# ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

## Model Syllabus for 4-Year UG Honours in B.Sc. (Statistics) as Major in consonance with Curriculum framework w.e.f. AY 2025-26

### Prepared by Yogi Vemana University, Kadapa

COURSE STRUCTURE (for Semester I to VI)

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | I | 1 | Descriptive Statistics | 3 | 3 |
| | | | Descriptive Statistics Practical Course | 2 | 1 |
| | | 2 | Theory of Probability and Mathematical Expectations | 3 | 3 |
| | | | Theory of Probability and Mathematical Expectations Practical Course | 2 | 1 |
| | II | 3 | Theoretical Discrete Distributions | 3 | 3 |
| | | | Theoretical Discrete Distributions Practical Course | 2 | 1 |
| | | 4 | Theoretical Continuous Distributions | 3 | 3 |
| | | | Theoretical Continuous Distributions Practical Course | 2 | 1 |
| II | III | 5 | Statistical Methods | 3 | 3 |
| | | | Statistical Methods Practical Course | 2 | 1 |
| | | 6 | Inferential Statistics | 3 | 3 |
| | | | Inferential Statistics Practical Course | 2 | 1 |
| | | 7 | Sampling Techniques | 3 | 3 |
| | | | Sampling Techniques Practical Course | 2 | 1 |
| | IV | 8 | Design and Analysis of Experiments | 3 | 3 |
| | | | Design and Analysis of Experiments Practical Course | 2 | 1 |
| | | 9 | Applied Statistics | 3 | 3 |
| | | | Applied Statistics Practical Course | 2 | 1 |
| | | 10 | Statistical data analysis using MS - excel | 3 | 3 |
| | | | Statistical data analysis using MS – excel practical course | 2 | 1 |

SEMESTER - III

## COURSE 5: STATISTICAL METHODS

| Theory | Credits: 3 | 3 hrs/week |
|---|---|---|

### Course Outcomes

After successful completion of the course students will be able to:

1. To get the knowledge of estimating future values by using curve fitting.
2. To calculate the relationship between bivariate data.
3. To find the relationship about the multivariate data.
4. To acquaint about the forecasting of the data by using regression techniques.
5. To find the association of the categorical data by using attributes.

### Unit – 1: Curve fitting

Bivariate data, Principle of least squares, fitting of $k^{th}$ degree polynomial. Fitting of straight line, Fitting of Second degree polynomial, fitting of family of exponential curves and power curve.

### Unit – 2: Correlation

Meaning, Types of Correlation, Measures of Correlation – Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Properties. Bivariate frequency distribution, correlation coefficient for bivariate data and problems.

### Unit – 3:

Coefficient of concurrent deviation, probable error and its properties, coefficient of determination, Concept of multiple and partial correlation coefficients (three variables only), properties and problems, Intra-class correlation and correlation ratio.

### Unit – 4: Regression

Concept of Regression, Linear and Non-Linear regression. Linear Regression – Regression lines, Regression coefficients and its properties, Angle between two lines of regression. Regressions lines for bivariate data and simple problems. Correlation vs regression. Explained and Unexplained variations.

### Unit – 5: Attributes

Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only, Independence of attributes, Association of attributes and its measures, Relationship between association and colligation of attributes.

**Text Books**

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

**References**

1. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
2. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.

**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts.
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc. on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

SEMESTER - III

## COURSE 5: STATISTICAL METHODS

**Practical** | **Credits: 1** | **2 hrs/week**

**List of Experiments:**

1. Fitting of straight line by the method of least squares.
2. Fitting of parabola by the method of least squares.
3. Fitting of exponential curve of two types by the method of least squares.
4. Fitting of power curve of the type by the method of least squares.
5. Computation of correlation coefficient and regression lines for ungrouped data.
6. Computation of correlation coefficient for bivariate frequency distribution.
7. Computation of correlation coefficient, forming regression lines for grouped data.
8. Computation of partial and multiple correlation coefficients.
9. Computation of Yule's coefficient of association and colligation.

SEMESTER - III

COURSE 6: INFERENTIAL STATISTICS

Theory | Credits: 3 | 3 hrs/week

**Course Outcomes**

After successful completion of the course students will be able to:

1. To acquaint with estimator, estimates, estimation techniques and its properties.
2. To acquire knowledge of testing the hypothesis of different distributions.
3. To learn about the large sample techniques by using various tools.
4. To learn about the small sample techniques by using various tools.
5. To deal with the situation where there are no parameters to the distributions.

**Unit – 1: Theory of estimation**

Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, & sufficiency. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's. Rao – Cramer Inequality, properties. Binomial, Poisson & Normal Population parameters estimate by MLE method. Confidence Intervals.

**Unit – 2: Testing of Hypothesis**

Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance, concept of p value and power of a test. One and two tailed tests. Neyman -Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

**Unit – 3: Large sample Tests**

Large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. Standard deviation(s) and correlation coefficient(s).

**Unit – 4: Small Sample tests**

Assumptions and t-test for single mean, difference of means and paired t-test. $\chi^2$ test for goodness of fit and independence of attributes. $\chi^2$ test for single variance, F-test for equality of variances.

**Unit – 5: Non parametric tests**

Advantages and disadvantages, comparison with parametric tests. One sample runs test, sign test and Wilcoxon – signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann – Whitney U test, Wald Wolfowitz runs test.

Text Books

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

References

1. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
2. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.

**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts.
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc. on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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SEMESTER - III

## COURSE 6: INFERENTIAL STATISTICS

**Practical** **Credits: 1** **2 hrs/week**

**List of Experiments:**

1. Large sample test for mean and difference of means.
2. Large sample test for proportion and difference of proportions.
3. Large sample test for standard deviation and difference of standard deviations.
4. Large sample test for correlation coefficient.
5. Small sample test for mean and difference of means.
6. Small sample test for correlation coefficient.
7. Paired t - test (paired samples).
8. Small sample test for single variance ($\chi^2$test) and difference of variances (F test).
9. $\chi^2$ test for goodness of fit and independence of attributes.
10. Non parametric tests for single sample (run test, sign test and Wilcoxon signed rank test).
11. Non parametric tests for related samples (sign test and Wilcoxon signed rank test).
12. Non parametric tests for two independent samples (Median test, Wilcoxon –Mann – Whitney – U test, Wald–Wolfowitz's runs test).

Note: Conclusions of practical problems must be drawn based on p value as well as critical values.

SEMESTER - III

## COURSE 7: SAMPLING TECHNIQUES

| Theory | Credits: 3 | 3 hrs/week |
|---|---|---|

**Course Outcomes**

After successful completion of the course students will be able to:

1. To review about the population and its concepts also methods to collect data and errors to deal.
2. Introduced to various statistical sampling schemes such as simple, stratified and systematic sampling.
3. An idea of conducting the sample surveys and selecting appropriate sampling techniques.
4. Knowledge about comparing various sampling techniques.
5. To use appropriate factorial experimental to analyze the experimental data.

**Unit – 1:**
Brief review of parameter and statistic, sampling distribution. Principal steps and principles in a sample survey, sampling and non – sampling errors, advantages of sampling over census, limitations, types of sampling – concept of subjective, probability and mixed sampling.

**Unit – 2: Simple Random Sampling** (with and without replacement)
Notations and terminology, various probabilities of selection. Random numbers tables and its uses. Methods of selecting simple random sample, lottery method, method based on random numbers. Estimates of population total, mean and their variances and standard errors, determination of sample size, simple random sampling of attributes.

**Unit – 3: Stratified random sampling**
Stratified random sampling, Advantages and Disadvantages of Stratified Random sampling, Estimation of population mean, and its variance. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.

**Unit – 4: Systematic sampling**
Systematic sampling definition when N = nk and merits and demerits of systematic sampling - estimate of mean and its variance. Comparison of systematic sampling with Stratified and SRSWOR. Comparison of variance of SRS, StRS and Sys for a linear trend. Concept of Cluster Sampling, Multistage Sampling and Quota Sampling.

**Unit – 5: National Statistics Office**
National Statistical Organization: vision and mission, National Statistics Office (NSSO and CSO), roles and responsibilities, important activities, publications etc.
National Statistical Commission: Need, Constitution, its role, functions, important acts.

**Text Books**

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

**References**

1. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
2. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.

**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts.
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc. on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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SEMESTER - III

## COURSE 7: SAMPLING TECHNIQUES

**Practical** **Credits: 1** **2 hrs/week**

**List of Experiments:**

1. Show the sample mean is unbiased estimator of population mean in SRSWOR and also find variance of sample mean.
2. Show the sample mean square is unbiased estimator of population mean square in SRSWOR.
3. Show the sample mean is unbiased estimator of population mean in SRSWR and also find variance of sample mean.
4. Compare means and variances between SRSWR and SRSWOR.
5. Allocation of sample sizes to various strata in proportional and in optimum allocations to draw a Stratified random sample.
6. Compare precision in proportional and optimum allocations with SRSWOR and gain in efficiency due to proportional and optimum allocations.
7. Systematic sampling with N=nk and compare the precision of an estimate in systematic sampling with that of in Stratified and in SRSWOR.

SEMESTER - IV

## COURSE 8: DESIGN AND ANALYSIS OF EXPERIMENTS

Theory | Credits: 3 | 3 hrs/week

### Course Outcomes

After successful completion of the course students will be able to:

1. To acquaint with the role of statistics indifferent fields with special reference to agriculture.
2. Learn to apply the one of the designs of experiment to agricultural fields.
3. Learn to apply the randomization to the blocks of various fields in agriculture.
4. To get the familiarity about applications of three principles.
5. Learn to deal the agricultural fields with different factors and levels.
6. To use appropriate experimental designs to analyze the experimental data.

**Unit – 1: Analysis of variance (ANOVA)**

Concept, Definition and assumptions. ANOVA one way classification – mathematical model, analysis – with equal and unequal classification. ANOVA two-way classification – mathematical model, analysis and problems.

**Unit – 2: Completely Randomised Design (CRD)**

Definition, terminology, Principles of design of experiments, CRD – Concept, advantages and disadvantages, applications, Layout, Statistical analysis. Critical Differences when hypothesis is significant.

**Unit – 3: Randomised Block Design (RBD)**

Concept, advantages and disadvantages, applications, Layout, Statistical analysis, problems and Critical Differences. RBD with one missing value and its analysis, problems.

**Unit – 4: Latin Square Design (LSD)**

Concept of LSD, its advantages and disadvantages, applications, Layout, Statistical analysis, problems and Critical Differences.

**Unit – 5:**

Estimation of one missing value in LSD and its analysis, problems. Efficiency of RBD relative to CRD. Efficiency of LSD over RBD and CRD and related problems.

**Text Books / References**


1. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
3. M.R. Saluja: Indian Official Statistics. ISI publications.


**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts.
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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SEMESTER - IV

## COURSE 8: DESIGN AND ANALYSIS OF EXPERIMENTS

**Practical** **Credits: 1** **2 hrs/week**

**List of Experiments:**

1. ANOVA – one way classification with equal number of observations.
2. ANOVA – one way classification with unequal number of observations.
3. ANOVA – Two way classification.
4. Analysis of CRD and critical differences.
5. Analysis of RBD and critical differences. Relative efficiency of CRD with RBD.
6. Estimation of single missing observation in RBD and its analysis.
7. Analysis of LSD and efficiency of LSD over CRD and RBD.
8. Estimation of single missing observation in LSD and its analysis.

SEMESTER - IV

## COURSE 9: APPLIED STATISTICS

Theory | Credits: 3 | 3 hrs/week

### Course Outcomes

After learning this course, the student will be able to know about

1. Forecasting Techniques and its applications.
2. Interpret and use a range of index numbers commonly used in the business sector.
3. Perform calculations involving simple and weighted index numbers.
4. Understand the basic structure of the Consumer price index and perform calculations involving its use.
5. Various data collection methods enabling to have a better insight in policy making, planning and systematic implementation.
6. Construction and implementation of life tables.
7. Population growth curves, population estimates and projections.
8. Real data implementation of various demographic concepts as outlined above through practical assignments.

### Unit – 1: Time Series

Time Series and its components with illustrations, additive, multiplicative and mixed models. Trend – Estimation of trend by free hand curve method, method of Semi Averages. Determination of trend by Least squares (Linear trend, parabolic trend only), Moving averages method.

### Unit – 2: Seasonal Component

Determination of seasonal indices by Simple Averages method, Ratio to Moving Average, Ratio to Trend and Link Relative methods, De-seasonalization.

### Unit – 3: Index numbers

Concept, construction, problems involved in the construction of index numbers, uses and limitations. Simple and Weighted index numbers –Various Weighted Aggregate Index numbers, Criterion of a good index number, Fisher's ideal index number. Cost of living index number and Whole sale price index number.

### Unit – 4: Vital Statistics

Introduction, definition, and uses of vital statistics, sources of vital statistics. Measures of Mortality Rates – Crude Death Rate, Specific Death Rate, Standardised Death Rate with different populations and problems.

### Unit – 5:

Life table – Columns, Construction and Uses of Life table, Proofs of life table functions. Measures of Fertility Rates – Crude Birth Rate, General Fertility Rate, Specific Fertility Rate, Total Fertility Rate. Measures of population growth – Pearls, Gross Reproduction Rate, Net Reproduction Rate and its problems.

**Text Books / References**


1. Fundamentals of Applied Statistics: V. K. Kapoor & S. C. Gupta.
2. Mukopadhyay, P(2011): Applied Statistics,2nd ed. Revised reprint, Books and Allied Pvt. Ltd.
3. Brock well, P.J. and Devis, R.A. (2003): Introduction to Time Series Analysis. Springer.
4. Chatfield, C.(2001): Time Series Forecasting, Chapman & Hall.
5. Srinivasan, K.(1998): Demographic Techniques and Applications. Sage Publications.
6. Srivastava, O.S. (1983): A Text Book of Demography. Vikas Publishing House.


**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
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SEMESTER - IV

## COURSE 9: APPLIED STATISTICS

**Practical** | **Credits: 1** | **2 hrs/week**

**List of Experiments:**

1. Measurement of trend by method of moving averages (odd and even period).
2. Measurement of trend by method of Least squares (linear and parabola).
3. Determination of seasonal indices by method of simple averages.
4. Determination of seasonal indices by method of Ratio to Moving Averages.
5. Determination of seasonal indices by method of Ratio to Trend.
6. Determination of seasonal indices by method of Link relatives.
7. Computation of simple index numbers.
8. Computation of all weighted index numbers.
9. Computation of reversal tests.
10. Computation of various Mortality rates.
11. Computation of various Fertility rates.
12. Computation of various Reproduction rates.
13. Construction of Life Table.

SEMESTER - IV

## COURSE 10: STATISTICAL DATA ANALYSIS USING MS - EXCEL

**Theory** | **Credits: 3** | **3 hrs/week**

### Course Outcomes

After completing this course, students will be able to:

1. Understand data entry and formatting, manage worksheets, apply arithmetic and logical operations, perform data sorting, filtering, validation, and use Excel add-ins for analysis.
2. Create and interpret different types of charts and graphs, prepare frequency tables, and summarize data effectively using PivotTables and Pivot Charts.
3. Calculate and interpret measures of central tendency and dispersion, apply ranking and position measures, analyze skewness and kurtosis, and generate descriptive statistics reports.
4. Analyze relationships using correlation and regression techniques, interpret regression outputs, and apply forecasting methods to predict future trends.
5. Perform hypothesis tests such as Z-test, t-test, F-test, ANOVA, and chi-square test, interpret Excel outputs, and apply results in real-world decision-making.

### Unit I – Excel Basics for Data Analysis

Data entry, formatting, worksheet management, Basic Excel Functions: *Arithmetic* → =SUM(), =PRODUCT(), =QUOTIENT(), =MOD(), Logical → =IF(), =AND(), =OR(), =IFERROR(), Lookup → =VLOOKUP(), =HLOOKUP(), =XLOOKUP(), =INDEX(), =MATCH(), Cell referencing: relative, absolute, mixed references, Data management: sorting, filtering, conditional formatting, Data validation (drop-down lists, input restrictions, error messages), Using Excel Add-Ins: Analysis ToolPak, Solver for advanced analysis

### Unit II – Data Visualization and Frequency Analysis

Charts and Graphs: Bar, Column, Line, Pie, Area, Scatter, Histogram, Frequency tables: =COUNT(), =COUNTIF(), =COUNTIFS(), =FREQUENCY() for grouped data, PivotTables and PivotCharts for data summarization.

### Unit III – Descriptive Statistics in Excel

Measures of Central Tendency: =AVERAGE(), =MEDIAN(), =MODE.SNGL(), =MODE.MULT(), =GEOMEAN(), =HARMEAN(), Measures of Dispersion:Range → =MAX()-MIN(). Variance → =VAR.S(), =VAR.P(), Standard Deviation → =STDEV.S(), =STDEV.P(), Coefficient of Variation (formula), Position & Ranking:=RANK.EQ(), =RANK.AVG(), =PERCENTRANK.INC(), =PERCENTRANK.EXC(), Shape of Distribution:Skewness → =SKEW(), Kurtosis → =KURT(), Descriptive Statistics report via Data Analysis ToolPak → Descriptive Statistics.

**Unit IV – Correlation, Regression, and Forecasting**

Correlation Analysis: Pearson → =CORREL(array1,array2), Covariance → =COVARIANCE.P(), =COVARIANCE.S(), Spearman Rank Correlation using =RANK.AVG() + =CORREL(), Regression Analysis: Simple Linear Regression via Data Analysis ToolPak → Regression, Extracting slope & intercept → =SLOPE(y_range,x_range), =INTERCEPT(y_range,x_range), Regression line → =FORECAST.LINEAR(x,known_y,known_x). Trend & Forecasting:=TREND() for future predictions

**Unit V – Excel for Hypothesis Testing**

Hypothesis Testing: Z-Test → =Z.TEST(), t-Test → Data Analysis ToolPak → t-Test (Paired, Two-Sample Equal/Unequal Variance), F-Test → Data Analysis ToolPak → F-Test Two-Sample Variance, ANOVA → Data Analysis ToolPak → ANOVA: Single Factor / Two Factor. Goodness of Fit & Association: Chi-Square Test → =CHISQ.TEST(). Real-world case studies: business, health sciences, social sciences applications, Interpreting Excel output for decision making.

**Text Books / References**


1. Statistics made simple: Do it yourself on PC Approach by K.V.S. Sharma.
2. N. Balakrishnan, K. Chandrasekaran & M. Saravanavel – Practical Statistics using Microsoft Excel – Sultan Chand & Sons.
3. Covers Excel functions, descriptive statistics, correlation, regression, and hypothesis testing.
4. S. P. Gupta & Archana Gupta – Statistical Methods – Sultan Chand & Sons.
5. Widely used in Indian universities; explains descriptive statistics, correlation, regression, and tests of significance.
6. J. K. Sharma – Business Statistics: Problems and Solutions using Excel – Vikas Publishing House.
7. Good for Excel-based applications of frequency analysis, regression, and hypothesis testing.
8. P. N. Arora & S. Arora – Statistics for Management with Excel Applications – S. Chand Publishing.
9. Focused on Excel tools for descriptive statistics, regression, and data visualization.
10. Vohra, N. D. – Business Statistics – McGraw Hill Education (India).
11. Explains correlation, regression, ANOVA, and hypothesis testing with practical orientation.


**Suggested Co-curricular Activities:**

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
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SEMESTER - IV

## COURSE 10: STATISTICAL DATA ANALYSIS USING MS - EXCEL

**Practical** **Credits: 1** **2 hrs/week**

**List of Experiments:**

1. Central Tendency – Calculate mean, median, and mode for a given dataset.
2. Dispersion – Compute variance, standard deviation, and coefficient of variation.
3. Skewness and Kurtosis – Calculate skewness and kurtosis, and interpret the distribution shape.
4. Correlation Analysis – Determine simple correlation coefficient and prepare a correlation matrix for multiple variables (e.g., height, weight, age).
5. Simple Linear Regression – Fit a regression line and estimate the dependent variable.
6. Z and t-tests – Conduct one-sample and two-sample t-tests (for large and small samples).
7. Paired t-test – Compare before-and-after observations to test significance of difference.
8. F-test – Test equality of variances between two independent samples.
9. Chi-Square Test: Test the goodness of fit.
10. ANOVA – Perform one-way and two-way ANOVA to test differences among groups.

Note: MS - Excel Practical Problems must be done in Computer Lab at least 4 hours per month.