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**Department of Statistics  
Central University of Rajasthan**

(REVISED SYLLABUS)



SYLLABUS  
for

**Open Elective**

Integrated M. Sc. STATISTICS

to be implemented for current Integrated M.Sc. Statistics batch admitted in year 2018  
and for students admitted in 2019 onwards.

Department of Statistics  
School of Mathematics Statistics and Computational Sciences  
Central University of Rajasthan  
Bandarsindri, NH-8, Kishangarh, Ajmer, Rajasthan-305801

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**Open Elective**

IV	IMST 231	Descriptive Statistics	3	0	0	0
	IMST 232	Banking and Insurance Practices	3	3	0	0
V	IMST 331	Statistical Methods for Experimenters	3	0	0	0
VI	IMST 332	Statistical Methods	3	3	0	0
	IMST 333	Statistical-Data Analysis Using software	3	3	0	0

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FORTH SEMESTER

Approved in 5 School Board

<b>Course Code</b>	<b>IMST 231</b>
<b>Course Name</b>	<b>Descriptive Statistics</b>
<b>Credit</b>	<b>03</b>
<b>Objective:</b>	
To make the students aware of different type of data sets and their graphical representations introducing of descriptive statistical measures, including those for two variables	
<b>Learning Outcome:</b>	
<ul style="list-style-type: none"> <li>- Graphical and Diagrammatic representation of data.</li> <li>- Calculation of Moments, understanding of Measures of Central Tendency, Dispersion, Skewness and Kurtosis with their interpretations.</li> <li>- Calculation, Interpretation and application of Correlation and Regression Analysis.</li> </ul>	
<b>Unit-1</b>	
<p>Meaning and scope of the word 'Statistics'. Data types: Qualitative and Quantitative Data scales of measurements: nominal, ordinal, ratio, interval Representation: Tabulation Compilation, Classification. Graphical and diagrammatic representation: Bar diagrams, multiple and stack bar diagrams, Histogram, Frequency Polygon, Frequency Curve, Ogive, Pie diagram, Box plot, Stem and leaf diagrams.</p> <p>Measures of Central Tendency: Concept, requirements of a good measure. Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode: properties, merits and demerits. Quartiles, Deciles and Percentiles, Graphical method of determination of Median, Mode and Quantiles.</p>	
<b>Unit-2</b>	
<p>Measures of Dispersion: Concept, Requirements of a good measure of dispersion. Range: Quartile Deviation Q.D. (Semi-interquartile range): Coefficient of Q.D. Mean Deviation, Proof of Minimal property of M.D. Mean Square Deviation (M.S.D.): proof of Minimal property of M.S.D. Variance and Standard Deviation: Effect of change of origin and scale, S.D. of pooled data (proof for two groups), Coefficient of Variation (CV).</p> <p>Moments: Raw moments and Central moments, relation between central moments and raw moments, Sheppard correction for moments (without derivation), Skewness: Measure of skewness, Types of skewness, Kurtosis, Types of kurtosis, Measure of kurtosis.</p>	
<b>Unit-3</b>	
<p>Bivariate Data. Scatter diagram. The concept of dependency, illustrative real life examples. Covariance: Definition, Effect of change of origin and scale. Karl Pearson's coefficient of correlation (r): Definition, Properties, Spearman's rank correlation coefficient: Definition, Interpretation. Derivation of the formula for without ties and Modification of the formula for with-ties computation, variance of linear combination of variables. Correlation coefficient for discrete frequency distribution.</p> <p>Concept of regression, Lines of regression, Principal of least square and curve fitting. Fitting of lines of regression by the least square method. Regression coefficients (<math>b_{xy}</math>, <math>b_{yx}</math>) and their geometric interpretations, Properties. Derivation of the point of intersection of two regression lines and the acute angle between the two lines of regression.</p>	
<b>References books for Descriptive Statistics</b>	
<ol style="list-style-type: none"> <li>1. Rohatgi V. K. and Saleh A. K. Md. E., An Introduction to probability and Statistics. John Wiley &amp; Sons (Asia).</li> <li>2. Mukhopadhyay, P., Mathematical Statistics, new Central Book Agency Pvt. Ltd., Calcutta.</li> <li>3. Hoel P. G., Introduction to Mathematical Statistics, Asia Publishing House.</li> <li>4. Meyer P. L., Introductory Probability and Statistical Applications, Addison Wesley.</li> <li>5. AM Goon, M K Gupta and B. Das Gupta, Fundamentals of Statistics, Volume-I, World Press</li> </ol>	

<b>Course Code</b>	<b>IMST 232</b>
<b>Course Name</b>	<b>Banking and Insurance Practices</b>
<b>Credits</b>	<b>03</b>
<b>Objective:</b> The main objective of this course is make students aware about the Banking system, Structure of Indian Banking, role and responsibility of Insurance Industry.	
<b>Learning Outcome.</b> Students will be aware of (a) Banking System and different facilities of banking sector. (b) Traditional Insurance Plan in Life and General Insurance.	
<b>Unit-1</b>	
Elements of Banking: Definition of Banking, Structure of Indian Banking; RBI- Objectives, Commercial Banks – Scheduled & Non-Scheduled Banks, Co-Operative Banks, Private Bank, Foreign Bank, National Payments Corporation of India.	
<b>Unit-2</b>	
Type of Banking Practices: Different Types of Accounts, Different means of Remittances:- Demand Draft, Letter of Credit, Credit Card, Debit Card, ATM, Cheque & Cash Deposit Machine, Online Banking ECS, NEFT, RTGS, Mobile Banking, E-Wallet.	
<b>Unit 3</b>	
Insurance: Meaning of Insurance, Definition of Insurance Concept, Importance of Insurance, Functions of Insurance, Principles of Insurance & their application, Types of Insurance Contracts. Role of IRDA, Classification of Insurance: Life and non-life insurance, health insurance, micro insurance, social insurance and general insurance (motor, marine, fire, miscellaneous), Types of insurance plans: whole life, term, endowment, Ayushman Bharat.	
<b>References</b>	
<ol style="list-style-type: none"> <li>1. 1.Basu, A. K. (1976). Fundamentals of Banking Theory and Practice. Modern Book Agency.</li> <li>2. Sethi, J., &amp; Bhatia, N. (2012). Elements of Banking and Insurance. PHI Learning Pvt. Ltd..</li> <li>3. Jatana, R., &amp; Uppal, R. K. (Eds.). (2007). E-banking in India: Challenges and opportunities. New Century Publications.</li> <li>4. Principles and Practice if Life Insurance, ICAI, New Delhi</li> <li>5. Black, K., &amp; Skipper, H. D. (2000). Life and health insurance. Prentice Hall.</li> </ol>	

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V SEMESTER

Approved in 5 School Board

<b>Course Code</b>	<b>IMST 331</b>
<b>Course Name</b>	<b>Statistical Methods for Experimenters (Open Elective)</b>
<b>Credits</b>	<b>03</b>
<p><b>Objective and Learning Outcomes:</b> Observations from disciplines like biological, clinical trials, and health surveys always carry some amount of uncertainty. In many cases, especially for the laboratory experiments, it is inevitable to just ignore this uncertainty due to large variation in observations. Tools from statistics are very useful in analyzing this uncertainty and filtering noise from data. Also, due to advancement of microscopy and molecular tools, a rich data can be generated from experiments. To make sense of this data, we need to integrate this data a model using tools from statistics. In this course, we will discuss about different statistical tools required to</p> <p>(i) analyze our observations,  (ii) design new experiments, and  (iii) integrate large number of observations in single unified model.</p> <p>We will discuss about both the theory of these tools and their applications.</p>	
<b>Unit-1</b>	
Descriptive statistics, Data representation and plotting, Measures of Central tendency and Dispersion. Moments, Skewness, Kurtosis, correlation. Basic fitting and regression (Correlation and regression, Interpolation & Extrapolation, Nonlinear data fitting).	
<b>Unit-2</b>	
Probability distribution: Concept of probability, introduction and basics, counting principle, permutations, combinations, conditional probability, Multiplication theorem for two events, Independence of events: Pairwise and Mutual Independence of events. Bayes' theorem(statement only). Random variables, probability mass function, probability density function, expectation, variance, covariance, Binomial random variables, moment generating function, probability distribution, Poisson distribution, Uniform distribution, Normal distribution, exponential distribution.	
<b>Unit-3</b>	
Sampling distributions, the Central limit theorem, students test, Population parameter hypothesis, statistical test for equality of mean and variance. Introduction to ANOVA.	
<b>References</b>	
<ol style="list-style-type: none"> <li>1. Introduction to Probability and Statistics - Medenhall, Beaver, Beaver 14th Edition</li> <li>2. Introduction to Probability and statistics for engineers and scientists, S M Ross, 3rd Edition</li> </ol>	

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SIXTH SEMESTER



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## IMST 332: STATISTICAL METHODS

(3 credit)

Pre requisite: student should undergo with IMST 331 course.

**Objective:** The proposed course is designed with an objective to give depth knowledge of Statistical concepts to the students of other disciplines.

**Learning Outcome:** After completing this course student are able to

- estimate the population parameter based on sample.
- test the significance of mean, variance and population proportion.
- determine statistical measures such as Covariance, correlation coefficient, rank correlation for Bivariate data.
- understand regression line its fitting, One factor and two factor ANOVA

**Unit 1: Estimation:** Concept of parameter, random sample, Estimator of the parameter. Method of moments and Maximization of likelihood. Unbiased estimator. Estimation of the parameter of the normal distribution. Central limit theorem, distribution of sample mean and sample variance of normal population (statement only).

**Unit 2: Testing of Hypothesis:** Hypothesis- simple, composite, null and alternate hypothesis. Problem of testing of hypothesis, critical region, type I and type II errors, probabilities of type I and type II errors. level of significance, p-values. Test concerning the mean of a normal population when variance is known and when unknown. Tests concerning variance of normal population when mean is known and unknown. Test concerning the populations proportion of an attribute. The concept of confidence intervals. t-Test and Chi-square test.

**Unit 3: Bivariate data analysis:** Bivariate Data. Scatter diagram. The concept of dependency illustrative real life examples. Covariance: Definition, Effect of change of origin and scale. Karl Pearson's coefficient of correlation Computation of  $r$  for ungrouped and grouped data. Spearman's rank correlation coefficient without ties and Modification of the formula for ties Computation. Illustrative examples.

**Unit-4: Regression and ANOVA:** Concept of regression, Lines of regression, Fitting of lines of regression by the least square method. One factor Analysis of variance. Two factor analysis of variance. Models, interpretations. Biological, chemical illustrative examples.

### References:

- (i) Bernard A. Rosner (2011), Fundamentals of Biostatistics, 7th ed., Cengage learning Ltd,
- (ii) Pagano M. Gauvreau K.: (2000) Principles of Biostatistics–Duxbury Press
- (iii) B Burt Gerstman, (2008) Basic Biostatistics-Statistics for Public Health Practice: Jones and Bertlett Publishers.

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## IMST 333: Statistical-Data Analysis Using Software

(3 credits)

Objective : The objective of this course is to give hands on training of statistical software.

Learning Outcomes: Students will learn computation of various statistical measure by using statistical software and interpret the results.

### UNIT I

Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data

### UNIT II

Generate automated reports giving detailed descriptive statistics, correlation and lines of regression. Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

### UNIT III

Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

### References:

1. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics
2. W.H. Freeman, Cunningham, B.J (2012):Using SPSS: An Interactive Hands-on approach
3. Cho, M,J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman and Hall/CRC