Department of Statistics

H.N.B. Garhwal University, Srinagar Garhwal (Uttarakhand)
(A Central University)

Syllabus for UG (Statistics)
3rd Year

(National Education Policy-2020)

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
III	V	STATT-123	Sampling Survey and Non-parametric Methods	Theory	04
		STATP-124	Sampling Survey and Non-parametric Methods Lab	Practical	02
		STATT-125	**Vocational Course/ Field Visit/ Entrepreneurship Skills**		04
		STATT-126	**Extracurricular Courses/Compulsory Course**		02
		STATT-127	**Languages –I** **(As proposed by the University)**		02
III	VI	STATT-128	Analysis of Variance and Design of Experiment	Theory	04
		STATP-129	Analysis of Variance and Design of Experiment Lab	Practical	02
		STATT-130	**Vocational Course/ Field Visit/ Entrepreneurship Skills**		04
		STATT-131	**Communication Skills**		02
		STATT-132	**Languages –II** **(As proposed by the University)**		02

Third Year (V Sem.)

Course outcomes:

After completing this course, a student will have:

- ✓ Knowledge of the concept to Sampling distributions.
- ✓ Ability to understand the difference between parameter & statistic and standard error & standard deviation.
- ✓ Knowledge of the sampling distribution of the sum and mean.
- ✓ Ability to understand and practice various methods of estimations of parameters.
- ✓ Ability to understand the concept of sampling and how it is different from complete enumeration.
- ✓ Knowledge of various probability and non-probability sampling methods along with estimates of population parameters.
- ✓ Ability to identify the situations where the various sampling techniques shall be used.
- ✓ Knowledge of sampling and non-sampling errors.
- ✓ Knowledge of regression and ratio methods of estimation in simple random sampling (SRS).
- ✓ Ability to apply distribution free tests (non-parametric methods) for one and two sample cases.

Program/Class: **Degree**	Year: **Third**	Semester: **Fifth**
Subject: **STATISTICS**		
Course Code: - **STATT-123**	Course Title: **Sampling Survey and Non parametric Methods**	
Credits: **04**	Core: **Compulsory**	

Unit	Topic	
I	Sampling vs. Complete enumeration: Sampling units and Sampling frame, Precision and efficiency of estimators, Simple Random sampling with and without replacement, Use of random number tables in selection of simple random sample, Estimation of population mean and proportion, Derivation of expression for variance of these estimators, Estimation of variances, Sample size determination.	
II	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, gain in precision due to Stratification, Role of sampling cost in the sample allocation, Minimization of variance for fixed cost.	
III	Systematic Sampling: Estimation of Population mean and Population total, standard errors of these estimators. Two stage sampling with equal first stage units: Estimation of Population mean and its variance.	
IV	Regression and ratio methods of estimation in simple random sampling, Cluster sampling with equal clusters, Estimators of population mean and their mean square errors.	
V	Non-parametric tests, Tests for randomness and test for goodness of fit. One sample test: Sign test, Wilcoxon Signed rank tests.	
VI	Two sample tests: Run test, Kolmogorov – Smirnov's test, Median test and Mann-Whitney U test.	

Suggested Readings

Ardilly, P. and Yves T. (2006). Sampling Methods: Exercise and Solutions. Springer.

Cochran, W.G. (2007). Sampling Techniques. (Third Edition). John Wiley & Sons, New Delhi.

Cochran, W.G. (2008). Sampling Techniques (3rd ed.), Wiley India.

Des Raj. (1976). Sampling Theory. Tata McGraw Hill, New York. (Reprint 1979). DesRaj and

Chandhok, P. (1998). Sample Survey Theory, Narosa Publishing House.

Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics (10th ed.), 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 (Second Edition). Iowa State University Press.

Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. & Asok, C. (1984): Sampling Theories of Survey with Applications, IOWA State University Press and ISAS.

Thompson, S.K. (2012). Sampling. John Wiley & Sons.

Course outcomes:

After completing this course, a student will have:

- ✓ Ability to draw a simple random sample with the help of table of random numbers.
- ✓ Ability to estimate population means and variance in simple random sampling.
- ✓ Ability to deal with problems based on Stratified random sampling for population means (proportional and optimum allocation).
- ✓ Ability to deal with problems based on Systematic random sampling
- ✓ Ability to deal with problems based on two-stage sampling
- ✓ Ability to deal with problems based on Ratio and regression estimation of population mean and total.
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Program/Class: **Degree**	Year: **Third**	Semester **Fifth**
Subject: **STATISTICS**		
Course Code: - **STATP-124**	Course Title: **Sampling Survey and Non parametric Methods Lab**	
Credits: **02**	Core: **Compulsory**	
Unit	Topic	
	1. Problems based on drawing a simple random sample with the help of table of random numbers.	
	2. Problems based on estimation of population means and variance in simple random sampling.	
	3. Problems based on Stratified random sampling for population means (proportional and optimum allocation).	
	4. Problems based on Systematic random sampling	
	5. Problems based on two stage sampling	
	6. Problems based on Ratio and regression estimation of population mean and total.	

	7. Problems based on non-parametric tests for one sample. 8. Problems based on non-parametric tests for two samples	

Vocational Course/ Field Visit/Entrepreneurship Skills

Programme/Class: **Degree**		Year: **Third**		Semester: **Fifth**
Subject: STATISTICS				
Course Code: - **STATT-125**		Course Title: **Vocational Course**		
Credits: **04**			Core: **Compulsory**	
	Vocational Course/ Field Visit/Entrepreneurship/ industry interface Course the students will have to submit a brief report at the end of the semester.			

Extracurricular Courses/Compulsory Course

Program/Class: **Degree**		Year: **Third**		Semester: **Fifth**
Subject: STATISTICS				
Course Code: - **STATT-126**		Course Title: **Extracurricular Courses**		
Credits: **02**			Core: **Compulsory**	
Unit	Topic			
	The contents of this course shall be common as framed by the University in regard to Culture, traditional and moral values.			

Languages –I

Program /Class: **Degree**	Year: **Third**	Semester: **Fifth**
Subject: **STATISTICS**		
Course Code: **- STATT-127**	Course Title: **Languages –I**	
Credits: **02**	Core: **Compulsory**	
Unit	Topic	
	The contents of this course shall be common as framed by the University in regard to Indian, Modern, Regional Languages –I.	

Third Year (VI Sem.)

Course outcomes:

After completing this course, a student will have:

- ✓ Knowledge of the concept of Analysis of Variance (ANOVA).
- ✓ Ability to carry out the ANOVA for One way and two-way Classification.
- ✓ Ability to carry out the post-hoc analysis.
- ✓ Knowledge of the concept of Design of experiment and its basic principles.
- ✓ Ability to perform the basic symmetric designs CRD, RBD and LSD with and without missing observations.
- ✓ Knowledge of the concept of factorial experiments and their practical applications.

Program/Class: **Degree**	Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**		
Course Code: **-STATT-128**	Course Title: **Analysis of Variance and Design of Experiment**	
Credits: **04**	Core: **Compulsory**	
Unit	Topic	
I	Definition of Analysis of Variance, Assumptions and Limitations of ANOVA, One way classification.	
II	Two-way classification with equal number of observations per cell. Duncan's multiple comparison tests.	
III	Principles of Design of Experiment: Randomization, Replication and Local Control, Choice of size and type of a plot using uniformity trials. Completely Randomized Design (CRD)	

IV	Randomized Block Design (RBD), Concept and definition of efficiency of design, Comparison of efficiency between CRD and RBD.
V	Latin Square Design (LSD), Lay-out, ANOVA table, Comparison of efficiencies between LSD and RBD; LSD and CRD
VI	Missing plot technique: Estimation of missing plots by minimizing error sum of squares in RBD and LSD with one or two missing observations.
VII	Factorial Experiments: General description of factorial experiments, 2^2, 2^3 and 2^n factorial experiments arranged in RBD and LSD, Definition of Main effects and Interactions in 2^2 and 2^3 factorial experiments,
VIII	Preparation of ANOVA by Yates procedure, Estimates and tests for main and interaction effects (Analysis without confounding).

Suggested Readings:

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

York. 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 Edition). 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. (2008). Design and Analysis of Experiments, John Wiley

Montgomery, D.C. (2017). Design and analysis of Experiments, 9Th Edition. John Wiley & Sons.

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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=statistics
https://www.coursera.org/search?query=statistics&

Course outcomes:

After completing this course, a student will have:

- ✓ Ability to conduct test of significance based non-parametric tests.

- ✓ Ability to deal with multivariate data.

- ✓ Knowledge of Principal Component Analysis and Factor Analysis. Ability to perform ANOVA for one way and two classifications.

- ✓ Ability to perform post-hoc analysis.

- ✓ Ability to conduct analysis of CRD, RBD and LSD with and without missing observations.

- ✓ Ability to conduct analysis for Factorial experiments (without confounding)

Programme/Class: **Degree**.		Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**			
Course Code: -STATT-129		Course Title: **Analysis of Variance and Design of Experiment LAB**	
Credits: **02**		Core: **Compulsory**	
Unit		Topic	
	1. Problems based on Principal Component Analysis 2. Problems based on Factor Analysis. 3. Problems based on Analysis of variance in one-way and two-way classification (with and without interaction terms). 4. Problems based on Analysis of a Latin square design. 5. Problems based on Analysis of variance in RBD and LSD with one or two missing observations. 6. Problems based on Factorial Experiment Practical		

Vocational Course/ Field Visit/Entrepreneurship Skills

Programme/Class: **Degree**		Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**			
Course Code: - **STATT-130**		Course Title: **Vocational Course**	
Credits: **04**		Core: **Compulsory**	
Vocational Course/ Field Visit/Entrepreneurship/ industry interface Course field visit could be conducted for students as par requirement of their core paper in case of field/ industrial visit the students will have to submit a brief report at the end of the semester.			

Communication Skills

Programme/Class: **Degree**		Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**			
Course Code: - **STATT-131**		Course Title: **Communication Skills**	
Credits: **02**		Core: **Compulsory**	
Unit		Topic	
	The contents of this course shall be common as framed by the University.		

Languages –II

Programme/Class: **Degree**		Year: **Third**		Semester: **Sixth**
Subject: **STATISTICS**				
Course Code: - **STATT-132**		Course Title: **Languages –II**		
Credits: **02**			Core: **Compulsory**	
Unit	Topic			
	The contents of this course shall be common as framed by the University in regard to Indian, Modern, Regional Languages –II.			