VIJAYA COLLEGE

R.V Road, Basavanagudi, Bengaluru -560004

DEPARTMENT OF STATISTICS

REGULATIONS AND SYLLABUS IN STATISTICS FOR THE THREE YEAR B.Sc. DEGREE COURSE (CBCS 2017&onwards)

PROGRAM OUTCOME

The course provides a foundation and motivation for exposure to statistical ideas. The students will be able to

- Acquire the ability to bring together and flexibly apply knowledge to characterize, analyse and solve a wide range of problems.
- Recognize and appreciate the connections between theory and applications.
- Independently read statistical literature of various types, including survey articles, scholarly books and online sources.
- Have the versatility to work effectively in a broad range of analytic, scientific, government, financial, health, technical and other positions.
- Choose appropriate statistical methods and demonstrate their ability to apply various concepts in exploratory data analysis.
- Use various statistical soft wares to perform data analysis.
- Have the intellectual curiosity and flexibility to grow with developing technology and new methods.

PROGRAM SPECIFIC OUTCOME

- Statistics with Mathematics and Economics OR Computer Science combination is an excellent course for students taking up CAT exam, career in management. Software giants like Infosys, Wipro prefer Computer Science students with a background in Statistics. The field of Actuaries requires youngsters with a good background in Statistics. Those who desire to serve their country can take up UPSC's a) Indian Statistical Service examination, b) Statistical officer in National Sample Survey Organization.
- Clinical trials are conducted by the medical fraternity to find out new and effective treatment for existing and new diseases. The knowledge of Statistics has a vital role to play in designing the trial and in answering medical questions effectively.
- A thorough grounding in Statistics is necessary for a career in any experimental science. When numerical data regarding any biological topic is collected, interpretation of the data can be done only with the help of Statistics.
- **After graduation if one wants to pursue higher studies, the following are the options:**

- **M.**Sc;(STATS); M.Sc(MATHS); M.Sc (Comp.Sc.); M.Sc (IT); MCA; M.Stat in ISI; MBA; CA; Company Secretary, ICWAI; CFA; Systems Analysis and Data Management and other Master degree courses in Econometrics, Operations Research, Population Research and Demography.

JOB OPPORTUNITIES : There is a likelihood of getting a suitable job in :

1) State and central government departments where graduation is the minimum qualification including the Bureau of Economics and Statistics, planning and implementation departments.
2) Indian statistical Institute
3) Institute for social and economic change
4) Census departments
5) Research centres like ISRO, IISc;
6) Private organizations and MNCs.

Program and Course outcome

SUBJECT	PAPER	COURSE OUTCOME
SEMESTER - I	PAPER-1 **BASIC STATISTICS-I**	Students will be able to ✓ recognize different types of data and scales of measurement. Represent the data using graphs and diagrams. ✓ Students should be able to compute and interpret measures of center and spread of data. Construct and analyze graphical displays to summarized data. ✓ Students should be able to calculate, interpret and communicate the simple correlation and simple linear regression. Fit different types of curves to the respective data. ✓ Students should be able to utilize basic concepts of probability including independence and conditional probability to calculate, interpret and communicate event probabilities. ✓ Students should be able to calculate, interpret and communicate the simple, partial and multiplecorrelation.
SEMESTER -II	PAPER-2 **BASIC STATISTICS-II**	Students should be able to ✓ construct probability distribution to a random variable. prove the properties and theorems on expectation and variance ✓ derive the distribution of functions of univariate random variables using appropriate techniques. ✓ calculate, interpret and communicate probabilities. ✓ understand different probability functions with respect to univariate continuous random variables ✓ derive the properties of other theoretical continuous distributions like uniform, exponential, beta and gamma ✓ determine the appropriate probability distribution based on experimental conditions and assumptions. ✓ determine the appropriate areas covered under a normal probability curve prove important properties of normal distribution including the preservation of normality under a linear transformation ✓ Students will be able to apply the Central Limit Theorem to problems involving sums and averages of variables from arbitrary distributions.

SEMESTER - III	PAPER-3 **STATISTICAL INFERENCE-I**	Students will be able to - describe the abstract idea of a sampling distribution and how it reflects the sample to sample variability of a statistic - explain how it is a measure of the precision of a point estimate (sampling variability) , know chi-square, t and F distributions and their properties - appreciate the need for statistical inference and point estimation of the parameters - compute point estimates of the parameters of theoretical discrete and continuous distributions - utilize the of method of maximum likelihood function and method of moments of obtaining point estimators. - understand the informal and formal explanations of any confidence interval - understand how factors like sample size, confidence level, and estimated standard deviation of estimator (i.e., standard error) affect the width of a confidence interval - distinguish between one-sided and two-sided confidence intervals - construct intervals for common population parameters (means, proportions and variances) - generate observations from different probability distributions. - recognize the central limit theorem and law of large numbers
SEMESTER - IV	PAPER-4**STATISTICAL INFERENCE-II**	Students will be able to - identify the appropriate null and alternative hypotheses, including one or two sided, simple or composite for a given study objective - identify correctly what are the type I and type II errors would be when presented with the results of a statistical study - apply Neyman-Pearson lemma for constructing most powerful tests - recognize similarity among all test statistics of the standardized score variety; exploit this similarity to derive test statistics for common tests involving proportions and means. - use p-values to make decisions about hypotheses under test.

		✓ correctly identify the appropriate statistical test that should be applied to analyze a study, choosing from proportion(s), mean(s), variance(s) correlation/linear regression, independence of attributes and goodness of fit and use statistical software for this analysis. ✓ compare and contrast parametric and nonparametri and to identify multiple applications where nonparametric approaches are appropriate. ✓ explain in detail and demonstrate the use of non-parametric statistical methods, wherein estimation and analysis techniques employed are not heavily dependent on the specifications of an underlying parametric model. ✓ Need for sequential tests, Wald's SPRT for binomial proportion and Normal population mean when variance is known
SEMESTER -V	PAPER-5 **SAMPLING THEORY AND STATISTICAL QUALITYCON TROL**	Students will be able to ✓ identify the population of interest, individuals, parameter, sample and statistics from a study. ✓ distinguish between (i) an observational study and an experiment. (ii) probability and non probability sampling methods. ✓ identify whether a probability sampling method or a non-probability sampling method was used to obtain the study data. ✓ understand the importance of sampling and how from samples can be used to provide estimates of population characteristics. ✓ learn about a variety of sampling methods, namely, random sampling, stratified random sampling and systematic sampling. ✓ understand how results from samples can be us provide estimates of population characteristics such as population mean, population total, popu standard deviation and /or population proportion. ✓ compare and recognize the best method of sampling ✓ the aims and objectives of Statistical Quality Control, the different quality tools and quality standards. ✓ construct control charts for variables and attributes. ✓ understand the meaning of product control; role of sampling plans. ✓ interpret the results of process capability studies.

SEMESTER -V	PAPER-6 **DESIGN OF EXPERIMENTS**	Students will be able to ✓ recognize the situation in which the analysis of variance (ANOVA) is appropriate and be able to perform one-way ANOVA with the assistance of computer software. ✓ explain the partitioning of the total sum of squares into the "within" and "between" group components and identify the degrees of freedom associated with each sum of squares. ✓ perform the F test in ANOVA, evaluating or approximating the P-value of the test statistic. ✓ Interpret the P valve at a given level of significance ✓ identify common features in experiments, like the experimental unit, treatment, factors, control groups, randomization and blocking. ✓ understand the importance of statistical design of experiments and benefits in R&D; to choose an appropriate experimental design based on the study objectives. ✓ design and conduct appropriate experiments, as well as analyze and interpret appropriate experimental data. ✓ understand the need and the procedure of conducting factorial experiments. ✓ analyse two factor and three factor factorial experiments at two levels.
SEMESTER - VI	PAPER-7 **APPLIED STATISTICS**	The student should be able to ✓ understand and identify the problems in the construction of various types of index numbers ✓ appreciate various tests of adequacy and the uses of index numbers ✓ understand the concept of Consumer Price Index and identify the limitations of index numbers ✓ understand and apply the concepts and methods underlying the analysis of univariate time series and the context for interpretation of results ✓ decompose a time series into trend, seasonal, cyclical and irregular components ✓ understand the theoretical bases of different

		methods of time series analysis including decomposition. ✓ understand basic demographic measures. Identify alternative sources of demographic data. Analyse and interpret basic demographic measures. ✓ understand and apply the concepts and methods underlying Observational, cross-sectional, prospective, retrospective, and randomized control studies. Odds ratio and its confidence interval. Relative risk and its confidence interval.. Receiver operating characteristic (ROC) curve. Body mass index. ✓ about the Ministry of Statistics and Programme Implementation (MoSPI) ✓ about the functions of NSSO and CSO ✓ National income. Basic concepts of GNP, GDP, NNP. National Income at factor cost – NDP, per capita income. Real national income. Methods of estimating national income.
SEMESTER - VI	PAPER-8**OPERATIONS RESEARCH**	Students will be able to ✓ formulate a linear programming problem and solve it using graphical, simplex and big M methods. ✓ conceptualize the feasible region and to find out feasible solution ✓ solve a transportation and assignment problems and give the optimal solution. ✓ solve simple decision and game problems using different techniques. ✓ describe an inventory system, simple inventory models and obtain mathematical solutions. ✓ understand a queueing system and its different components; derive the characteristics of a single server queue. ✓ Understand Need for replacement. Replacement policy for items which deteriorate with time. Optimum policy with discrete and continuous time. Group replacement policy

COURSE OBJECTIVES

There are twin objectives:

(i) To impart education in Statistics (ii) to give an in-depth knowledge of Statistics and applied topics like time series, demography, etc. It is said that, "Knowledge of Statistics may prove to be of use at any time under any circumstance", be it Medicine, Psychology, Astronomy, Industry, Finance, Management or any other field, Statistics plays a very important role to make inferences about sampled populations, to inculcate logical reasoning in students and improve their analytical skills.