

(Applicable to the batch of students admitted in the academic year 2025-2026)

B.Sc.(Statistics) (CBCS)

FACULTY OF SCIENCE, IIMC

B.Sc.(STATISTICS)
Syllabus (CBCS)
(w.e.f. 2025-26)
Semester III & IV



FACULTY OF SCIENCE
Department of Statistics
INDIAN INSTITUTE OF
MANAGEMENT & COMMERCE
Autonomous College (UG & PG)

6-1-91, Khairatabad, Hyd- 500 004, T.S

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Dept. of Statistics
Indian Institute of
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6-1-91, Khairatabad, Hyd-500004

Dean (Academic)
Indian Institute of Management and Commerce
6-1-91, Khairatabad, Hyderabad-500 004.

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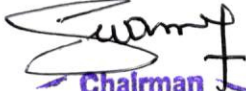
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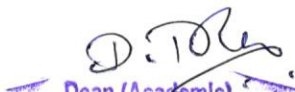
B.A./B.SC. (CBCS) (STATISTICS) SYLLABUS
(With Mathematics Combination only)
With effect from the Academic Year: 2025-26 Onwards

Year	Sem	Paper code	Theory/ Practical	Paper Title	Cred its	Work Load (Hours / Week)	Total Marks
I	I	Bs-101-T	Paper-I	Basic Statistics And Probability	4	4	80
		BS-101-P	Practical -I	Basic Statistical Analysis Lab using Excel & R	1	2	20
	II	BS-202-T	Paper-II	Probability Distributions	4	4	80
		BS-202-P	Practical -II	Probability Distributions Lab using Excel & R	1	2	20
II	III	BS-303-T	Paper-III	Statistical Inference	4	4	80
		BS-303-P	Practical-III	Statistical Inference lab using Excel & R	1	2	20
	IV	BS-404-T	Paper-IV	Analysis of Correlation, Regression and Basic Experimental Designs	4	4	80
		BS-404-P	Practical-IV	Analysis of Correlation, Regression and Basic Experimental Designs Lab	1	2	20
III	V	BS-505-T	Paper-V	Sampling Theory & Operation Research	4	4	80
		BS-505-P	Practical-5	Sampling Theory & Operation Research Lab	1	2	20
		BS-501-SEC	SEC-1	Skill Enhancement Course -1 (University Specified)	2	2	50
		BS-502-SEC	SEC-2	Skill Enhancement Course -1 (Subject Specified: Data Collection, Presentation and Interpretation)	2	2	50
		BS-501-MDC	MDC	Statistical Analysis	4	4	70E+30I
		BS-505-VAC	VAC	Value Added Course-1	3	3	70
	VI	BS-606-T	Paper-VI	Industrial Statistics	4	4	80
		BS-606-P	Paper-VI	Industrial Statistics	1	2	20
		BS-603-SEC	SEC-3	Skill Enhancement Course -2 (University Specified)	2	2	50
		BS-604-SEC	SEC-4	Skill Enhancement Course -2 (Subject Specified: Data Scaling Techniques and Report Writing)	2	2	50
		BS-602-VAC	VAC	Value Added Course-2	3	3	70
		BS-601	Internship	Data Analysis Project	4	8	100

Note:

1. No of credits = No of theory hours for teaching = twice the no. of credits for practical teaching.


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B.SC. SECOND YEAR, III-SEMESTER SYLLABUS
BS-303-T: PAPER-III (Theory): STATISTICAL INFERENCE
(4 HPW:: 4 Credits :: 80 Marks: (External:50 & Internal:30))

Course Objectives:

1. Able to evaluate and familiar to estimate the parameter (if exists) for the any standard probability distribution(s) using methods of maximum likelihood and method of moments, and estimation of parameters using method of least squares.
2. Able to examine the estimator satisfies the criteria of good estimation (Consistency, unbiasedness, sufficiency) for standard distributions.
3. Able to evaluate and familiar the confidence interval estimates for the parameter using pivot method.
4. Framing statistical hypothesis and knowing the statistical test procedure.
5. Identifying the suitable large / small sample parametric / non parametric tests among the basic statistical tests.

UNIT –I

Point and Interval Estimation: Review on Sampling distributions; exponential family of distributions Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of a good estimator. Consistency (Definition, necessary conditions, problems); Unbiasedness (Definition, Median modal unbiasedness necessary conditions, problems);

UNIT –II

Sufficiency: Definition, properties, Statement of Neyman's Factorization theorem, one parameter exponential family, computation of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Methods of Estimation: Method of Moments and Method of Maximum likelihood estimation (MLE); their properties and computation for standard probability distributions (if exists), statements of asymptotic properties of MLE. Method of least squares, Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method.

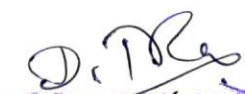
UNIT –III

Testing of Hypothesis: Concepts of statistical hypotheses, Statement and Proof of Neyman-Pearson's fundamental lemma for Randomized tests. Examples in case of Binomial, Poisson, Exponential and Normal distributions and their power of the test functions. **Large sample tests:** Tests for single sample mean, difference of means, single sample proportion, difference of proportions and difference of standard deviations. **Order statistics:** Definition, statements of their distributions and applications.

UNIT – IV

Small sample Tests: Tests for single sample mean, variance, difference of means (independent and related samples), equality of variances, Test for goodness of fit and independence of attributes.


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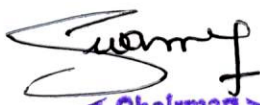
Non-parametric tests: Advantages and disadvantages, comparison with parametric tests. Use of Central Limit Theorem for normal approximations. Single sample Sign test and Runs test, Wilcoxon-signed rank test (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's runs test.

Course Outcome:

1. Familiar to estimate the parameter (if exists) for the any standard probability distribution(s) using methods of maximum likelihood and method of moments, and estimation of parameters using method of least squares.
2. Examine the estimator satisfies the criteria of good estimation (Consistency, unbiasedness, sufficiency) for standard distributions.
3. Evaluate and familiar the confidence interval estimates for the parameter using pivot method.
4. Framing statistical hypothesis and knowing the statistical test procedure.
5. Identifying the suitable large/small sample parametric/non-parametric tests among the basic statistical tests.

List of Reference Books:

1. V.K. Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons,
2. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., .
3. V.K.Rohatgi: An introduction to probability and statistics.Wiley series.
4. Sanjay Arora and Bansilal: New Mathematical Statistics Satya Prakashan , New Delhi
5. Siegal, S., and Sidney: Non-parametric statistics for Behavioral Science. McGraw Hill.
6. Hogg, Tanis, Rao. Probability and Statistical Inference. 7th edition. Pearson Publication.


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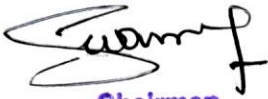
B.SC. SECOND YEAR, III-SEMESTER SYLLABUS
BS-33-P: PAPER – III (Lab):
STATISTICAL INFERENCE LAB USING EXCEL AND R
(2 HPW:: 1 Credit :: 20 Marks)

Topics to be covered:

1. Large sample tests for mean(s), proportion(s), Standard deviation(s).
2. Small sample tests for single sample mean and difference of means (related & independent).
3. Small sample test for single sample variance and equality of variances.
4. Test for goodness of fit and independence of attributes.
5. Nonparametric tests for two independent samples (Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test)

Note:

1. Practice can also be done on data sets available in web sources: www.kaggle.com, <https://ieee-dataport.org/datasets>, <https://data.world/datasets/link>, <https://archive.ics.uci.edu>, (Few selected data sets are: Fishers Iris data set, heart_failure_clinical_records, cancer, Mental Health Dataset, Indian Food Dataset, water-quality-1, etc.)
2. Establishing formulae in Excel cells and deriving the results and also usage existing Excel statistical functions in Excel.
3. Writing R-program for evaluation and usage of libraries in R.
4. Maintaining the Practical records is mandatory.
5. Answer any two out of four choosing at least one each section of Excel and R having two questions in each.


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B.SC. II YEAR, IV-SEMESTER SYLLABUS
BS-44T: PAPER-IV(Theory):
ANALYSIS OF CORRELATION, REGRESSION AND
DESIGN OF EXPERIMENTS

(4 HPW:: 4 Credits :: 80 Marks: (External:50 & Internal:30))

Course Objectives:

1. Able to understand and conducting experiment for the given task i.e. designing an experiment and carrying out its analysis.
2. Identifying the suitable complete block experimental design for the given data.
3. Identifying and carryout the complete analysis for the simple & multiple linear regression for the given data set.
4. Identifying the suitable measure of association / correlation for the given data set.

UNIT-I

Correlation Analysis: Concept of Correlation Different Correlation Measures: Scatters diagram, Karl Pearsons coefficient (raw & grouped data), Spearman's Rank Correlation, Correlation ratio. Concepts of Partial and Multiple correlation coefficients (only for three variables). Analysis of categorical data, their independence, Association and partial association of attributes. Various measures of association: (Yule's) for two-way data and coefficient of contingency (Pearson and Tcherprow) and coefficient of colligation.

UNIT –II

Regression Analysis: Simple linear regression, Principle of least squares for estimation of Regression coefficients (linear, quadratic and power curves), properties of regression coefficients, Simple linear Regression Analysis and extending to Multiple linear Regression Analysis including Estimation of parameters and Computation of R^2 , Adjusted R^2 , MSE, lack of fit of the model, testing significance of regression coefficient(s).

Fisher's Z-transformation for population correlation coefficient(s) and testing the same in case of one sample and two samples

UNIT –III

Analysis of Variance: Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, Concept of Analysis of Variance (ANOVA), statistical models analysis for single factor and two factor (with one / m-observations per cell), Expectation of various sums of squares, Statistical analysis, Importance and applications of design of experiments. Concept of Critical difference, Post-hoc tests (DMR & LSD).

UNIT –IV

Design and Analysis of Experiments: Definition, Principles of experimental designs, Statistical planning for the experimentation Statistical linear models, estimation of parameters and Analysis of Completely



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Randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D).
Expectation of various sum of squares. Comparison of the efficiencies of above designs. Estimation one missing observation in RBD & LSD and their analysis

Course Outcomes:

1. Able to designing an experiment for the given task and carrying out its analysis.
2. Able to identify the suitable complete block experimental design and carrying out its analysis for the given data.
3. Able to identify the suitable model and carryout the complete analysis for the simple & multiple linear regression for the given data set.
4. Able to identify and compute the suitable measure of association / correlation for the given data set

List of Reference Books:

1. V.K. Kapoor and S.C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi
2. V.K. Kapoor and S.C. Gupta: Applied Statistics, Sultan Chand & Sons, New Delhi
3. Sanjay Arora and Bansilal: New Mathematical Statistics Satya Prakashan, New Delhi.


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B.SC. II YEAR, IV-SEMESTER SYLLABUS

BS-44T: PAPER-IV(Lab):

ANALYSIS OF DESIGN OF EXPERIMENTS, CORRELATION & REGRESSION MODELS USING R

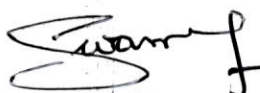
(2 HPW:: 1-Credit : 20 Marks)

Topics to be covered:

1. Analysis of single, two factor models and two factor model with m- per cell and computation of Critical Difference, post-hoc tests (DMR& LSD)
2. Analysis of CRD, RBD and LSD and computing the efficiencies one over other (RBD over CRD, LSD over RBD& CRD)
3. Estimation of missing observation in RBD & LSD and their Analysis .
4. Analysis of LSD with one missing observation and computation of Critical Difference.
5. Drawing of Scatter diagram
6. Computation of Karl Pearsons, Spearman's correlations for grouped & ungrouped data sets
7. Computation of correlation ratio.
8. Computation of multiple and partial correlation coefficients.
9. Fitting of simple Linear and Quadratic Regression models.
10. Fitting of log-linear regression models ($y = a x^b$, $y = a b^x$ & $y = a e^{bx}$)
11. Analysis of Simple linear Regression model.
12. Analysis of Multiple linear regression model
13. Computation of Yule's coefficient of association.
14. Computation of Pearson's, Tcherprows coefficient of contingency.

Note:

1. Practice on the following tests should be on small and large data sets available in www.kaggle.com.
2. Writing R-program for evaluation and usage of libraries in R.
3. Maintaining the Practical records is mandatory.
4. Answer any two out of four questions.


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