RANI CHANNAMMA UNIVERSITY BELAGAVI

THE COURSE STRUCTURE & SYLLABUS OF UNDER GRADUATE

BACHELOR OF ARTS

APPLIED STATISTICS

1ST TO 6TH Semesters

w.e.f.

Academic Year 2020-21 and Onwards
Under

CHOICE BASED CREDIT SYSTEM (CBCS)

B.A Applied Statistics (UG) Course Structure (CBCS)

Sem	Course Code	Title of the Paper	Teaching Hrs Per	Credits	Marks			Duration of Exam
					Sem Exam	IA	Total	
I	DSC1A	Basics Statistics	5hrs	3	80	20	100	3 hrs
II	DSC1B	Descriptive Statistics	5hrs	3	80	20	100	3 hrs
III	DSC1C	Probability & Standard Probability Distributions	5hrs	3	80	20	100	3 hrs
	SEC-1	Descriptive Statistics–I	2hrs	1	40	10	50	2 hrs
IV	DSC1D	Inference and Exact Sampling Distributions	5hrs	3	80	20	100	3 hrs
	SEC-2	Descriptive Statistics - II	2hrs	1	40	10	50	2 hrs
V	DSC1E	Theory of Sampling	5hrs	3	80	20	100	3 hrs
	DSE1A OR	Population Studies	5hrs	3	80	20	100	3 hrs
	DSE1B	Statistical Quality Control & Econometrics	5hrs	3	80	20	100	3 hrs
	SEC3	Sampling Theory	2hrs	1	40	10	50	2 hrs
VI	DSC1F	ANOVA and Design of Experiments	5hrs	3	80	20	100	3 hrs
	DSE2A OR	Operation Research -I	5hrs	3	80	20	100	3 hrs
	DSE2B	Operation Research-II	5hrs	3	80	20	100	3 hrs
	SEC4	Population Studies	2hrs	1	40	10	50	2 hrs

Regulations and Syllabus

For

APPLIED STATISTICS

In

Three Year B.A. Course (CBCS 2020)

Regulation and Scheme of Instructions:

Regulations for governing three years semesterised bachelor degree programme of Rani Channamma University, Belagavi in Applied Statistics optional subject with effect from academic year 2020-2021.

I. Goals and Objectives:

The following aims have been kept in view while designing the syllabus of Bachelor's programme (BA) in applied statistics as one of the optional statistics.

1. To create an aptitude and bring statistical awareness among the students.

2. To train promising learners to teach Applied Statistics effectively at various level in the educational institutions.

3. To provide adequate Statistical knowledge and skills as required for the competitive examination.

4. To enrich and enhance analytical skill through Statistical techniques.

5. To make the subject student friendly, socially relevant and to cultivate research culture among the students.

II. Admission criteria:

Any candidate who have passed PUC/10+2 with any subjects are eligible to choose Applied Statistics as one of the optional subjects at the under graduate course. The other rules for admission are as per the university and government notifications from time to time.

III. Medium of Instruction:

The medium of instruction will be in English, however, the students are allowed to opt Kannada medium also.

IV. Attendance:

A minimum of 75% of attendance in each semester is compulsory.

V. Scheme of instruction:

1. The M.A/M.Sc./M. Stat. Master degree holders in Statistics can only teach Applied Statistics optional subject at UG level.
2. Applied Statistics as an optional subject at UG level which consists of six semesters. There will be one theory paper in I, II, III and IV semester of 100 marks. Where as in the V and VI semesters there will be two theory papers each of 100 marks. The duration of teaching hours will be 5 hours per week in each paper.

VI. Scheme of Instruction:

1. Theory course shall carry 100 marks of which 80 marks allotted for semester end examination and 20 marks for internal assessment.
2. The semester end examination will be conduction by the university which will be of three hours duration and maximum 80 marks. The minimum passing marks in the examination is of 40 percent.
3. There shall be three sections in every question paper- A, B and C. Section A shall have 12 question of each 2 marks and candidates have to solve 10 questions (10x2 = 20 marks). Section B shall have 8 questions of each 5 marks and the candidate has to solve 6 questions only (6x5 = 30 marks). Section C shall have 6 questions of each 10 marks and the candidate has to solve 3 questions as per instructions (3x10 = 30 marks).

Question Paper Pattern in Applied Statistics (Optional) for all semester

Section A

I. Answer any **10** questions out of **12** questions (Q. No. 1 to 12)

$$10 \times 2 = 20 \text{ Marks.}$$

Section B

II. Answer any **6** questions out of **8** questions (Q. No. 13 to 20)

$$6 \times 5 = 30 \text{ marks.}$$

Section C

III. Answer any **6** questions out of **8** questions (Q. No. 21 to 26)

$$3 \times 10 = 30 \text{ marks.}$$

21 or 22

23 or 24

25 or 26

Total = 80 marks

Rani Channamma University, Belagavi

BLUE PRINT FOR MODEL QUESTION PAPERS IN APPLIED STATISTICS

Questions of 2 marks, 5 marks and 10 marks to be asked from each unit of the semester syllabus of B.A. Course in Applied Statistics is as follows:

B.A.I Semester Applied Statistics Paper
DSC1A - Basic Statistics

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Introduction to Statistics and Basic concepts	3	2	1	26
II Diagrammatic and Graphical representation	2	2	1	24
III Measures of Central Tendency	3	1	2	31
IV Measures of Dispersion	2	2	1	24
V Skewness and Kurtosis	2	1	1	19
Total Questions	**12**	**08**	**06**	**124**

B.A.II Semester Applied Statistics Paper
DSC1B -Descriptive Statistics

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Index Numbers	3	2	2	36
II Time Series	3	2	1	26
III Correlation	2	2	1	24
IV Regression	2	1	1	19
V Association of Attributes	2	1	1	19
Total Questions	**12**	**08**	**06**	**124**

B.A.III Semester Applied Statistics
DSC1C – Probability and Standard Probability Distributions

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Probability	3	2	1	26
II Random variable and Mathematical Expectation	3	2	1	26
III Binomial Distribution	2	1	1	19
IV Poisson Distribution	2	1	1	19
V Normal Distribution	2	2	2	34
Total Questions	**12**	**08**	**06**	**124**

B.A.III Semester Applied Statistics
SEC1 – Descriptive Statistics-I

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Introduction to Statistics	2	1	0	09
II Measures of Central Tendency	2	2	2	34
III Measures of Dispersion	2	1	1	19
Total Questions	**6**	**4**	**3**	**62**

B.A.IV Semester Applied Statistics
DSC1D - Statistical Inference & Exact Sampling Distributions

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Sampling Distribution	2	1	00	09
II Estimation	2	2	1	24
III Testing of Hypothesis	2	1	2	29
IV Chi-Square Distribution	3	2	1	26
V t - test and F-test	3	2	2	36
Total No of Questions	**12**	**08**	**06**	**124**

B.A.IV Semester Applied Statistics
SEC2 – Descriptive Statistics-II

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Index Numbers	2	1	1	19
II Time Series	2	1	1	19
III Correlation Regression	2	2	1	24
Total Questions	**6**	**4**	**3**	**62**

B.A.V Semester Applied Statistics

DSC1E – Theory of Sampling

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Indian Official Statistics	2	1	0	09
II Sampling Theory	3	2	1	26
III Simple Random Sampling	2	1	2	29
IV Stratified Random Sampling	2	2	2	34
V Systematic Random Sampling	3	2	1	26
Total Questions	**12**	**08**	**06**	**124**

B.A.V Semester Applied Statistics

DSE1A – Population Studies

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I National Population Census	3	2	0	16
II Census Survey	3	2	1	26
III Population Studies	2	2	2	34
IV Measurement of Mortality	2	1	1	19
V Life Tables	2	1	2	29
Total Questions	**12**	**08**	**06**	**124**

B.A.V Semester Applied Statistics

DSE1B –SQC & Econometrics

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Introduction to SQC	3	1	1	21
II Control Charts for Variables	2	1	2	29
III Control Charts for Attributes	3	2	1	26
IV Single sampling and Double Sampling	2	2	1	24
V Econometrics	2	2	1	24
Total Questions	**12**	**08**	**06**	**124**

B.A.V Semester Applied Statistics
SEC3 – Sampling Theory

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Introduction to Sampling	2	2	0	14
II Simple Random Sampling	2	1	1	19
III Stratified Random Sampling	2	1	2	29
Total Questions	**6**	**4**	**3**	**62**

B.A.VI Semester Applied Statistics

DSC1F – ANOVA & Designs of Experiment

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I One-way Classification	3	2	1	26
II Two-way Classification	3	2	1	26
III Completely Randomised Design	2	1	1	19
IV Randomised Block Design	2	2	1	24
V Latin Square Design	2	1	2	29
Total Questions	**12**	**08**	**06**	**124**

B.A.VI Semester Applied Statistics

DSE2A – Operations Research - I

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Linear Programming Problems	3	2	2	36
II Transportation Problems	3	2	1	26
III Assignment Problems	2	1	1	19
IV Game Theory	2	2	1	24
V Replacement Theory	2	1	1	19
Total Questions	**12**	**08**	**06**	**124**

B.A.VI Semester Applied Statistics

DSE2B – Operations Research - II

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Linear Programming Problems	3	2	2	36
II Sequencing	2	1	1	19
III Decision Theory	2	2	1	24
IV Inventory Theory	3	1	1	21
V PERT/CPM	2	2	1	24
Total Questions	**12**	**08**	**06**	**124**

B.A.VI Semester Applied Statistics
SEC4 – Population Studies

Unit and unit Title	Questions from each unit			Total Marks
	2 marks	5 marks	10 marks	
I Census survey	2	2	0	14
II Population Studies & Fertility	2	1	1	19
III Measurement of Mortality	2	1	2	29
Total Questions	**6**	**4**	**3**	**62**

COURSE: DSC1A (BA-I Semester)
Basic Statistics

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Introduction to Statistics and Basic Concepts:

Meaning, origin, definition, functions and limitations of Statistics, applications in other subjects. Primary and secondary data. Methods of collection of primary data with merits and demerits. Meaning of questionnaire and schedule, Source of secondary data. Classification meaning and objectives of classifications. Types of classifications. Chronological, Geographical, Qualitative and Quantitative classifications. Explanation with examples, Explanation of range, class, class limits, class intervals, width of class interval, open-end classes, inclusive and exclusive classes. Formation of discrete and continues frequency distributions.

Tabulation: Meaning and objectives and Rules of tabulation, format of a table and brief explanation of parts of table. Types of table Preparation of tables of blank table and tables with numerical information   15 Hours

Unit-II. Diagrammatic and Graphical Representation of Data:

Diagrams : Meaning, importance of diagrams and general rules of construction of diagrams. Types of Diagrams – simple, multiple, Component, percentage bar diagrams and pie diagram. Problems on the construction of diagrams. Graphs: Types of Graphs – explanation of construction histogram and examples on obtaining mode from histogram. Method of construction of frequency Polygon and frequency curve. Ogives - method of construction of Ogives and problems obtaining the value of median and quartiles from less than Ogive. Difference between diagrams and graphs.   10 Hours

Unit-III. Measures of Central Tendency:

Meaning, types and functions of measures of central tendency. Essentials of a good measure of central tendency. Arithmetic mean definition, merits and demerits. Properties of arithmetic mean. Problems on both grouped and ungrouped data. Median-definition and merits and demerits. Problems on grouped and ungrouped and data. Mode –definition and merits and demerits. Problems on grouped and ungrouped data. Median Empirical relationship between mean, median and mode. Geometric mean-definition merits and demerits.Harmonic mean mean-definition merits and demerits. Partition values-definition and types of partition values , meaning of quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only.   15 Hours

Unit-IV. Measures of Dispersion:

   Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Range –definition, absolute and relative measures formulae. Examples on ungrouped data, Merits and demerits. Quartile Deviation definition, absolute and relative measures formulae. Merits and demerits Problems on grouped and ungrouped data. Mean Deviation definition, absolute and relative formulae, merits & demerits, simple problems on grouped and ungrouped data, Standard Deviation-definition and merits and demerits, Coefficient of Variation, Simple problems on grouped and ungrouped data on standard deviation and coefficient of variation.   15 Hours

Unit-V. Skewness and Kurtosis:

Skewness- Definition, objectives and types of skewness, explanation of positive skewness and negative skewness with diagrams. Measures of skewness- Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness. Simple problems.

Kurtosis :Definition and types of kurtosis. Explanation of types of kurtosis with neat diagrams. Measure of skewness based on moments. Difference between skewness and kurtosis.   05 Hours

Books for Reference:

1. Sankhyshastra and Ganakayantra: by S. G Gani

2. Fundamentals of applied Statistics: by Gupta S C. and V K Kapoor :

3. Applied Statistics: Parimala Mukhyopadhyaya

4. Gupta S P. and V K Kapoor

5. Applied Statistics: by S.P.Gupta

6. Statistics Volume-1. by Raj Mohan

Descriptive Statistics

MAX. MARKS: 100 (SEC- 80 + IA – 20) **Credits: 3**
Teaching Hours: 60 Hours **Workload: 05 Hrs/ Week**

Unit-I. Index Numbers:

Definition, uses and limitations of index numbers. Brief description of the steps in the construction of index numbers, Classification of index numbers. Construction of Laspeyre's, Paasche's, Fishers, and Marshall – Edge worth's price and quantity index numbers. Tests of a index number-Unit test, time reversal test, factor reversal test and circular test. Verification of index numbers satisfying the time reversal and factor reversal tests. Problems on index numbers. Cost of living index numbers- meaning, uses and brief description of the steps involved in the construction of a cost of living index number. Methods of construction of cost of living index numbers-Aggregate expenditure method and Family budget method. Problems on cost of living index number. 15 Hours

Unit-II. Time Series:

Definition, uses, components of time series, brief explanation of the components of time series. Measurement of trend by graphical, semi average, moving averages method and problems on them. Method of least squares- Fitting of straight line trend –method, normal equations, obtaining trend values, estimating future trend and plotting the original and trend values on the graph. Fitting of second degree trend–Normal equations and obtaining trend line and making future estimates. 15 Hours

Unit-III. Correlation:

Definition, meaning of types of correlation-positive, negative, perfect and no correlation with examples. Utility of study of correlation analysis. Methods of studying correlation. Scatter diagram-definition and explanation with charts. Merits and demerits, problems regarding construction of scatter diagram. Karl Person's coefficient of correlation-definition, formulae, and properties of coefficient of correlation. Problems based on ungrouped data. Spearman's Rank coefficient of correlation-definition and explanation of method with merits and demerits. Problems with ties and without ties. 15 Hours

Unit-IV. Regression:

Definition of regression, regression equation of X on Y and Y on X, Properties of regression co-efficient and regression lines. Problems based on ungrouped data. Comparison between correlation and regression. 08 Hours

Unit-V. Association of Attributes:

Meaning of association of attributes, definition of class of the first order and second order. Methods of studying association. Yule's coefficient of association and its interpretation. Determination of Yule's coefficient of association in case of two attributes. 07 Hours

Reference Books :

1. Goon A.M., Gupta M.K.: Das Gupta B. (2005): Fundamentals of Statistics, Vol. I, World Press, Calcutta.

2. Mukhopadhyay.P, (2005): Applied statistics, New Central Book agency , Calcutta.

3. Gupta S.C and Kapoor V.K.: Statistical Methods-Sultan Chand & Sons Publications Delhi.

Probability and Standard Probability Distributions:

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Theory of Probability:

Introduction to probability, definition of experiment, outcomes, sample space, events, equally events, mutually exclusive events, exhaustive events, favourable events, complimentary events, independent events, dependent events, union and intersection of events with examples. Classical/mathematical, empirical/Statistical and axiomatic definitions of probability. Statements and proof of $p[\phi] = 0$, $P[S] = 1$ and $0 \leq P[A] \leq 1$. Statement and proof of addition theorem of probability for two non-mutually exclusive events and mutually exclusive events. Definition of independent and dependent events with examples. Conditional probability. Statement and proof of multiplication of theorem of probability for dependent independent events. Simple numerical problems.   15 Hours

Unit-II. Random Variable and Mathematical Expectation:

Definition with examples of discrete and continuous random variables. Definition of probability mass function and probability density function. Definition of mathematical expectation, expected mean and variance of discrete random variable. Applications to find expectation of a discrete random variable and variance. Expectation and variance of the functions-a, ax, ax+b,where a and b are constants and related examples.Statement of addition and multiplication theorem of expectation.   15 Hours

Unit-III. Binomial Distribution:

Definition of Binomial variate, Bionomical distribution and probability mass function. Properties of Bionomical distribution. Examples of Occurrence of Binomial distributions, expression for mean and variance of Binomial distribution. Given the mean and variance, finding the parameters. Fitting of Binomial distribution and obtaining expected probabilities. Simple problems.   10 Hours

Unit- IV. Poisson Distribution:

Definition of Poisson variate, Poisson distribution and probability mass function. Examples of occurrence of Poisson Distribution. Properties of Poisson distribution. Expression for mean and variance of Poisson distribution. Computing probabilities for large n and small p for the given λ, finding λ for given two successive probabilities. Conditions for Poisson distribution as limiting form of Binomial distribution.
                    10 Hours

Unit-V. Normal Distribution:

Definition of normal variate, normal distribution, examples of occurrence of normal distribution, properties of normal distribution and importance of normal distribution, Definition of standard normal variate, standard normal distribution and properties of standard normal distribution. Statement of conditions under which binomial distribution tend to normal distribution. Finding probabilities and expected numbers when mean and variance are given quartile deviation, mean deviation and standard deviation and problems.
                    10 Hours

Reference and Text Books:

1. S.G. Gani - A New Introductory Statistics Vol-II
2. S.C. Gupta and V.K.Kapoor - Fundamental of Mathematical Statistics.
3. S.C. Gupta - Fundamentals of Statistics.
4. S.P. Gupta - S atistical Methods.
5. D.C. Sanchethi and V.K.Kapoor - Statistics.
6. R.H. Dhareshwar & Sangeetashetti- Business Statistics

COURSE: SEC1 (BA–III Semester)

Descriptive Statistics-I

MAX. MARKS: 50 (SEC- 40 + IA – 10)   **Credits: 3**
Teaching Hours: 30 Hours   **Workload: 02 Hrs/ Week**

Unit-I. Introduction:

Meaning, origin, definition, functions and limitations, scope of Statistics. Basics Concept of statistics, Primary and secondary data. Presentation – classification meaning , objectives, types. Construction of frequency distribution,. Tabulation - meaning , objectives, types, format of table, parts of table. Procedure for construction of blank tables with examples. Diagrammatic and Graphical representation data: Meaning, types of diagrams - simple, multiple, subdivided, percentage and pie-diagram. Graphs– Construction Histogram examples on obtaining mode, construction of frequency polygon, frequency curve, ogive curves, construction, obtaining median with simple examples.   15Hours

Unit-II. Measures of Central Tendency:

Meaning, definition, essentials of a good measure of central tendency. A.M, Median and Mode. Merits and demerits, problems on grouped and un-grouped data. Partitioned values - quartiles, deciles and percentiles.   07Hours

Unit-III. Measures of Dispersion:

Meaning and objectives of measures, essential of good measure of dispersion absolute and relative measure - range, quartile deviation, mean deviation, standard deviation problems on grouped and un-grouped data. coefficient of variation, problems on grouped and un-grouped data on standard deviation and coefficient of variation.   08 Hours

Books for Reference:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Gupta S.C and Kapoor V.K.: Fundamentals of Mathematical Statistics- Sultan Chand & Sons publications.

Inference and Exact Sampling Distributions

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Sampling distribution:

Definition of population, parameter, sample, statistic, sampling distribution of a statistic along with examples. Definition of standard error. Standard error. Standard error of mean, standard deviation, proportion, difference of means and difference of proportions. Uses of standard error and simple problems.   05 Hours

Unit-II. Estimation:

Explanation of the terms – estimation, point estimation and interval estimation. Meaning of confidence interval, confidence limits and confidence co-efficient with examples. Construction of 95% and 99% confidence interval for mean, difference of means, proportion and difference of proportions for large samples only .Numerical problems on the construction of 95% and 99% confidence limits for mean , difference mean, proportion and difference of proportions.   15 Hours

Unit-III. Testing of Hypothesis:

Explanation of terms – Statistical hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, critical region, size of the test , power of the test with examples. Definition of type–I and type–II errors. Large sample tests- Test of significance of population mean, test of significance of equality of means of two populations, test of significance of two population proportion and test of significance of equality proportion of two populations.

        15 Hours

Unit-IV. Chi-Square Distribution.

Introduction to Chi-square distribution, definition of Chi-square variate. Properties of chi-square distribution. Applications of chi-square distribution. Chi-square test of goodness of fit. Problems on Chi-square test of Goodness of fit. Chi-square test of independence of attributes. Problems on Chi-square test of independence attributes.   10 Hours

Unit-V. *t* **- test and F-test.**

Definition of t-statistic, assumptions of t-test, properties of t-distribution and applications of t-test. Study of t-test for testing population mean, equality of means and paired t-test and their applications.

Definition of F-statistic, assumptions of F-test and properties of F-distribution. F-test for equality of variances and its applications.   15 Hours

Books for Reference:
1. Sankhyshastra and Ganakayantra: by S.G. Gani
2. Fundamentals of Applied Statistics –by Gupta S C. and V K Kapoor
3. Applied Statistics- by Parimala Mukhyopadhyaya
4. Applied Statistics- by Gupta S P. and V K Kapoor
5. Statistical Methods-by S.P.Gupta
6. Statistics Volume-1 by Raj Mohan

Descriptive Statistics-II

MAX. MARKS: 50 (SEC- 40 + IA – 10)   **Credits: 3**
Teaching Hours: 30 Hours   **Workload: 02 Hrs/ Week**

Unit-I. Index Numbers:

Meaning and definition, Uses ,Limitations, Brief description of the steps in the construction of index number types- Price, quantity and Value index. Un-weighted and weighted prices and quantities. Cost of living index numbers, Uses and brief description of the steps involved in the construction of cost of living index number-Aggregate expenditure method and Family budget method. Problems on cost of living index numbers.   8 Hours

Unit–II. Time Series :

Meaning and definition of time series, uses , components of time series. brief explanation of the components Measurement of Time series – Graphical method. semi- averages method, method of moving averages (3,4 and 5 yearly),methods of least square(Linear) simple problems.   8 Hours

Unit-III.   Correlation & Regression:

Correlation: Meaning and Definition simple correlation, types- positive, negative and Zero correlation. Methods of measurement- scatter diagram, Karl Pearson's correlation coefficient, Spearman's Rank correlation coefficient, Properties, coefficient of correlation co-efficient. numerical problems.

Regression: Meaning, definition, regression equations. Regression co-efficient, properties of regression lines and regression co-efficient and numerical problems. Comparison between correlation and regression.   14 Hours

Books for Reference:
1. Sankhyshastra and Ganakayantra: by S.G. Gani
2. Fundamentals of Applied Statistics –by Gupta S C. and V K Kapoor
3. Applied Statistics- by Parimala Mukhyopadhyaya
4. Applied Statistics- by Gupta S P. and V K Kapoor
5. Statistical Methods-by S.P.Gupta
6. Statistics Volume-1 by Raj Mohan

Theory of Sampling

MAX. MARKS: 100 (SEC-80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Indian Official Statistics:

Statistical organization at the Centre, National Sample Survey–historical background and functions. Central Statistical Organization–introduction, functions and publications of CSO.

5 Hours

Unit-II. Sampling Theory:

Meaning of population, population size, finite population, infinite population, sample, sample size, sampling, sampling technique, sampling unit, sampling frame, census and sample survey, advantages of sampling. Examples of sampling. Types of errors in sample survey-Sampling errors and non-sampling errors- non response errors, response errors and tabulation errors. Advantages of sampling over complete census. Limitation of sampling. Planning of sample survey and its execution.   10 Hours

Unit-III. Simple Random Sampling:

Methods of sampling. Meaning of random sampling. Definition of simple random sampling and formulae for estimating population mean, total and variance. Methods of obtaining simple random sample-Lottery method and Random numbers table method. Merits demerits of methods. Simple problems on simple random sampling method.   15 Hours

Unit-IV. Stratified Random Sampling:

Definition of strata, stratification, and stratified random sampling. Formulae for estimating population mean, total and variance. Methods of allocation and sample size in difference strata-Equal allocation, Proportional allocation and Optimal allocation. Determination of Bowley's formulae for proportional allocation and Neyman's formula for optimal allocation. Advantages and disadvantages of stratified random sampling method. Simple problems on stratified random sampling method, Proportional and Optimal allocation.   15 Hours

UNIT-V. Systematic Random Sampling:

Definition of systematic random sampling. Explanation of methods of obtaining systematic random sample. Examples of systematic random sample. Formulae for estimating population mean, total and variance. Situations of applications of systematic random sampling method. Merits and demerits of systematic random sampling method. Simple problems on systematic random sampling method.   15 Hours

Books for Reference:

1. Sankhyshastra and Ganakayantra: by S.G. Gani

2. Fundamentals of applied Statistics: by Gupta S.C. and V.K. Kapoor

3. Applied Statistics: by Parimala Mukhyopadhyaya

4. Statistics Volume-I: by Raj Mohan

Population Studies

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**

Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. National Population Census:

Definition of National Population census, official system in India for census enumeration. Reference point of time. Methods of collecting census data - Household method, Canvasser method and Mailed questionnaire method, their merits & demerits. Framing of census questionnaire.   10 Hours

Unit-II. Census Survey:

Methods of conducting census survey. De-facto method and D-jure method, their merits and demerits. Distinction between D-facto and D-jure methods of conducting census. Functions and aims of census. Changes introduced in the house schedule of 2010 and 2011 census.

10 Hours

Unit-III. Population Studies and Fertility Measures:

Meaning of population studies. Definition of vital events and vital Statistics. Sources of vital Statistics- Census enquiry, Registration method, Sample survey, Hospital records and Research and analysis. Uses of Vital Statistics. Merits and demerits. Fertility measure- Definition of fertility and fecundity. Population growth rates- CBR, GFR, ASFR and TFR- definition, merits and demerits , computation and interpretation. Growth Rate – Gross Reproduction Rate and Net Reproduction Rate – definition, merits and demerits, computation and interpretation, difference between GRR and NRR.   15 Hours

Unit-IV. Measurement of Mortality:

Mortality rates – CDR, ASDR, STDR- Definition, merits and demerits , Computation and interpretation, Infant mortality rate (IMR), Neo-Natal morality rate (NNMR) and maternal mortality rate (MMR) – meaning and simple problems.   10 Hours

Unit-V. Life Tables: Life Tables: Definition and uses, components of life table- Explanation of the columns of life table. Abridged life table- King's method.   15 Hours

Books for Reference:

1. Sankhyshastra and Ganakayantra- by S. G Gani

2. Fundamentals of Applied Statistics- by Gupta S C. and V K Kapoor

3. Applied Statistics – by Parimala Mukhyopadhyaya

4. Applied Statistics- by Gupta S P. and V K Kapoor

5. Statistical Methods – by S.P.Gupta

6. Statistics Volume-1 by Raj Mohan

SQC & ECONOMETRICS

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**

Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

UNIT- I: Introduction: Quality assurance and management, Quality pioneers, Quality costs. Aims &objectives of statistical process control. Chance & assignable causes of variation. Statistical Quality Control, importance of Statistical Quality Control in industry.   10 Hours

UNIT-II: Control charts for variables: Theoretical basis and practical background of control charts for variables. 3 -sigma limits, Warning limits & probability limits. Criteria for detecting lack of control. Derivation of limits and construction of a Mean (x) and R-charts and interpretation. Natural limits &specification limits. .   15 Hours

UNIT-III: Control charts for attributes: np-chart, p-chart c-chart and u-chart.- Construction and examples.   15 Hours

UNIT-IV: Single Sampling & Double Sampling Plans: 10 Hours

UNIT-V: Econometrics: Definition and scope of econometrics. Relationship between variables, the simple linear regression model.   10 Hours

Books for Reference:

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.

2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.

3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,

4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

5. Applied Statistics by S.C. Gupta & V.K.Kapoor

Sampling Theory

MAX. MARKS: 50 (SEC- 40 + IA – 10)   **Credits: 3**
Teaching Hours: 30 Hours   **Workload: 02 Hrs/ Week**

Unit-I. Introduction:

Meaning of population, population size, finite population, infinite population, sample, sample size, sampling, sampling technique, sampling unit, sampling frame, census and sample survey, advantages of sampling. Examples of sampling. Types of errors in sample survey-Sampling errors and non-sampling errors- non response errors, response errors and tabulation errors. Advantages of sampling over complete census. Limitation of sampling. Planning of sample survey and its execution.   10 Hours

Unit-II. Simple Random Sampling:

Methods of sampling. Meaning of random sampling. Definition of simple random sampling and formulae for estimating population mean, total and variance. Methods of obtaining simple random sample-Lottery method and Random numbers table method. Merits demerits of methods. Simple problems on simple random sampling method.   10 Hours

Unit-III. Stratified Random Sampling:

Definition of strata, stratification, and stratified random sampling. Formulae for estimating population mean, total and variance. Methods of allocation and sample size in difference strata-Equal allocation, Proportional allocation and Optimal allocation. Determination of Bowley's formulae for proportional allocation and Neyman's formula for optimal allocation. Advantages and disadvantages of stratified random sampling method. Simple problems on stratified random sampling method, Proportional and Optimal allocation.   10 Hours

Books for Reference:

1. Sankhyshastra and Ganakayantra: by S.G. Gani

2. Fundamentals of applied Statistics: by Gupta S.C. and V.K. Kapoor

3. Applied Statistics: by Parimala Mukhyopadhyaya

4. Statistics Volume-I: by Raj Mohan

Analysis of Variance and Design of Experiment

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Analysis of Variance: One-Way Classification:

Definition of analysis of variance and basic assumptions of it. Meaning of assignable and chance variations. ANOVA for one-way classified data-definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various components, degrees of freedom and ANOVA table. Simple numerical problems one-way classified data.   10 Hours

Unit-II. Two-Way Classification:

Analysis of variance for two way classification – definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various components. Degrees of freedom and ANOVA table. Simple numerical problems on two way classified data.   10 Hours

Unit-III. Completely Randomized Design:

Definition of terms - Experiment, treatment, experimental unit, experimental material, yield, block, precision, experimental error, uniformity trails, and efficiency. Basic principles of design of experiments - Replication Randomization and Local control. Completely Randomized Design-definition, layout, linear mathematical model, assumptions, hypothesis, splitting up of sum of squares into various components, degrees of freedom and ANOVA table. Merits and demerits and applications of CRD. Simple numerical problems.
          10 Hours

Unit-IV. Randomized Block Design:

Definition of RBD, layout, linear mathematical model, assumptions, statistical hypothesis, splitting up of total sum of squares into various components, degree of freedom, and ANOVA table. Merits and demerits of RBD. Applications of RBD. Comparative study of CRD and RBD. Simple problems.   15 Hours

Unit-V. Latin Square Design:

Definition of LSD, layout of LSD, linear mathematical model, Assumptions, Statistical hypothesis, splitting up of total sum of squares into various components, degree of freedom and ANOVA table., merits and demerits of LSD, applications of LSD, Comparative study of RBD and LSD. Simple problems.   15 Hours

Books for Reference:

1. Sankhyshastra and Ganakayantra- by S. G Gani

2. Fundamentals of Aapplied Statistics- by Gupta S C. and V K Kapoor

3. Applied Statistics – by Parimala Mukhyopadhyaya

4. Applied Statistics- by Gupta S P. and V K Kapoor

5. Statistical Methods – by S.P.Gupta

6. Statistics Volume-1 by Raj Mohan

Operations Research-I

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Linear Programming Problem:

Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Explanation of terms- Objective function, feasible solution and Optimal solution. Mathematical formulation of linear programming problem in case of two variables with examples. Graphical method of solving LPP and merits and demerits. Simple numerical problems.   15 Hours

Unit-II. Transportation Problem:

Definition of transportation problem, feasible solution, basic feasible solution , degenerate solution, non-degenerate solution and optimal solution. Methods of finding basic feasible solution-North West Corner Rule, Vogel's approximation method (Unit cost penalty method) and Matrix Minima method (lowest cost entry method) simple problems.   15 Hours

Unit-III. Assignment Problem:

Definition of Assignment problem, procedure of solving assignment problem. Simple numerical problems on assignment.   10 Hours

Unit-IV. Game Theory:

Meaning of a competitive game. Explanation of a n-person game, a two-person game, a two-person zero-sum game, strategy, pure and mixed strategies, pay off matrix, meaning of maximin and minimax, and saddle point. Solving rectangular game with maximin-minimax principle and dominance principle.   10 Hours

Unit-V. Replacement Theory:

Meaning, need for replacement, the principle of replacement in case of items that deteriorate with age (discrete case) without considering the change in money value. The formula for finding the average annual cost and problems relating to it.   10 Hours

Books for Study:
1. Kantiswaroop,Man Mohan and P.K Gupta (2003):Operations Research-Sultan Chand & co .
2. S.Kalavathy. Operations Research, Vikas Publishing House.
3. Sharma J.K: Operations Research - Theory and Applications, Mc Millan India Ltd., New Delhi
4. Anand Sharma: Quantitative techniques, Himalaya Publishing House.
5. Kapoor V.K: Operations Research- Sultan Chand & Co.
6. Vohra N.D. Quantitative Techniques in Management. Mc Graw Hill Education Pub's

Operations Research-II

MAX. MARKS: 100 (SEC- 80 + IA – 20)   **Credits: 3**
Teaching Hours: 60 Hours   **Workload: 05 Hrs/ Week**

Unit-I. Linear Programming Problem:

Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Explanation of terms- Objective function, feasible solution and Optimal solution. Mathematical formulation of linear programming problem in case of two variables with examples. Graphical method of solving LPP and merits and demerits. Simple numerical problems.   15 Hours

Unit-II. Sequencing Problems: Introduction, Terminology and notations. Principle assumptions. Solution of sequencing problems. Processing of n jobs through 2 machines. Processing n jobs through 3 machines.   10 Hours

Unit-III. Decision Theory: Introduction, basic terminology, steps in decision making. Decision making environment - Decision under conditions of uncertainty – maximax criterion, maximin criterion, Laplace criterion, Regret criterion and Hurwicz criterion. Decisions making under conditions of risk – EMV, EVPI and EOL. Decision tree analysis.

15 Hours

Unit-IV. Inventory Theory: Description of Inventory system. Inventory costs. Demand, lead time. EOQ model without shortages – Purchasing model with uniform demand and with finite replenishment rate. Examples based on these models.   10 Hours

Unit-V. PERT-CPM: Introduction, Historical development of PERT/CPM techniques. Basic steps in PERT/CPM techniques. Network diagram representation. Rules for drawing network diagram. Labelling: Fulkerson's I-J rule. Time estimation and Critical path in network analysis. Project evaluation and Review techniques (PERT). Uses of PERT and CPM for management.   10 Hours.

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Books for Study:
1. Kantiswaroop,ManMohan and P.K Gupta (2003):Operations Research-Sultan Chand & co .
2. S.Kalavathy. Operations Research, Vikas Publishing House.
3. Sharma J.K: Operations Research - Theory and Applications, Mc Millan India Ltd., New Delhi
4. Anand Sharma: Quantitative techniques, Himalaya Publishing House.
5. Kapoor V.K: Operations Research- Sultan Chand & Co.
6. Vohra N.D. Quantitative Techniques in Management. Mc Graw Hill Education Pub's

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Statistical Data Analysis

MAX. MARKS: 50 (SEC- 40 + IA –10)   **Credits: 3**
Teaching Hours: 30 Hours   **Workload: 02 Hrs/ Week**

Unit-I. Introduction:

Meaning, objectives and motivation in research. Types of research, research approach, and significance of research. Research problems: Definition, selection and necessity of research problems, techniques in defining a research problem.   10 Hours

Unit-II. Survey Methodology and Data Collection

Introduction, inference and error in surveys, target population, sampling frames and coverage error. Methods of data collection, non response, questions and answers in surveys.

10 Hours

Unit-III. Statistical Analysis and Report Writing

Measures of Central Tendency and average. Measures of Dispersion, Skewness and Kurtosis.

Layout of research report and characteristics of a good research report.   10 Hours

Books for Reference:

1. Research Methodology Methods and Techniques: Kothari C.R. (2004)- New age International (P) Ltd, Publishers.