

Further Suggestions:

In practical classes a series of lectures for any statistical software (e.g., Excel or R) may be organized for students and they may be asked to use it to perform practical problems assigned to them.

shar

Schender

Program	Class: Diploma	Year: 8	Second	Semester: Th	nird
		Subjec	t: STATIST	TICS	
	de: 0320601	Course Title: The	ory of Estin	nation and Sampling S	urvey
	outcomes:				
	npleting this course, a				
	owledge of the conception				
Stat	idald deviation.			& statistic and standard	error &
	owledge of the sampli				
 Abi chai 	lity to understand the racteristics of these di	t, F and Chi-squar stributions.	e distributio	n and to identify the ma	in
Kno char	wledge of the concer racteristics of a good	t of Point and Inte estimator.	rval Estimat	ion and discuss	
🛠 Abi	lity to understand and	practice various n	nethods of e	stimations of parameters	5.
🛠 Abi	lity to understand the meration.	concept of sampling	ng and how :	it is different from comp	olete
Kno estir	wledge of various pro nates of population pa	bability and non-parameters	probability s	ampling methods along	with
 Abil 	lity to identify the situ	ations where the v	various samp	ling techniques shall be	used.
Kno	wledge of sampling a	nd non-sampling e	errors.		
	Credi	ts: 04		Core: Compu	lsory
	Max. Marks	: 25+75		Min. Passing Mark	
	Total No. of Lectur	es-Tutorials-Pract	ical (in hour	s per week): 4-0-0.	
Unit			Dics		No. of
	i linen 17 - En Altonia (m. 1891) Maria	Part-A: Sam	nling Surger		Lectures
	Types of populati			in Sample Survey,	
I	Benefit of Sampli Sampling units ar estimators. Types of	ng Survey, Sampl nd Sampling fram of Sampling Metho	ling vs. Con ne, Precision ods: Probabi	mplete enumeration: n and efficiency of ility Sampling, Non- ntary and Snowball	6
Ш	random number t	ables in selectio pulation mean a	n of simpl and proport	eplacement, Use of le random sample, ion, Derivation of ation of variances.	8

Rihen Schender hy

Page | **16**

ш	Stratified random sampling, Problem of allocation, proportional allocation, optimum allocation. Derivation of the expressions for the standard error of the usual estimators when these allocations are used. Comparison between SRS & Stratified Sampling in terms of Variance	8
IV	Systematic Sampling: Estimation of Population mean and Population total, standard errors of these estimators.	8
Part-I	B: Sampling Distributions and Theory of Estimation	<u> </u>
v	Sampling Distributions: The concept of sampling distribution, Parameter, Statistic and Standard error. The sampling distribution for the sum of independent random variables of Binomial, Poisson and Normal distributions.	4
VI	Central limit theorem (Statement only), Sampling distribution of Z, t, F, and Chi-square without derivations, Simple properties of these distributions and their interrelationship.	8
VII	Point estimation: Characteristics of a good estimator: Unbiasedness, Consistency, Sufficiency and Efficiency. Problems and examples, Interval estimation.	10
VIII	Method of Maximum Likelihood and properties of Maximum Likelihood estimators (without proof), Method of Least squares and method of Moments for estimation of parameters.	8

Part-A

- Ardilly, P. and Yves T. (2006). Sampling Methods: Exercise and Solutions. Springer.
- Cochran, W.G. (2007). Sampling Techniques, 3rd Edn., John Wiley & Sons, New Delhi.
- Des Raj (1976). Sampling Theory. Tata McGraw Hill, New York. (Reprint 1979).
- Des Raj and Chandhok, P. (1998). Sample Survey Theory, Narosa Publishing House.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn., Sultan Chand and Sons.
- Mukhopadyay, P. (2007). Survey Sampling. Narosa Publisher, New Delhi.
- Murthy, M.N. (1977). Sampling Theory and Statistical Methods. Statistical Pub. Society, Kolkata.
- Singh, D. and Choudhary, F.S. (1977). Theory and Analysis of Sample Survey Designs. Wiley Eastern Ltd, New Delhi (Reprint 1986).
- Sukhatme, P.V. and Sukhatme, B.V. (1970). Sampling Theory Surveys with Applications, 2nd Edn., Iowa State University Press.
- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984). Sampling Theories of Survey with Applications, IOWA State University Press and ISAS.
- Thompson, S.K. (2012). Sampling. John Wiley & Sons.

shew,

Seunder Page | 17

<u>Part- B</u>

- Ferund, J.E. (2001). Mathematical Statistics, Prentice Hall of India.
- Freedman, D., Pisani, R. and Purves, R. (2014). Statistics, 4th Edn. Norton & Comp. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I., Kolkata, The World Press.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn., Sultan Chand and Sons.
- Hanagal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp., New Delhi.
- Hogg, R.V., McKean, J.W. and Craig, A.T. (2009). Introduction to Mathematical Statistics, 6th Edn., Pearson.
- Kendall, M.G. and Stuart, A. (1979). The Advanced Theory of Statistics, Vol. 2. Inference and Relationship. 4th Edition. Charles Griffin, London.
- Kendall, M.G., Stuart, A. and Ord, J.K. (1994). The Advanced Theory of Statistics, Vol. 1.
 Distribution Theory. 6th Edition. Halsted Press (Wiley Inc.).
- Kenney, J.F.and Keeping, E.S. (1947). Mathematics of Statistics. Part I. 2nd Edition. Chapman & Hall.
- Kenney, J.F. and Keeping, E.S. (1951). Mathematics of Statistics. Part II. 2nd Edition. Chapman & Hall.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics, 3rd Edn., New Delhi, Tata McGraw Hill Publishing Co. Ltd.
- Tanner, M. (1990). An Investigation for a Course in Statistics. McMillan, New York.
- Tanur, J.M. (1989). Statistics. A Guide to the Unknown. 3rd Edition, Duxbury Press.
- Yule, G.U. and Kendall, M.G. (1973). An Introduction to the Theory of Statistics, 14th Edn. Charles Griffin & Comp.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=statisticshttps://nptel.ac.in/course.htmlhttps://www.edx.org/search?q=statisticshttps://www.coursera.org/se

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Stender

Program/Class: Diploma	Year: S	econd	Semester: Third
	Subje	et: STATIST	
Paper Code: 0320680	CourseTitle: Sa	mpling Surv	ev Lah
Course outcomes:			
After completing this course	, a student will hav	'e:	
* Ability to draw a simple			table of random numbers
* Ability to estimate popul	lation mean and va	riance in sime	le random sampling
Ability to deal with prob mean (Proportional and (lems based on Stra	tified random	sampling for population
Ability to deal with prob			n sampling.
·			
Cre	edits: 02		Core: Compulsory
	edits: 02 eks: 25+75		Core: Compulsory Min. Passing Marks:
Max. Mar	rks: 25+75	ctical (in hour	Core: Compulsory Min. Passing Marks: s per week): 0-0-4.

As suggested for Paper Code: 0320601.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Viva-voce.

Further Suggestions:

In practical classes a series of lectures for any statistical software may be organized for students and they may be asked to use it to perform practical problems assigned to them.

viv 1

Stender

	/Class: Diploma	Year: Second	Semester:	Fourth
······		Subject: STAT	ISTICS	
	ode: 0420601	Course Title: Testing of H	ypothesis and Applied Sta	atistics
	outcomes:			
	npleting this course,			
 Kı alt 	nowledge of the terr remative hypotheses,	ns like Null and Alternative level of significance and p-v	hypotheses, two-tailed an value etc.	d one-taile
		he concept of MP, UMP and		
🏼 🛠 🕹	oility to understand u	nder what situations one wor ase of one sample and two sa	uld conduct the 11	ole and
🌣 Fa	miliarity with differe uations.	ent aspects of Applied Statist	ics and their use in real life	:
🄄 At	ility to understand th	e concept of Time series alo	ing with its different comp	monto
🌣 Kn	owledge of Index numbers.	mbers and their applications	along with different types	of Index
Fai Fer	niliarity with various tility.	s demographic methods and o	different measures of morta	ality and
Ab	ility to understand th	e concept of Life table and it	ts construction	
🕻 Kn	owledge to understar arts for Variables and	nd the concept of Statistical (Quality Control and differe	nt Control
	Cred	its: 04	Core: Compu	lsorv
<u> </u>	Max. Mark	s: 25+75	Min. Passing Mark	·
	Total No. of Lectu	res-Tutorials-Practical (in ho		
Unit		Topics		No. of
an a	and a second		A DATE AND A	Lectures
		esting of Hypothesis and Te	ests of Significance	
I		othesis (Simple and C nesis. Type–I and Type–II en	omposite), rors, Significance level,	8
п	Most Powerful (MP), U Most Powerful U (UMPU) tests.		JMP) and Uniformly	8
nı	Test of Signific Variables) propor samples.	ance: large sample tests tions and means (i) for one	for (Attributes and sample (ii) for two	6

Lh nder Rshow \leq

Page | 20

v	Introduction & Definition of Time Series, its different components, illustrations, additive and multiplicative models. Determination of trend by free hand curve, semi average method, moving average method, method of least squares, Analysis of Seasonal Component by Simple average method, Ratio to moving Average, Ratio to Trend, Link relative method.	9
VI	Index number, its definition, application of index number, price relative and quantity or volume relatives, link and chain relative, problem involved in computation of index number, use of averages, simple aggregative and weighted average method. Laspeyre's, Paasche's and Fisher's index number, time and factor reversal tests of index numbers, consumer price index.	9
VII	Vital Statistics: Measurement of Fertility– Crude birth rate, general fertility rate, age-specific birth rate, total fertility rate, gross reproduction rate, net reproduction rate, standardized death rates, Complete life table, its main features and construction.	6
VIII	Introduction to Statistical Quality Control, Process control, tools of statistical quality control, 3σ control limits, Principle underlying the construction of control charts. Control charts for variables \overline{X} and 'R' charts, construction and interpretation, Control charts for attributes 'p' and 'c' charts, construction and interpretation.	6

<u> Part- A</u>

- Ferund, J.E. (2001). Mathematical Statistics, Prentice Hall of India.
- Freedman, D., Pisani, R. and Purves, R. (2014). Statistics, 4th Edition. Norton & Comp.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I., Kolkata. The World Press.
- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edn., Sultan Chand and Sons.
- Hangal, D.D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp., New Delhi.
- Kendall, M.G. and Stuart, A. (1979). The Advanced Theory of Statistics, Vol. 2. Inference and Relationship 4th Edition. Charles Griffin & Comp.
- Kendall, M.G., Stuart, A. and Ord, J.K. (1994). The Advanced Theory of Statistics, Vol. 1.
 Distribution Theory 6th Edition. Halsted Press (Wiley Inc.).
- Kenney, J.F. and Keeping, E.S. (1947). Mathematics of Statistics. Part I. 2nd Edition. Chapman & Hall.
- Kenney, J.F. and Keeping, E.S. (1951). Mathematics of Statistics. Part II. 2nd Edition. Chapman & Hall.
- Mood, A.M., Graybill F.A. and Boes, D.C. (2007). Introduction to the Theory of

Jege |21 W

Statistics, 3rd Edn., New Delhi, Tata McGraw Hill Publishing Co. Ltd.

- Tanner, M. (1990). An Investigation for a Course in Statistics. McMillan, New York. Tanur, J.M. (1989). Statistics. A Guide to the Unknown 3rd Edition, Duxbury Press.
- Yule, G.U. and Kendall, M.G. (1973). An Introduction to the Theory of Statistics, 14th Edition. Charles Griffin & Comp.

<u>Part - B</u>

- Croxton, F.E., Cowden, D.J. and Klein, S. (1973). Applied General Statistics, 3rd Edn., Prentice Hall of India Pvt. Ltd.
- Gupta, S.C. and Kapoor, V.K. (2008). Fundamentals of Applied Statistics, 4th Edn., Sultan Chand and Sons.
- Montgomery, D.C. (2009). Introduction to Statistical Quality Control (6th ed.), Wiley India Pvt. Ltd.
- Mukhopadhyay, P. (2011). Applied Statistics, 2nd edition revised reprint, Books and Allied (P) Ltd.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=statisticshttps://nptel.ac.in/course.htmlhttps://www.edx.org/search?q=statisticshttps://www.coursera.org/se

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Stemders

Program/Class: Diploma	Year	: Second	Semester:	———— Fourth
	Subject:	STATISTICS		
Paper Code: 0420680	Course Title: Tests			
Course outcomes:		or organicane	e and Appned 5	taustics Lab
After completing this cours	se, a student will have.			
 Ability to conduct tes 		nt Eand Chi		
* Ability to deal with p	oblems based on large	ni u r ang um-	square tests.	
Ability to deal with proceedings for foregoing the second seco	oblems based on time s	eries and colou	lation of its street	
components for foreca	sung.		Tation of its diffe	rent
Ability to deal with pr	oblems based on Index	number.		
 Acquire knowledge at 	out measurement of mo	ortality and fert	ility.	
 Ability to deal with pr 	oblems based on life tab	ole.		
Ability to work with c	ontrol charts for variabl	es and attribute	s and draw infere	ences.
C	redits: 02		Core: Com	pulsory
Max. M	arks: 25+75		Min. Passing M	
Total No. of Le	ctures- Tutorials-Practic	cal (in hours pe	r week): 0-0-4.	
anna an an an ann an Anna an A Anna an Anna an	List of Practicals			No. of
	based on t-test.			Lectures
2. Problems	based on F-test.			
3. Problems	based on Chi-square tea	st.		
	based on calculation of		n.	
	based on large sample t			
	based on time series and			60
7. Problems	based on Index number			
8. Problems	based on measurement	of mortality an	d fertility.	
9. Problems	based on life table.			
10. Problems	based on control charts	for variables an	nd attributes.	

As suggested for Paper Code: 0420601.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Vivavoce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

Page | 23 Why? WW/

	am/Class: B.Sc.	Year:	Third	Seme	ster: Fifth
		Subjec	ct: STATIST		
Paper C	odc: 0520601	Course Title: Mult			
	outcomes:				ametric Metho
After con	npleting this course,	, a student will have			
🌣 Abil	ity to understand the ivariate distribution	e hasic concepts of	matrices in o	rder to study	
 Abili 	ity to understand biv	variate normal distri	bution and it	s applications	
Know	wledge of the applic lihood estimates of 1	ations of multivoria	to monut 1'		mum
 Abili cases 	ty to apply distribut	ion free tests (Non-	parametric m	ethods) for one and	l two sample
	Cree	dits: 04		Core: Cor	mpulsory
	Max. Marl	ks: 25+75			 Marks:
	Total No. of Lect	ures- Tutoriale Proc	<u>.</u>		
		aros rutoriais-riac	tical (in hou	s per week) 4-0-0	
Unit		s in the set of the result of the	tical (in hour	s per week): 4-0-0 .	No. of
Unit I	Elementary op	s in the set of the result of the	opics	f Matrix Bow	No. of Lectures
ι Unit I I	Elementary op Column Rank, 1 Introduction to Applications of	rations on Matric Inverse of a matrix. multivariate analysi multivariate analysi	pics. ces, Rank o Eigen values s, Uses and is Bivariate	f Matrix, Row as and Eigen vectors	No. of Lectures
·	Elementary op Column Rank, 1 Introduction to Applications of distribution: def Multivariate Conditional Dis	To erations on Matric Inverse of a matrix. multivariate analysi multivariate analysi inition and Simple J Normal Distribut tributions, Characte	opics ces, Rank o Eigen values s, Uses and is, Bivariate properties. ion, Marg ristics function	f Matrix, Row as and Eigen vectors normal inal and on	nd . 8
Π	Elementary op Column Rank, 1 Introduction to Applications of distribution: def Multivariate Conditional Dis Maximum Likel Dispersion matri these estimates.	rations on Matric Inverse of a matrix. multivariate analysi multivariate analysi inition and Simple p Normal Distribut tributions, Characte lihood Estimation of ix and their Indepen	opics ces, Rank o Eigen values s, Uses and is, Bivariate properties. ion, Marg ristics function f Mean vector adence, suffic	f Matrix, Row and Eigen vectors normal inal and on r and itent statistics of	No. of Lectures ad . 8 7 8 8 7
П	Elementary op Column Rank, 1 Introduction to Applications of distribution: def Multivariate Conditional Dis Maximum Likel Dispersion matri these estimates.	rations on Matric Inverse of a matrix. multivariate analysi multivariate analysi inition and Simple J Normal Distribut tributions, Characte lihood Estimation of ix and their Indepen	opics ces, Rank o Eigen values s, Uses and is, Bivariate properties. ion, Marg ristics function f Mean vector adence, suffice ple and Part	f Matrix, Row and Eigen vectors normal inal and on r and itent statistics of	nd 8 7 8
II III IV	Elementary op Column Rank, 1 Introduction to Applications of distribution: def Multivariate Conditional Dis Maximum Likel Dispersion matr these estimates. Concepts and c Multiple Regres practical applica	rations on Matric Inverse of a matrix. multivariate analysi multivariate analysi inition and Simple J Normal Distribut tributions, Characte lihood Estimation of ix and their Indepen	opics ces, Rank o Eigen values s, Uses and is, Bivariate properties. ion, Marg ristics function f Mean vector adence, suffice ple and Part ee variables	f Matrix, Row and and Eigen vectors normal inal and on r and itent statistics of ial correlations and on only (with their	nd 8 7 8
П Ш IV V	Elementary op Column Rank, I Introduction to Applications of distribution: def Multivariate Conditional Dis Maximum Likel Dispersion matr these estimates. Concepts and c Multiple Regress practical applica Non-parametric tests: Sign test, V Tests for random	erations on Matric Inverse of a matrix. multivariate analysi multivariate analysi multivariat	opics ces, Rank o Eigen values s, Uses and is, Bivariate properties. ion, Marg ristics function f Mean vector adence, suffice ple and Part ee variables tion and symmetric tor goodnes	f Matrix, Row and and Eigen vectors normal inal and on r and cient statistics of ial correlations and only (with their metry, one sample s of fit.	nd 8 7 8 7 d r 8

- Anderson, T.W. (2003). An Introduction to Multivariate Statistical Analysis, 3rd Edn., John Wiley
- Gibbons, J.D. and Chakraborty, S. (2003). Non-parametric Statistical Inference, 4th Edition. Marcel

Shew Page 124 Shew Shawden h

Dekker, CRC.

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata.
- Johnson, R.A. and Wichern, D.W. (2007). Applied Multivariate Analysis, 6th Edn., Pearson & Prentice Hall
- Kshirsagar, A.M. (1972). Multivariate Analysis, 1st Edn., Marcel Dekker.
- Muirhead, R.J. (1982). Aspects of Multivariate Statistical Theory, John Wiley.
- Rohatgi, V.K. and Saleh, A.K. Md. E. (2009). An Introduction to Probability and Statistics, 2nd Edn. (Reprint). John Wiley and Sons.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=statis ticshttps://nptel.ac.in/course.htmlhttps://www.edx.org/search?q=statisticshttps://www.coursera.org/search?q=statisticshttps://search?

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

shew

Schemder

Prog	ram/Class: B.Sc.	Year: Th	ird	Semester	 : Fifth
	•	Subject:	STATISTICS		
	Code: 0520602	CourseTitle: Analys		and Design of F	
	outcomes:				
	ompleting this course, a				
* K1	nowledge of the concep	ot of Analysis of Var	iance (ANOVA)).	
* Al	oility to carry out the A	NOVA for One way	and Two-way (lassification	
 At 	oility to carry out the p	ost-hoc analysis.	2		
🎸 Kr	nowledge of the concep	ot of Design of experi	ment and its bas	SiC principles	
* At mi	ollity to perform the ba ssing observations.	sic symmetric design	s CRD, RBD an	d LSD with and	
Kn	owledge of the concep	t of factorial experim	ents and their p	ractical applicati	ons.
		ts: 04		Core: Comp	ulsory
<u>-</u>	Max. Marks		N	Ain. Passing Ma	ks:
e i gente	Total No. of Lectu	res- Tutorials-Practic	al (in hours per	week): 4-0-0.	
-Unit		Topics			No. of
I	Limitations of AN	ysis of Variance, Ass OVA, One way class	ification.	<u>din ninan'i Alfrein (Annold</u> ing) ang katalog ang katalo	- Eectures 8
ш		cation with one ob sing critical difference	e criteria.		8
ш	uniformity trials.	gn of Experiment: I, Choice of size	and type of a	a plot using	7
IV	Statistical analysis	mized Design (CRI of CRD, Merits and c	lemerits.		7
v	RBD.	c Design (RBD), c n, Comparison of ef	ficiency betwee	en CRD and	7
VI	ethciencies berween	n (LSD), Lay-out, Al 1 LSD and RBD; LSI	D and CRD		
VII	Missing plot techni error sum of squ observation.	que: Estimation of n ares in RBD and	uissing plots by LSD with o	minimizing me missing	7
VIII	Factorial Experimen 2^2 , 2^3 and 2^n fact Definition of Main experiments,	nts: General descripti orial experiments an effects and Interacti	ranged in RBI) and LSD	8

• Cochran, W.G. and Cox, G.M. (1957). Experimental Design. John Wiley & Sons, NewYork.

UNI Shender

- Cochran, W.G. and Cox, G.M. (1959). Experimental Design. Asia Publishing House.
- Das, M.N. and Giri, N.S. (1986). Design and Analysis of Experiments, 2nd Edn., Wiley.
- Dean, A. and Voss, D. (1999). Design and Analysis of Experiments. Springer-Verlag, New York.
- Federer, W.T. (1955). Experimental Design: Theory and Applications. Oxford & IBH Publishing Company, Calcutta, Bombay and New Delhi.
- Joshi, D.D. (1987). Linear Estimation and Design of Experiments. New Age International
- (P) Ltd. New Delhi.
- Kempthorne, O. (1965). The Design and Analysis of Experiments, John Wiley.
- Montgomery, D.C. (2017). Design and analysis of Experiments, 9th Edition. John Wiley & Sons.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/ScarchContent.aspx https://swayam.gov.in/explorer?searchText=statistics https://nptel.ac.in/course.html https://www.edx.org/search?q=statistics https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Rshow Slunder

Program/Class: B.Sc.	Year: Third	Sement	er: Fifth
	Subject: STATISTIC		<u> </u>
Paper Code: 0520680	Course Title: Non-parametri		
			; Lab
After completing this course, a	a student will have:		
 Ability to conduct test of 	significance based on Non-pa	Trametric tests	
 Ability to deal with multi 	ivariate data.	arumetrie tests.	
✤ Ability to perform ANOV	A for one way and two way o		
 Ability to perform post-h 	oc analysis.		
 Ability to conduct analyst observations. 	is of CRD, RBD and LSD wit	h and without missing	Ş
Credi	ts: 02	Core: Com	
Max. Marks		Min. Passing M	
Total No. of Lectur	es- Tutorials-Practical (in hou	ITS Der week): 0-0 4	
	Topics		NTA
1. Problems bas			Lectures
2. Problems bas	ed on Non-parametric tests for	r one sample.	
3. Problems base	ed on Non-parametric tests for ed on Rank and Inverse of a m	r two samples.	
manyanate n	ed on Mean vector and Disper ormal distribution.		
5. Problems base way classifica	d on Analysis of variance in c tion.	one-way and two-	60
6. Problems base	d on Analysis of a Latin squa	re design.	
7. Problems base one missing of	d on Analysis of variance in F	RBD and LSD with	

As suggested for Paper Codes: 0520601 and 0520602.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Vivavoce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

han

nder

Prog	ram/Class: B.Sc	•	Year:	Third	Semeste	er: Sixth
			Subjec	t: STATIST	and the second	
	ode: 0620601	Cour Softv	se Title: Statistic:		g and Introduction	to Statistical
	outcomes:					
uter con	mpleting this co	urse, a	student will have			
	• •	0	and a pronuncing F	$1 a \mu m c s m R$	e basic notions for de and Excel.	
✤ Abil as E	ity to perform d xcel.	ata ana	lysis for both uni	variate and m	ultivariate data sets u	using R as well
	<u> </u>	Credi	s: 04		Core: Com	oulsory
	Max.	Marks	: 25+75		Min. Passing Ma	
	Total No. of	Lectur	es- Tutorials-Prac	tical (in hour	s per week): 4-0-0.	
Unit		2	Toj	والواج الماري ويوز الأمير بالقواق ماترا بالاه	o por weekj. 4-U-U.	The second second
	Introduction			and the second sec		No. of Lectures
I	(Binary, Oc statistical pro	stal, I blems	Hexadecimal System	ts periphera stems). Flo ⁻	er, Basic Structure of ls, number systems wchart for simple	
II	formatting, de and print wor	elete, i kbook.	nsert and adjust c	ells, column	Started with Excel, & Editing, Number s and rows, Preview	б
ш	Colour, Add,	Delet	Sheels, manaoin	g worksheet Worksheet V	ta Formatting, Sort s-Changing Name, Views- Comparing zing Panes,	6
IV	Karl Pearson o	correla	tion coefficient, R	e-way & T egression Ar		10
v	Vectors, Matri	ces, A	rays, Data Frame	anding a data s, Factors and	1	8
VI		anaoie	s, recoaing variat	le, renaming	1	7
VII	Normality, t-te: paired t-test.	R, In st for s	terential Statistic ingle mean, t-test	es- Parametr for differenc	ic test: Test for e between means,	8

Kshew

Sil den Page | 29

Ż

VIII	Using R: Wilcoxon signed rank sum test, Mann Whitney U test, Kolmogorov-Smirnov Test for normality, Analysis of Variance (One- way & Two-way ANOVA), Karl Pearson correlation coefficient, Regression Analysis.	i I	
------	--	-----	--

- Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
- Crawley, M.J. (2017). The R Book, John Wiley & Sons.
- Eckhouse, R.H. and Morris, L.R. (1975). Minicomputer Systems Organization, Programming and Applications, Prentice-Hall.
- Eckhouse, R.H. and Morris, L.R. (1975). Minicomputer Systems Organization, Programming and Applications, Prentice-Hall.
- Great Harvey (2019). Excel 2019 all in one, John Wiley & Sons.
- Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspx https://swayam.gov.in/explorer?searchText=statistics https://nptel.ac.in/course.html https://www.edx.org/search?q=statistics https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

sharl

Schundey lig

Page | 30

	Program/Class: B.Sc.	Year:	Third	Semester:	 Sixth
		Subjec	t: STATIST		
	Code: 0620602	Course Title	e: Operation	s Research	
	outcomes:				· <u> </u>
After co	ompleting this course,	a student will have:			
An	idea about the histori	cal background and	l need of Ope	rations research.	
 Ab des 	ility to identify and de cription of the real-lif	velop operational r è problems.	esearch mod	els from the verbal	
Kn	owledge of the mather	natical tools that ar	re needed to s	colve optimization proble	ems
 Pro 	blems, Job sequencing	programming prob 3, etc.	lem, Transpo	ortation and Assignment	5113.
🏵 Abi	lity to solve the proble		e Theory.		
		its: 04		Core: Compute	 sory
	Max. Mark			Min. Passing Marks	 s:
	Total No. of Lectu	res- Tutorials-Prac	tical (in hour	s per week): 4-0-0.	<u> </u>
Unit			Copics		No. o
	History & backgro			ses of OR in different	Lectur
I		ar programming pro	oblems and the	heir formulations.	6
	Solving LPP by Gr				
п		aphical Method Sol	lving LPP by	Simplex method.	10
					10
п Ш	Method Solving LP	P by Big-M metho	ed and Two-p	hase Method.	10 8
	Method Solving LP Transportation pro Vogel's approximat	P by Big–M metho blem: North-west ion method. Optim	ed and Two-p corner rule um solution:	hase Method. , least cost method, Modi method.	
III	Method Solving LP Transportation pro Vogel's approximat Assignment Problem Problem,	P by Big–M metho blem: North-west ion method. Optim n: Hungarian Meth	od and Two-p corner rule um solution: od, Travellin	hase Method. , least cost method, Modi method. g Salesman	8
III IV	Method Solving LP Transportation pro Vogel's approximat Assignment Problem Problem, Job sequencing: n jo machines.	P by Big–M metho blem: North-west ion method. Optim n: Hungarian Metho bbs–2 machines, n j	od and Two-p corner rule um solution: od, Travellin obs-k machin	hase Method. , least cost method, Modi method. g Salesman nes, 2jobs –n	8 10 6
III IV V	Method Solving LP Transportation pro Vogel's approximat Assignment Problem Problem, Job sequencing: n jo machines. Game theory: Intro Competitive Games	P by Big–M metho blem: North-west ion method. Optim n: Hungarian Meth bbs–2 machines, n j duction, Competit	od and Two-p corner rule um solution: od, Travellin obs-k machin ive Situation	hase Method. , least cost method, Modi method. g Salesman	8

- Gupta, R.K. (2018). Operations Research. Krishna Publication.
- Hadley, G. (2002). Linear Programming. Narosa Publications

lhy!

Page 131 Schender

- Hillier, F.A. and Lieberman, G.J. (2010). Introduction to Operations Research-Concepts and cases, 9th Edn., Tata McGraw Hill.
- Prabhakar, P. (2013). Operations Research: Principles and Practice, Oxford University Press.
- Swarup, K., Gupta, P.K. and Manmohan (2007). Operations Research, 13th Edn., Sultan Chand & Sons.
- Taha, H.A. (2007). Operations Research: An Introduction, 8th Edn., Prentice Hall of India.

Suggested Online Links/ Readings:

http://heecontent.upsdc.gov.in/SearchContent.aspxhttps://swayam.gov.in/explorer?searchText=stati sticshttps://nptel.ac.in/course.html https://www.edx.org/search?q=statistics https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Kshen Shenders

Program/Class: B.Sc.	Year: Thir	d Seme	ester: Sixth			
	Subject: STA	TISTICS				
Paper Code: 0620680	Course Title: Operations					
Course outcomes:			a Computing Lab			
After completing this course	, a student will have:					
 Knowledge of mathem 	atical formulation of L.P.P					
Ability of solving LPP	using different methods.					
 Ability to solve Alloca 	tion Problems based on Tra	nsportation and A				
 Ability to solve problem 	ns based on Game Theory.	insportation and Assignm	nent models.			
 Ability to use program. 	ning language R as Calcula	tor				
 Knowledge of using R 	in simple data analysis					
 Ability to perform statis Excel. 	tical functions, creating gra	phs and statistical analys	is by using			
Credits: 02 Core: Compulsory						
Max. Marks: 25+75		Min. Passing Marks:				
Total No. of Lect	ures- Tutorials-Practical (in	hours ner week): 0-0-4				
	Topics					
1. Problems base	d on Mathematical formula		No. of Lectures			
2. FIODIEINS Dase	d on solving LPP using Gr	mbinal Meril 1				
	u on solving LPP using Cin	mlow Master - t				
1 TODIEIIIs Dase	4. Problems based on solving LPP using Big M-method involving artificial variables.					
	/103.					
 Allocation Problem based on Transportation model. Allocation Problem based on Assignment model. Broblem based on Assignment model. 						
7. Floblens based on Game pay off matrix						
8. Problems based on solving Graphical solution to mx2 /2xn rectangular game.						
9. Problems based	on solving Mixed strategy	and a second sec				
10. FIODIeins Dased	On application of R as Cat	milatan				
11. FIUDICINS Dased	01 application of P in sim	مام الملي الم	1			
12. Problems based	on application of Excel in	data analysis				

As suggested for Paper codes: 0620601 and 0620602.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Viva-voce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

Page 133 hys

Progra	amme/Class: B.Sc. (I	Ionours)	Year: Fourth	Semester: S	eventh
	i	5	Subject: STATISTICS		
	ourse Code: 0720601 Course Title: Population Studi				
Course	Outcomes:				
On succ	cessful completion of	this course,	, the students will be able to:	•	
🏼 🕈 Ur	nderstand how population in the standard design of the standard desi	ation trends	influence various concete	of human life, such a	as social,
			ce the fertility, mortality and	migration	
😽 Un	derstand the challen nographic shifts.	ges and opp	portunities related to popula	tion growth, aging,	and other
	Credits: 04		Core: C		
	Max. Marks:			Compulsory	
	Total No. of Leature			Passing Marks:	•
	- other interesting	ires-1 utori	als-Practical (in hours per	week): L-T-P: 4-0.	-0
Unit			Topics		No. of
I	Introduction to I and uses of demo data.	Demography graphic dat	y, Sources of Demographic a: Coverage and content erro	data, Limitations ors in demographic	Lecture 8
п	Whipple, Meyer	and UN in	s and Chandrasekharan-De gistration data, adjustment d dices. Population compositi demographic transition		14
ш	Measurement of Age-specific deat uses of Life tabl Fertility: Crude b Total fertility rate.	ency ratio, Theory of demographic transition. ement of Mortality: Crude death rate, Standardized death rates, cific death rates, Infant Mortality rate, Definition, construction and Life table, Complete and abridged life tables. Measurement of crude birth rate, General fertility rate, Age-specific birth rate, tility rate, Gross reproduction rate, Net reproduction rate. Population Growthy Additional States of			
IV	growth rates, Dec growth and their population growth international mig migration. Stable	adal growth fitting to Internal ration, Net and quasi tion, Methe	1: Arithmetic, Geometric 1 rate Doubling time, Mode 2 population data. Stocha 2 migration and its measurer 3 migration, Factors affe -stable populations, Station 2 population project	and Exponential els for population astic models for nent, Concept of cting population	22

- Benjamin, B. (1969). Demographic Analysis. George, Allen and Unwin. .
- Biswas, S. (1988). Stochastic Processes in Demography and Applications, Wiley Eastern Ltd. ø
- Cox, P.R (1970). Demography. Cambridge University Press. ۰
- Keyfitz, N. (1971). Applied Mathematical Demography, Springer Verlag. •
- Office of Registrar General and Census Commissioner India (Ministry of Home Affairs) •

ishan, Page 134 light

- Spiegelman, M. (1969). Introduction to Demographic Analysis, Harvard Universit
- Principles and accommodation of National Populations Census UNESCO.

Principles and accommodation of National Populations Census UNESCO.

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Course Prerequisite:

To study this course, student must have passed U.G. Degree.

Kihow Sulunder Wy

	gramme/Class: B.Sc. (Honour	s) Year: Fourth	Semester: Sevent		
		Subject: STATISTICS			
	urse Code: 0720602	Course Title: Distribution The			
	e Outcomes:				
On suc	ccessful completion of this cou	urse, students will be able to:			
🌣 [Inderstand different types of d	listributions and their application in real-life	mana la tara		
🌣 E	Describe the distinguishing fea	tures of various probability distributions.	problems.		
* V	Vork with sampling distributio	ons (central and non-central Chi-square, t and			
	Credits: 04	(contral and non-central Chi-square, t and	l F distributions).		
Max. Marks:		Core: Compulsory	Core: Compulsory		
Minimum Passing		arks:			
	Total No. of Lectures-Tu	Itorials-Practical (in how			
I	Joint, marginal, and condi	tional distributions of two dimensions	a series of the		
1	of random variable.	variables, Distributions of transformations	8		
II	Characterization and distributions: Binomial, Geometric, Negative binor Uniform, Normal (univaria and bivariate), Laplace, lognormal distributions.	20			
Ш 	Symmetric distributions, Truncated distributions, Compound distributions, Mixture distributions, Exponential family of distributions. Sampling distributions, elementary ideas of non-central distributions: non-central Chi-square, t and F distributions and their properties.				
IV	statistics, their distribution	forms. Approximating distributions of g moment generating function, Order n and properties, Joint and marginal tics, Extreme values and their asymptotic	16		

- Edn., The World Press, Kolkata.
- Goon A.M., Gupta, M.K. and Gupta, B.D. (2002). Fundamentals of Statistics, Vol. I & II, 8th
- Goon, A.M., Gupta, M.K. and Gupta, B.D. (2011). Fundamentals of Statistics, Vol. I. The World Press, Kolkata.
- Hogg, R.V., Tanis, E.A. and Rao, J.M. (2009). Probability and Statistical Inference, 7th Edn., Pearson Education, New Delhi.

en 1

mde

Page | 36
- Hogg, Robert V. and Craig, A.T. (1995). Introduction to Mathematical Statistics 5th Edn.,
 Englewood Hills, New Jersey.
- Johnson, Norman L., K. Samuel and Balakrishnan, N. (1995). Continuous Univariate Distributions. John Wiley and Sons.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (1963). Introduction to the Theory of Statistics. Mc-Graw Hill Book Company, Inc., New York.
- Rohatgi, V. K. (1976). An Introduction to Probability Theory and Mathematical Statistics. Wiley, New York.

n Brad

Slunder Log

Programm	e/Class: B.Sc. (Honour	s) Year: Fourth	Semester: Seventl
		Subject: STATISTICS	
Course (Code: 0720603	Course Title: Survey Sampli	ng
Course Ou	tcomes:		······································
On successi	ful completion of this co	urse, students will be able to:	
 Under proble 	stand the distinctive forms.	eatures of different sampling schemes an	d related estimation
 Learn sampli 	about various approacting scheme, sampling wi	hes to estimate the parameters; with and ith varying probability of selection.	without replacemen
 Learn 	the practical application	s of the various sampling techniques in real-l	life situations.
·	Credits: 04	Core: Compulsory	,
M	lax. Marks:	Minimum Passing Ma	
1	Total No. of Lectures-T	utorials-Practical (in hours per week): L-7	
Unit		Topics	
I S f a	principles of sample su Types of sampling, Ne Simple random sampling without replacement, Un for population mean a uttributes.	apling, Basic concepts in sampling, Basic rveys, Sampling and non-sampling errors, on-probability and probability samplings. , Sampling from finite populations with and abiased estimation and confidence intervals and total, Simple random sampling of ng, Reasons for stratification, Estimation of	14
TI TI TI A TI TI TI TI TI TI TI TI TI TI TI TI TI	oopulation mean and Proportional and optimu lifferent allocations, Con ixed sample size, System in integral multiple of s	its variance, Construction of strata, m allocation, Variances of estimates under mparison with simple random sampling for natic Sampling (when population size (N) is ampling size (n), Estimation of population s estimate, Comparison with simple random	18
III p	opulation mean, Evalua	ssion methods of estimation, Estimation of tion of bias and variance to the first order omparison with simple random sampling.	
IV E S a	Cluster Sampling, Estimation equal clusters, Efficie coefficient. Concept of two-stage sampling wi estimation of populatio tratification, Sampling nd without replacement	ates of mean and its variance for equal and ncy in terms of the intra-class correlation multistage sampling and its application, th equal number of second stage units, n mean and total, Double sampling for with probability proportional to size (with nt method), Des Raj estimator, Horvitz- d-ZunoSen sampling scheme.	18

٠

Kshan Page 108 Why

.

- Cochran, William G. (1977). Sampling Techniques, 3rd Edition. John Wiley and Sons.
- Des Raj and P. Chandhok (1998). Sample Survey Theory. Narosa Publishing House.
- Mukhopadhyay, Parimal (2008). Theory and Methods of Survey Sampling. PHI Learning Pvt. Ltd. •
- Murthy, M.N. (1977). Sampling Theory and Methods. Statistical Publishing Society, Calcutta.
- Sampat, S. (2001). Sampling Theory and Methods. Narosa Publishing House. 8
- Singh, Daroga, and Chaudhary, F.S. (1986). Theory and Analysis of Sample Survey Designs. John
- Sukhatma, P.V.and Sukhatme, B.V. (1970). Sampling Theory with Applications, 2nd Edition. • Iowa State University Press.

Suggested Continuous Evaluation Methods:

non stendey life

Fiogram	me/Class: B.Sc. (Ho	nours)	Year: Fourth	Semester: Sevent
···		Sı	ubject: STATISTICS	
	Code: 0720604	,	Course Title: Programming	with D
Course O	utcomes:			
On succes	sful completion of the	is course,	students will be able to:	
 Effect 	ctively visualize and	summarize	e the data using R-language.	
 Carry 	y out data analysis us	sing R-land	niage	
	pret the results of sta			
	Credits: 04			
<u>-</u>	Jax. Marks:		Core: Compulsor	
			Minimum Passing M	larks:
	Fotal No. of Lecture	es-Tutoria		
<u> </u>			opics opics s of R over other programming	
I V D op op R	Variable assignment, peleting variables, R perators, Logical op perators. Decision making: i	Data types Operators erator, Ass	ling an R package, R Data types: , Factors, Data frame, R variables, s of variable, Finding variable Is(), a Arithmetic operators, Relational signment operators, Miscellaneous at, if – else statement, if – else if	16
II Lo din file CS	op, Loop control s bading and handling rectory – getwd(), se e, Reading a CSV n(), max(), range(), SV File, R -Excel file	tatement, R 1 tatement: Data in R etwd(), dir(File, Anal mean(), n c, Reading	oops: repeat loop, while loop, for break statement, next statement, : Getting and setting the working (), R-CSV Files - Input as a CSV yzing the CSV File: summary(), nedian(), apply() - Writing into a the excel file.	16
III Cha Va dia	arts and plots. Vis arts and plots. Vis riation, and Shape. grams, pie chart, ster	g R (both t sualising 1 Histogran n and leaf	wo and three dimensions); Tables, Measures of Central Tendency, n, Boxplot, Scatter plot, Pareto display.	.12
V regi (A)	ression. One and	two samp tests: good	variate and Multivariate statistics; ovariance, Correlation, Linear le t-tests, Analysis of Variance dness of fit, Contingency tables, functions in R.	16

• Alain F. Zuur, Ieno, E.N. and Meesters, E. (2009). A Beginner's Guide to R. Springer.

Rshen Page 140 - 41

- Braun W. J. and Murdoch, D.J (2007). A First Course in Statistical Programming with R.
 Cambridge University Press, New York.
- Chambers, John M. (2008). Software for Data Analysis: Programming with R, Vol. 2. New York: Springer.
- Dalgaard, Peter (2020). Introductory Statistics with R. Springer.
- Gardener, M. (2012). Beginning R: The Statistical Programming Language, Wiley Publications.
- Maria L. Rizzo (2008). Statistical Computing with R. Chapman and Hall/CRC, Boca Raton, FL.
- Michael J. Crawley (2005). Statistics: An Introduction using R. Wiley.
- Sandip Rakshit (2017). R Programming for Beginners. McGraw Hill Education India.
- Seema Acharya (2018). Data Analytics using R. McGraw Hill Education, India.

Now I

- Hender

Programme/Class: B	.Sc. (Honours)	Year: Fourth	Semester: Seventh
	Subj	ect: STATISTICS	Berentin
Course Code: 0720680		Course Title: Practical Lal)
Course Outcomes:			
On successful completion	on of this course, si	tudents will be able to:	
		model fitting approach.	
		wledge of R-Software.	
		pling through R-Software.	
Credits: (
Max. Marks		Core: Compul	
		Minimum Passin	g Marks:
10tal No. of Le	ctures-Tutorials-	Practical (in hours per week):]	
1. Probl		fitting of Distributions e.g.,	No. of Lectures
2. Prob	lems based on Sim	ple random sampling.	
3. Problems based on Stratified random sampling.			60
	ems based on Ra	tio and regression methods of	00
5. Proble	ems on data analys	sis with R.	

As suggested for Paper codes: 0720602, 0720603 and 0720604.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Viva-voce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

hent

Slunder hy

Progr	amme/Class: B.Sc. (Honours)	Year: Fourth	Semester: Eight
	S	ubject: STATISTICS	
	e Çode: 0820601	Course Title: Probability Th	leory
On succe	Dutcomes: essful completion of this course, work with probability measure mework.		<u> </u>
🌣 Pro	ove and apply the convergence of	of a sequence of random variables.	
🔹 Un	derstand the concept of independent of independent of the state of the	ndence of random variables, weak an	d strong laws of large
	Credits: 04	Core: Compulso	ory
·	Max. Marks:	Minimum Passing	
	Total No. of Lectures-Tutori	als-Practical (in hours per week): L	- T-P: 4-0-0
I	Classes of Sets, Fields, Si Borel Sigma Field, Sequer Sequence of Sets, Measure, Measure, Random experimen Various definitions of proba probability, Boole's inec Independence of events, Bayo Random variable, Probabilit density function (pdf), Cum Expectation of a random v Moment generating function Characteristic function and Levy's continuity theorem.	y mass function (pmf), Probability nulative distribution function (cdf), variable, Properties of expectation, n, Probability generating function, its properties, Uniqueness theorem,	
ш	Jenson's inequalities. Dif (convergence in distribution, mean) and their interrelations 1 law.	Kolmogorov's, Minkowski's and fferent modes of convergence in probability, almost surely, and r th . Borel-Cantelli lemma and Borel 0-	10
IV	large numbers, Liapounoff's (WLLN), Kolmogorov strong law of Central limit theorem for a sequence iables, Central limit theorem for distributed random variables.	19

- Ash, Robert B. (2000). Probability and Measure Theory. Academic Press.
- Bhat, B. R. (2014). Modern Probability Theory. Wiley Eastern Limited.
- Hogg, R.V., J. McKean, and A.T. Craig(2013). Introduction to Mathematical Statistics, 7th Edition. Pearson.

Page 143 hele Stunder.

- Mood, A. M., F. A. Graybill, and D. C. Boes (1963). Introduction to the Theory of Statistics. McGraw Hill Book Company, Inc., New York.
- Mukhopadhyay, Parimal (2012). Theory of Probability. New Central Book Agency.
- Pittman, J. (1993). Probability. Narosa Publishing House.
- Rohatgi, V. K. (1976). An Introduction to Probability Theory and Mathematical Statistics. Wiley, New York.
- Ross, Sheldon M. (2014). Introduction to Probability Models. Academic Press.

Stender Nivi

	ne/Class: B.Sc. (Hone		Year: Fourth	Semester: Eight
		S	ubject: STATISTICS	
	Code: 0820602		Course Title: Statistical Infere	ence-I
Course Ou	tcomes:			
On successi	ful completion of this	course	the students will be able to:	
			and testing procedures to deal with real	-life problems
✤ Learn	about the Fisher Info	mation.	lower bounds to variance of estimator	-inc problems.
✤ Under	stand the concent of t	he Nevr	nan-Pearson fundamental lemma and L	s, and MVUE.
	Credits: 04		man-realson lundamental lemma and L	JMP test.
			Core: Compulsor	у
W	Iax. Marks:		Minimum Passing M	larks:
r	otal No. of Lectures	-Tutori	als-Practical (in hours per week): L-	
Unit .		11) 4 1944 - 1	Topics	No. of Lectures
I E	Efficiency, Sufficienc ange of variate depe	y and C and C ands on	timator, Consistency, Unbiasedness, Completeness, Sufficiency when the the parameter, Characterization of nt statistics, Factorization theorem.	12
М И р Ц U	Animum variance nequality, Extension arameter case, Bhat ehman-Scheffe's th Inbiased Estimator (U	bound of C tacharya eorem, MVUE	(MVB) estimator, Cramer-Rao Cramer-Rao inequality for multi- a bounds, Rao-Blackwell theorem, Uniformly Minimum Variance).	16
III so m A	quare, Moment and aximum likelihood symptotically Norma	l Least l estir l (BAN)	kimum likelihood, Minimum chi- squares. Optimal properties of mator, Existence of a Best estimate, Hazoor Bazar's theorem.	12
IV IV IV N C IT It fo ex M U	ull, alternative, simp ritical Region, Critica est, Level of Significa s Generalization, Uni sts for simple null hy or one-sided null agai sponential family. Ext fonotone Likelihood	ole and al functi ance, p-v iformly pothesis nst one- tension (N rful unl	composite hypotheses, Concept of on, Two-type of Errors, Power of a value, Neyman-Pearson Lemma and Most Powerful (UMP) Test, UMP s against one-sided alternatives and sided alternatives in one parameter of these results to distributions with MLR) property, Randomized Tests, biased (UMPU) test, Types A, A ₁	20

- Bartoszynski, R. and Bugaj, M.N. (2007). Probability and Statistical Inference. John Wiley and Sons.
- Dudewitz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics. John Wiley.
- Ferguson, T.S. (1967). Mathematical Statistics. Academic Press.

un/

Page | 45

- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edition.
 Sultan Chand and Sons.
- Kale, B.K. (1999). A First Course on Parametric Inference. Narosa Publishing House.
- Lehman, E.L (1988). Theory of point estimation. John Wiley.
- Lehmann, E.L. (1986). Testing Statistical Hypotheses. Student Editions.
- Rao, C.R. (1973). Linear Statistical Inference and its Applications. Wiley Eastern.
- Rohatgi, V.K. (1988). An Introduction to Probability and Mathematical Statistics. Wiley Eastern, New Delhi.
- Zacks, S. (1971). Theory of Statistical Inference. Wiley, New York.

Then stender

Program	me/Class: B.Sc. (Hon	ours)	Year: Fourth	Semeste	
			Subject: STATISTICS		
Cours	Course Code: 0820603 Course Title: Linear Models and Experimental Designs				Designs
Course (Dutcomes:				
On succe	ssful completion of th	iis cou	rse the students will be able to		
	derstand the concepts				
			plications of ANOVA, ANCOVA		
🌣 Ap			ns of Designs i.e., CRD, RBD, LS		is fields of
	Credits: 04		Core: Com		
	Max. Marks:			sing Marks:	
	Total No. of Lectur	es-Tut	orials-Practical (in hours per w		
Unit			Topics		No. of Lectures
I	space, Normal equa square estimators, C	itions : Feneral es and	lels, Estimable functions, Error a and least square estimators, Prop lized inverse of a matrix and solu covariances of least square es BLUE).	berties of least tion of normal	16
Ш	One-way and two-w models. Analysis of	vay cla f varia	assifications, fixed, random and ince for one-way and two-way of a one-way layout with concomita	classifications,	14
ш	The basic principle and Local control randomized design	of exp), Co (CRD)	perimental design (Randomizatio mplete analysis and layout o , Randomized block design (RE Missing plot technique.	n, Replication of completely	14
IV	confounding, Incon Designs (BIBD) wi	nplete ith par	3 ² , 3 ³), Complete and Partial, block designs, Balanced Incon ametric relations and analysis using and Strip Plot Design.	mplete Block	16

- Bapot, R.B. Linear Algebra and Linear Model. Cambridge University Press.
- Cochran W.G. and Cox, G.M. (1959). Experimental Design. Asia Publishing House.
- Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments, 2nd Edition. Wiley.
- Federer, W.T. (1955). Experimental Design: Theory and Applications. Oxford and IBH (P) Ltd., New Delhi.
- John, P.W.M. (1971). Statistical Design and Analysis of Experiments. Macmillan Co., New York.
- Joshi, D.D. (1987). Linear Estimation and Design of Experiments. John Wiley.
- Kempthorne, O. (1965). The Design and Analysis of Experiments. John Wiley.

Page | 47 Junder

• Montgomery, D.C. (2008). Design and Analysis of Experiments. John Wiley.

Suggested Continuous Evaluation Methods:

Stender lh

Program	mme/Class: B.Sc. (Honours)	Year: Fourth	Semester: Eigl
<u> </u>		Subject: STATISTICS	<u>. </u>
	se Code: 0820604 Cou	rse Title: Statistical Quality Control and R	eliability Theory
Course	Outcomes:		
On succe	essful completion of this cour	se the students will be able to:	
Un	derstand the techniques of St prove the quality of production	atistical Quality control and application of the	iese techniques to
* Ap	ply reliability tools to improv	e the system's reliability.	
	Credits: 04	Core: Compulsory	
	Max. Marks:	Minimum Passing Mar	
	Total No. of Lectures-Tut	orials-Practical (in hours per week): L-T-	
I	for quality control, Bas capability and Product con General theory of contro Control limits, Charts for for attributes: p-chart, np-	ol charts, Causes of variation in quality, variables: R, (\overline{X}, R) , (\overline{X}, σ) charts., Charts chart, C-chart.	12
11	acceptance sampling, Reje risk, Producer's risk, Ac Single, Double, Multiple properties, OC, AOQL, As	As 100% inspection. Introduction to ection and Rectification types, Consumer's ecceptance sampling plans for attributes: and Sequential sampling plans and their SN and ATI curves.	12
ш 	Reliability function, Failur tub failure rate curve, R censored sample, Lifetir Gamma, Normal, Bivariat parameters and tests in the		18
īv	parallel, Mixed, K-out of- to system failure (MTSF) of redundancy, different reliability improvement. A standby redundancy, Anal with constant failure and r	Series, Parallel, Parallel-series, Series- n and related configurations. Mean time and mean time between failures, Concept types of redundancy and its use in nalysis of reliability and MTSF of n-unit ysis of non-identical unit series system epair rates, two identical unit active and with constant failure and repair rates.	18

- Balagurusamy, E. (1984). Reliability Engineering. Tata McGraw Hill Publishing Company Ltd, New Delhi.
- Barlow R.F. and F. Proschan (1965). Mathematical Theory of Reliability. John Wiley, New York.

Page | 49 -se | 49 nn

- Goon, A.M., M.K. Gupta and B. Das Gupta (2002). Fundamentals of Statistics, Vol. 1 and 2. The World Press, Kolkata.
- Lawless, J.F. (2003). Statistical Models and Methods for Life Data. Wiley.
- Marshall, A.W. and Olkin, I. (2007). Life Distributions. Springer.
- Montgomery, D.C. (2009). Introduction to Statistical Quality Control. Wiley India Pvt. Ltd.
- Sinha, S.K. (1986). Reliability and Life Testing. Wiley Eastern.

Shew Stender

Г

Programmer /Cl			
Programme/Class: B.Sc. (He	onours)	Year: Fourth	Semester: Eigh
		Subject: STATISTICS	5.
Course Code: 0820680		Course Title: Practical Lab	
Course Outcomes:			
On successful completion of	this course	e oftredente in the second	
Solve day to day mobil		c, students will be able to:	
Learn the small is	ems with l	knowledge of Statistical Inference.	
application o	t Design o	of experiments in real life and	
 Learn the application of 	Control of	charts.	
Credits: 04	T		
Max. Marks:		Core: Compulsory	
		Minimum Passing Mark	s:
1 otal No. of Lectur	es-Tutor	ials-Practical (in hours per week): L-T-F	
		and the second	
1. Problems on H	Estimation	of Parameters.	No. of Lectures
2. Problems base	d on Test	ing of Hypothesis.	
3. Problems base	d on One.	-way and Two-way ANOVA.	
4. Problems hase		way and Two-way ANOVA.	
	0 00 6 81	RBD and ISD	60
		, and LOD.	
Froblems baseFroblems baseProblems baseProblems base	d on Facto	orial Experiments.	

Suggested Readings:

As suggested for Paper codes: 0820602, 0820603 and 0820604.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Viva-

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

1ant

Schander hay

Program	nme/Class: B.Sc. (H	onours with Research)	Year: Fourth	Semester:	Seventh
		Subject: STAT	ISTICS		
	e Code: 0720601	Course	Title: Population St	udies	
Course	Outcomes:				
On succ	cessful completion of	this course, the students	will be able to:		
 U ci 	Inderstand how popu ultural, political, and	lation trends influence va economic aspects.	rious aspects of hum	an life, such a	as social,
∻ U	Inderstand the factors	that influence the fertility	, mortality and migra	ation	
♦ U		nges and opportunities re			and other
	Credits: 04		Core: Compuls	ory	
	Max. Marks:		Minimum Passing	Marks:	
	Total No. of Lectu	res-Tutorials-Practical)
.Unit. I II	and uses of de demographic data Use of balancing check the comple of Whipple, Me pyramid, Depende Measurement of J	emography, Sources of E mographic data: Cover	age and content e sekharan-Deming for a adjustment of age opulation composition ographic transition. ate, Standardized dea	mitations errors in rmula to data- use on, Age	8 14
ш 	and uses of Life t of Fertility: Crud rate, Total fertility	able, Complete and abrid e birth rate, General fer rate, Gross reproduction on Growth: Arithmetic,	ged life tables. Meas tility rate, Age-speci rate, Net reproduction	surement fic birth n rate.	16
IV	growth rates, Deca growth and their population growth international mign migration. Stable	adal growth rate Doubling fitting to population of Internal migration and ration, Net migration, I and quasi-stable popula tion, Methods for popula	time, Models for po lata. Stochastic mo its measurement, Co Factors affecting po tions, Stationary po	pulation dels for ncept of pulation pulation	22

- Benjamin, B. (1969). Demographic Analysis. George, Allen and Unwin.
- Biswas, S. (1988). Stochastic Processes in Demography and Applications, Wiley Eastern Ltd.
- Cox, P.R (1970). Demography. Cambridge University Press.

Page 152 Schender

- Keyfitz, N. (1971). Applied Mathematical Demography, Springer Verlag. .
- Office of Registrar General and Census Commissioner India (Ministry of Home Affairs) •
- Principles and accommodation of National Populations Census UNESCO.
- Spiegelman, M. (1969). Introduction to Demographic Analysis, Harvard University 0

Continuous Internal Evaluation (CIE) of 25 marks shall be based on written Assignment, Presentation, Class test, Quiz, Essay, Exhibition etc. as per NEP revised guidelines.

Course Prerequisite:

To study this course, student must have passed U.G. Degree with 75% marks.

Semder Nm/

Program	me/Class B Sc (Ho	nours with Research)	<u> </u>	
			Year: Fourth	Semester: Seventh
		Subject: STATIS	STICS	
	Course Code: 0720602 Course Title: Distribution Theory Course Outcomes:			Theory
On succe	essful completion of t	his course, students will b	e able to:	
* Uno	derstand different typ	es of distributions and the	ir application in reat	life problems
 Des 	cribe the distinguishi	ng features of various pro	bability distribution	-me problems.
✤ Woi	rk with sampling dist	ributions (central and non-	central Ch:	j.
	Credits: (t and F distributions).
	Max. Marks		Core: C	ompulsory
			Minimum I	Passing Marks:
A State	1 otal No. of Lecture	es-Tutorials-Practical (in	hours per week):]	 Ն-T-P: 4-0-0
I II	Joint, marginal, an multi-dimensional of random variable Characterization an Binomial, Poisso Negative binomia Normal (univarian bivariate), Laplace distributions. Symmetric distri	nd applications of discrete on, Multinomial, Hype l. Continuous probability te and bivariate), Expo c, Cauchy, Beta, Gamma butions, Truncated di	ns of two-dimension butions of transform e probability distribu- r-geometric, Geom- y distributions: Un onential (univariate , Weibull and logn	ations: netric, iform, and ormal
III	distributions, Mit distributions. Samp distributions: non-c properties.	xture distributions, E ling distributions, elementer central Chi-square, t and	xponential family stary ideas of non-co F distributions and	entral 16 their
IV	statistics, their distributions of orde	uadratic forms. Approxi- limiting moment gene stribution and propertie er statistics, Extreme valu- ent only) with application	rating function, C s, Joint and mar	Drder

- Goon A.M., Gupta, M.K. and Gupta, B.D. (2002). Fundamentals of Statistics, Vol. I & II, 8th Edn., The World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Gupta, B.D. (2011). Fundamentals of Statistics, Vol. I. The World Press, Kolkata.
- Hogg, R.V., Tanis, E.A. and Rao, J.M. (2009). Probability and Statistical Inference, 7th Edn., Pearson Education, New Delhi.

Page 54 Sender 4

- Hogg, Robert V. and Craig, A.T. (1995). Introduction to Mathematical Statistics 5th Edn.,
 Englewood Hills, New Jersey.
- Johnson, Norman L., K. Samuel and Balakrishnan, N. (1995). Continuous Univariate Distributions. John Wiley and Sons.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (1963). Introduction to the Theory of Statistics. Mc-Graw Hill Book Company, Inc., New York.
- Rohatgi, V. K. (1976). An Introduction to Probability Theory and Mathematical Statistics. Wiley, New York.

Lender

	umme/Class: B.Sc. (Hor		Year: Fourth	Semester: Sevent
Cor	urse Code: 0720603	Subject: STATISTIC		
	e Outcomes:	Course Ti	tle: Survey Samplin	ng
	•	hia		
**	Understand the disc	his course, students will be abl	e to:	
	-	ctive features of different sa		
	1 0, umin	pproaches to estimate the par pling with varying probability	of selection.	
*	Learn the practical appl	lications of the various sampling	ng techniques in real	-life situations
	Credit	s: 04		
	Max. Ma	rks:		mpulsory
	Total No. of Leaster		Minimum P	assing Marks:
Unit	Total Ito. Of Lectur	es-Tutorials-Practical (in ho	urs per week): L-T	- P: 4-0-0
la son al re-	Concept of populat	Topics ion and sample, Need for sa		No. of Lectures
I	rinciples of sampl Types of sampling Simple random samp without replacement for population me attributes.	sampling, Basic concepts in e surveys, Sampling and nor , Non-probability and proba- pling, Sampling from finite po- t, Unbiased estimation and co an and total, Simple rando	a sampling, Basic a-sampling errors, ability samplings. pulations with and anfidence intervals om sampling of	14
ш	Proportional and opt different allocations, fixed sample size, Sy an integral multiple mean and variance of sampling.	mpling, Reasons for stratificat and its variance, Constru- imum allocation, Variances o Comparison with simple rand stematic Sampling (when pop of sampling size (n), Estimati this estimate, Comparison wi	ction of strata, f estimates under lom sampling for ulation size (N) is ion of population th simple random	18
Ш ————	of approximation, and	egression methods of estimation aluation of bias and variance I Comparison with simple rand	to the first order	10
IV	Cluster Sampling, Es unequal clusters, Eff coefficient. Concept Two-stage sampling Estimation of popula stratification, Samplin and without replacer	timates of mean and its variant iciency in terms of the intra- of multistage sampling and with equal number of second ation mean and total, Doub ng with probability proportion nent method), Des Raj esti Mid-ZunoSen sampling schem	ice for equal and class correlation its application, ond stage units, le sampling for nal to size (with mator. Horvitz-	18
	and without replace	nent method), Des Rai esti	mator Horvitz	

Kshun

- Cochran, William G. (1977). Sampling Techniques, 3rd Edition. John Wiley and Sons.
- Des Raj and P. Chandhok (1998). Sample Survey Theory. Narosa Publishing House.
- Mukhopadhyay, Parimal (2008). Theory and Methods of Survey Sampling. PHI Learning Pvt. Ltd.
- Murthy, M.N. (1977). Sampling Theory and Methods. Statistical Publishing Society, Calcutta.
- Sampat, S. (2001). Sampling Theory and Methods. Narosa Publishing House.
- Singh, Daroga, and Chaudhary, F.S. (1986). Theory and Analysis of Sample Survey Designs. John Wiley and Sons.
- Sukhatma, P.V.and Sukhatme, B.V. (1970). Sampling Theory with Applications, 2nd Edition. Iowa State University Press.

Suggested Continuous Evaluation Methods:

Hemder \mathbf{x}^{*} w

Programme/Class: B.Sc. (Ionours with Research)	Year: Fourth	Semester: Seventh	
	Subject: STATIS	STICS		
Course Code: 0720680	Cours	se Title: Practical Lat		
 Learn the practical kn Solve real life problem 	of this course, students will b owledge of the model fitting ns with the knowledge of R-	approach. Software.		
Credit	owledge of sampling through			
Max. Marks:		Core: Compulsory Minimum Passing Marks:		
Total No. of Lect	ures-Tutorials-Practical (i	n hours per week): L		
	Topics based on fitting of Distribu		No. of Lectures.	
2. Problems b				
3. Problems based on Stratified random sampling.			60	
	ased on Ratio method of est	-		
5. Problems h	ased on Regression method		Í	

As suggested for Paper codes: 0720602 and 0720603.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Vivavoce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

nan

Schemder

F

	mme/Class: B.Sc. (Ho	nours with Research)	Year: Fourth	Semester: Eig
	<u> </u>	Subject: STATIS	STICS	g.
	Course Code: 0820601 Course Title: Probability Th			
	e Outcomes:			
On suce	cessful completion of the	his course, students will be	e able to:	
◆ T fi	o work with probabili ramework.	ity measures, random var	iables and their distribu	tions in an abstra
* P	rove and apply the con	vergence of a sequence of	random variables.	
* U	umberstand the concept	of independence of rando	om variables, weak and s	trong laws of lar
	Credits: 04 Max. Marks:		Core: Compulsory	,
			Minimum Passing Ma	arks:
	Total No. of Lecture	es-Tutorials-Practical (in	hours per week). I T	
I	Random experiment definitions of proba Boole's inequality, events, Bayes Theor	ence of Sets, LimsupandL operties of a measure, at, Outcomes, Sample sp bility, Laws of total and c , Conditional probabilit em.	Probability Measure, pace, Events, Various compound probability, y, Independence of	16
П	Random variable, Probability mass function (pmf), Probability density function (pdf), Cumulative distribution function (cdf), Expectation of a random variable, Properties of expectation, Moment generating function, Probability generating function, Characteristic function and its properties, Uniqueness theorem, Levy's continuity theorem. Markov's, Chebychev's, Kolmogorov's, Minkowski's and Jenson's inequalities. Different			15
ш 	distribution, in proba	bility, almost surely, and Cantelli lemma and Borel	ce (convergence in I r th mean) and their	10
IV	of independently and ide	umbers (WLLN), Kolmo punoff's Central limit the dom variables Central	orem for a second	19

- Ash, Robert B. (2000). Probability and Measure Theory. Academic Press.
- Bhat, B. R. (2014). Modern Probability Theory. Wiley Eastern Limited.
- Hogg, R.V., J. McKean, and A.T. Craig(2013). Introduction to Mathematical Statistics, 7th Edition. Pearson.

Page | 59 hn

- Mood, A. M., F. A. Graybill, and D. C. Boes (1963). Introduction to the Theory of Statistics.
 McGraw Hill Book Company, Inc., New York.
- Mukhopadhyay, Parimal (2012). Theory of Probability. New Central Book Agency.
- Pittman, J. (1993). Probability. Narosa Publishing House.
- Rohatgi, V. K. (1976). An Introduction to Probability Theory and Mathematical Statistics. Wiley, New York.
- Ross, Sheldon M. (2014). Introduction to Probability Models. Academic Press.

Stender

	me/Class: B.Sc. (Hor	ours with R	esearch)	Year: Fourth	Semester: Eig
	· · ·	Subj	ect: STATIST	ICS	
Course Code: 0820602 Course Title: Statistical Infere			 re_T		
On succes	ssful completion of th	is course the	students will b	be able to:	
🛠 Und	erstand the various e	stimation and	l testing proced	ures to deal with real-l	
🌣 Lear	n about the Fisher In	formation, lo	wer bounds to	variance of estimators,	ite problems.
🛠 Unde	erstand the concept o	f the Nevmar	-Pearcon fund	amental lemma and UN	and MVUE.
	Credits: 04			amental lemma and UN	AP test.
	Max. Marks:			Core: Compulsor	y
				Minimum Passing M	arks:
	Total No. of Lecture	s-Tutorials-	Practical (in h	ours per week): L-T-	P: 4-0-0
Unit			opics		No. of Lectures
	Characteristics of	a good esti	mator, Consis	toward YT 1	. internet
I		haracteristics of a good estimator, Consistency, Unbiasedness, ficiency, Sufficiency and Completeness, Sufficiency when the nge of variate depends on the parameter, Characterization of stribution admitting sufficient statistic			
		ICDCHUS AN	12		
	distribution admitti Minimum varian	c nonna	(MVR) orth		
YT	Inequality, Extension	on of Cramer	-Ran inequality	r for mult'	
Ц	Inequality, Extension of Cramer-Rao inequality for multi-parameter case, Bhattacharya bounds, Rao-Blackwell theorem, Lehman- Scheffe's theorem, Uniformly Minimum Variance Unbiased				16
	Estimator (UMVUE	, Uniformly	10		
	Estimation methods	of Maximur	n likelihood N	linimum chi-square,	
m	Lease and Lease	i squares.	Infimal propo	unting of the second	
	incontrood estimato	Jr, EXIStence of a Rest Asymptotically M.			12
	<u>(=141) ostillato</u> , 11a	LUOI Bazar s	theorem.		
	Critical Region, Cri	tical function	UMPOSITE hypo	theses, Concept of	
	Critical Region, Critical function, Two-type of Errors, Power of a Test, Level of Significance, p-value, Neyman-Pearson Lemma and its Generalization, Uniformly Most Powerful (UMP) Test, UMP tests for simple null hypothesis against one-sided alternatives and for one-sided null against one-sided alternatives in one parameter exponential family. Extension of these results to distributions with Monotone Likelihood P at a parameter				
IV I				20	
				20	
	monotone Likelinoc	Powerful unbiased (UMPI) test Types A			
1	Childring Most FO				
[Critical Regions, Like	elihood Ratic	Test.		

- Bartoszynski, R. and Bugaj, M.N. (2007). Probability and Statistical Inference. John Wiley and Sons.
- Dudewitz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics. John Wiley.
- Ferguson, T.S. (1967). Mathematical Statistics. Academic Press.

Page | 61

- Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics, 10th Edition.
- Kale, B.K. (1999). A First Course on Parametric Inference. Narosa Publishing House.
- Lehman, E.L (1988). Theory of point estimation. John Wiley.
- Lehmann, E.L. (1986). Testing Statistical Hypotheses. Student Editions.
- Rao, C.R. (1973). Linear Statistical Inference and its Applications. Wiley Eastern.
- Rohatgi, V.K. (1988). An Introduction to Probability and Mathematical Statistics. Wiley Eastern, New Delhi.
- Zacks, S. (1971). Theory of Statistical Inference. Wiley, New York.

Stunder

New

		Honours with Research)	Year: Fourth	Semester	: Eight
<u> </u>		Subject: STATIS	STICS	<u>. </u>	
	rse Code: 0820603	Course Title: Linea	r Models and Expe	erimental Dec	
Cours	e Outcomes:		and Exp(igns
On suc	cessful completion of	this course the students wil	I be able to		
♦ U	Inderstand the concept	s of linear estimation			
✤ A		and applications of ANOV	A, ANCOVA.		
₩ A	pply and analyse varic pplications.	ous forms of Designs i.e., C	RD, RBD, LSD etc.	to various fiel	lds of
	Credits	: 04	Core: (
	Max. Mar	ks:	Core: Compulsory		
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0.			Passing Mar	ks:	
		es-rutorials-Practical (in	hours per week):	L-T-P: 4-0-0	
Unit		Topics.	hours per week):		No. of
Unit	Gauss-Markov linea	Topics.		1	
Unit	Gauss-Markov linea Normal equations an	Topics. r models, Estimable function d least square estimators. Prov	ns, Error and estima	tion space,	
	Gauss-Markov linea Normal equations an Generalized inverse	Topics r models, Estimable function d least square estimators, Prop of a matrix and solution of a	ns, Error and estima perties of least square	tion space, estimators,	
	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s	r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators. Best linear	ns, Error and estima perties of least square normal equations, Van	tion space, estimators, riances and	Lecture
	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of variance	Topics. r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators, Best linear of ay classifications, fixed, rand e for one-way and two-we	ns, Error and estima perties of least square normal equations, Van unbiased estimator (B dom and mixed effect	tion space, estimators, tiances and LUE).	Lecture 16
I	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one-	Topics. r models, Estimable function d least square estimators, Proj of a matrix and solution of r quare estimators, Best linear to ay classifications, fixed, rand e for one-way and two-way way layout with concomitant	ns, Error and estima perties of least square normal equations, Var unbiased estimator (B dom and mixed effect ay classifications, A	tion space, estimators, riances and LUE). ets models. nalysis of	
I II	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one- The basic principle o	r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators, Best linear r ay classifications, fixed, rand e for one-way and two-way way layout with concomitant f experimental design (Rando	ns, Error and estima perties of least square formal equations, Var unbiased estimator (B dom and mixed effect ay classifications, A variable.	tion space, estimators, tiances and LUE). ets models. nalysis of	Lecture 16
I II	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one- The basic principle of control), Complete an	r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators, Best linear r ay classifications, fixed, rande e for one-way and two-way way layout with concomitant f experimental design (Rando palvsis and layout of complete and sources and layout of sources and l	ns, Error and estima perties of least square normal equations, Van unbiased estimator (B dom and mixed effect ay classifications, A variable. mization, Replication	tion space, estimators, riances and LUE). ets models. nalysis of and Local	Lecture 16 14
I II	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one- The basic principle of control), Complete an Randomized block de technique.	Topics. r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators, Best linear r ay classifications, fixed, rand e for one-way and two-way way layout with concomitant f experimental design (Rando nalysis and layout of comple sign (RBD) and Latin square	ns, Error and estima perties of least square formal equations, Var unbiased estimator (B dom and mixed effect ay classifications, A variable. mization, Replication tely randomized desig design (LSD), and M	tion space, estimators, riances and LUE). ets models. nalysis of and Local gn (CRD), issing plot	Lecture 16
I	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one- The basic principle of control), Complete an Randomized block de technique.	r models, Estimable function d least square estimators, Proj of a matrix and solution of r quare estimators, Best linear r ay classifications, fixed, rand e for one-way and two-way way layout with concomitant f experimental design (Rando nalysis and layout of comple sign (RBD) and Latin square	ns, Error and estima perties of least square normal equations, Van unbiased estimator (B dom and mixed effect ay classifications, A variable. mization, Replication tely randomized design design (LSD), and M	tion space, estimators, riances and LUE). ets models. nalysis of and Local gn (CRD), issing plot	Lecture 16 14
I II	Gauss-Markov linea Normal equations an Generalized inverse covariances of least s One-way and two-w Analysis of varianc Covariance for a one- The basic principle of control), Complete an Randomized block de technique. Factorial experiments Incomplete block de	r models, Estimable function d least square estimators, Prop of a matrix and solution of r quare estimators, Best linear r ay classifications, fixed, rande e for one-way and two-way way layout with concomitant f experimental design (Rando palvsis and layout of complete and sources and layout of sources and l	ns, Error and estima perties of least square normal equations, Van unbiased estimator (B dom and mixed effect ay classifications, A variable. mization, Replication tely randomized desig design (LSD), and M	tion space, estimators, tiances and LUE). Ets models. nalysis of and Local gn (CRD), issing plot	Lecture: 16 14

- Bapot, R.B. Linear Algebra and Linear Model. Cambridge University Press.
- Cochran W.G. and Cox, G.M. (1959). Experimental Design. Asia Publishing House.
- Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments, 2nd Edition. Wiley.
- Federer, W.T. (1955). Experimental Design: Theory and Applications. Oxford and IBH (P) Ltd., New Delhi.
- John, P.W.M. (1971). Statistical Design and Analysis of Experiments. Macmillan Co., New York.
- Joshi, D.D. (1987). Linear Estimation and Design of Experiments. John Wiley.
- Kempthorne, O. (1965). The Design and Analysis of Experiments. John Wiley.
- Montgomery, D.C. (2008). Design and Analysis of Experiments. John Wiley.

Page 163

shew/

Stender

£

		Ionours with Research)	Year: Fourth	Semester: Eigl
	·· <u> </u>	Subject: STATIS	STICS	
Course Code: 0820680 Course 7			e Title: Practical Lab	
Solve da	l completion on the second s	of this course, students will b lems with knowledge of Sta of Design of experiments in	be able to:	
	Credits Max. Mari	ks:	Core: Compu Minimum Passin	
1. H 2. F S	Problems base Problems base Stratified rand	ares-Tutorials-Practical (in Topics ed on fitting of Distributions. d on Simple random sampli om sampling.	ng. Problems based on	P: 0-0-4 No. of Lectures
 Problems based on Ratio and regression methods of estimation Problems based on regression method of estimation. Problems based on Experimental Designs e.g., CRD, RBD, LS etc. 			stimation.	60

Suggested Readings:

As suggested for Paper codes: 0820602 and 0820603.

Practical Examination Evaluation Method (100 Marks):

Practical Examination Evaluation shall be based on Practical record, Practical Exercises and Vivavoce.

Further Suggestions:

Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

Rshaw Schunder

Minor Multidisciplinary Course open to all other faculty

To be opted in First/Second Semester

Course prerequisites: To study this course, a student must have the subject Mathematics/ Elementary Mathematics in class 10th.

This course can be opted as a Minor Multidisciplinary Course open to all other faculty.

<u>۰</u>۰-

Syllabus of the Course

Program/Class: Certificate		Year: First	Semester: First		
	Subjec	t: STATISTI	ICS		
Course Code: B060103T					
Course outcomes:			Course Title: Basic Statistics		
After completing this course,	a student will have	e:			
 Ability to understand concepts of collecting Primary and Secondary data. 					
 Knowledge of methods (such as Boxplot, Histog 	for summarizing	data anto in	1 11		
✤ Ability to describe data y	vith measures of c	entral tenden	cy and measures of dispersion.		
✤ Ability to understand t	he concept of p	robabilita at	by and measures of dispersion.		
			ong with basic laws and axioms of		
 Ability to understand the 	terms: mutually e	xclusive and	equally likely and their relevance		
 Ability to understand the terms: mutually exclusive and equally likely and their relevance. Ability to identify the appropriate method (i.e., union, intersection, conditional, etc.) for solving a problem. 					
 Ability to apply basic pro 	bability principles	s to solve real	life problems		
 Ability to apply basic probability principles to solve real life problems. Ability to understand the concept of random variable (discrete and continuous), concept of probability distribution. 					
Knowledge of the conc correlation and regression	epts of correlati analysis.	on and sim	ple linear regression and Perform		
 Ability to interpret results 		and regression	n		
Credit					
Max. Marks:	25+75		Core: Minor Elective		
	l		Min. Passing Marks:		
	Part-A: B	asic Statistic	S		
Unit	Торі	えきゅう しょうてもん	No: of Lecture		
Primary and Seconda	ry data and their o	collection. Tv			
Primary and Secondary data and their collection, Types of classification:IChronological, Geographic, Qualitative and Quantitative, Construction of frequency distributions, Cumulative frequency distribution.18					
	is, cumulative fre	quency distri	bution. 18		
Rsha	Page	: 66	har		

	Tabulation of data preparing a table manufacture and the second s				
п 	Tabulation of data, preparing a table, Types of tables, Diagrammatic representation of data using various Bar diagrams, Area diagrams, Pie chart, Graphs: Histogram, Frequency Polygon, Frequency curve, Ogive.	18			
ш	average, Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode, Partition values: Quartiles and Percentiles their properties, merits, demerits and applications of the above measures	18			
IV	Meaning of variability or dispersion, Measures of Dispersion: Range, Quartile Deviation, Variance, Mean Deviation, and Standard Deviation, coefficient of variation with their merits, demerits and applications.Concepts of Skewness and Kurtosis.	18			
v	Meaning of correlation, Types of correlation, Scatter diagram, Karl- Pearson correlation coefficient with its properties, Spearman's Rank Correlation. Concept of Regression analysis, Properties of Regression lines.	18			

- Gupta, S.C. (2015). Business Statistics. Sultan Chand & Sons, New Delhi.
- Gupta, S.C. and Kapoor, V.K. (2016). Fundamentals of Mathematical Statistics. Sultan Chand & Sons, New Delhi.
- Sharma, K.K., Arun Kumar and Chaudhary, A. (2006). Statistics in Management Studies.
 Krishna Publication Media Pvt. Ltd., Meerut.
- Snedecor, G.W. and Cochran, W.G. (1989). Statistical Methods, Iowa State University Press, Ames, Iowa.

Suggested Continuous Evaluation Methods:

nen'

Stewar 14