



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಲ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-01/BOS /Statistics (UG) /20-21/ ೨೩೮

Date:
16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Statistics UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

- Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 01, dt. 24.07.2020.
3. Special Faculty Res. No. 13, dt. 11.08.2020.
4. Special Academic Council Res. No. 34, dt. 21.08.2020.
5. Vice-Chancellor's order dated - 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Statistics UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

Haud: 15/10/2020
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Statistics (UG), Dept. of Statistics, K.U.Dharwad.
2. The Chairman, Dept. of Statistics, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fives to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analyst, Computer Unit Exam Section, K.U.Dharwad.



KARNATAK UNIVERSITY, DHARWAD

B.Sc. Programme

**SYLLABUS FOR
STATISTICS
(OPTIONAL)**

**AS DISCIPLINE SPECIFIC COURSE (DSC),
DISCIPLINE SPECIFIC ELECTIVE (DSE) and
SKILL ENHANCEMENT COURSE (SEC)
UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)**

Effective from 2020-21

KARNATAK UNIVERSITY, DHARWAD

DEPARTMENT OF STATISTICS

**CBCS syllabus for Under Graduate Programme
in Statistics (optional) as
DISCIPLINE SPECIFIC COURSE (DSC)**

Effective from 2020-21

Regulations and Scheme of Instructions:

Regulations for governing three years semester CBCS syllabus for Under Graduate Programme of Karnatak University Dharwad in B. Sc. Statistics optional subject with effect from academic year 2020-2021 and onwards.

I. Goals and Objectives:

The following aims have been kept in view while designing the CBCS syllabus for Under Graduate Programme in B. Sc. Statistics optional subject.

1. Students will be able to understand basic theoretical and applied principles of statistics needed to enter the job force.
2. Students will gain proficiency in using statistical software for data analysis needed to enter the job force in software industry.
3. Students will be able to communicate key statistical concepts to non-statisticians.
4. To train promising learners to teach Statistics effectively at various level in the educational institutions.
5. To provide adequate Statistical knowledge and skills as required for the competitive examination.

II. Eligibility and Admission Criteria

1. The students who have taken Mathematics at Pre-University level or at 12th standard under CBSE syllabi or at an equivalent course with mathematics as one of the subjects are eligible to offer this course.
2. Those who offer this optional Statistics course at B.Sc. CBCS must take Mathematics as one of the optional paper.
3. The other rules for admission are as per the Government and University notifications from time to time.

III. Medium of Instruction: The medium of instruction will be in English.

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

V. Scheme of instruction: The M.A/M.Sc./M. Stat. Master degree holders in Statistics can only teach Statistics optional subject at UG level.

VI. GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL DSC and DSE

1. Question number 1-12 carries 2 marks to answer any 10 questions : 20 marks
2. Question number 13-20 carries 5 marks to answer any 6 questions : 30 marks
3. Question number 21-26 carries 10 marks, candidate has the following choice
 - a. Question number 21 or Question number 22 :10 marks
 - b. Question number 23 or Question number 24 :10 marks
 - c. Question number 25 or Question number 26 :10 marks

Sub total : 30 marks

Total semester end examination marks : 80 marks

Internal examination and assignment marks : 20 marks

Total course paper marks :100 marks

VII. GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL SEC

1. Question number 1-6 carries 2 marks to answer any 5 questions : 10 marks
2. Question number 7-12 carries 5 marks to answer any 4 questions : 20 marks
3. Question number 13-14 carries 10 marks to answer any 1 questions : 10 marks

Total semester end examination marks : 40 marks

Internal examination and assignment marks : 10 marks

Total course paper marks :50 marks

VIII. General Instructions and Pattern for Practical Paper for All DSC, DSE and SEC

1. The practical paper carries 30 marks. The journal carries 5 marks and viva-voce 5 marks. The practical examination is of 3 hours duration.
 2. Journal marks will not be carried forward for subsequent examinations.
 3. Students must complete all the practical exercises to the satisfaction of the teacher concerned.
 4. Students must produce at the time of practical examination, the journal along with the completion certificate signed by concerned teacher and the Head of the Department.
 5. Pattern for Practical Paper:
 - a. Question number 1-4 carries 10 marks to answer any 3 questions : 30 marks
 - b. Submission of Certified Journal : 05 marks
 - c. viva-voce : 05 marks
 - d. Internal examination marks : 10 marks
- Total course paper marks :50 marks

B.Sc. (General) Programme structure under CBCS

Semester	*Core			Elective			Ability Enhancement Course						Total Credits
	DSC			**DSE			***SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	4+0+4	4+2=6							English-1	2+1+0	2+1=3	26
	DSC-2A	4+0+4	4+2=6							MIL-1	2+1+0	2+1=3	
	DSC-3A	4+0+4	4+2=6							ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	4+0+4	4+2=6							English-2	2+1+0	2+1=3	26
	DSC-2B	4+0+4	4+2=6							MIL-2	2+1+0	2+1=3	
	DSC-3B	4+0+4	4+2=6							CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	4+0+4	4+2=6							English-3	2+1+0	2+1=3	24
	DSC-2C	4+0+4	4+2=6							MIL-3	2+1+0	2+1=3	
	DSC-3C	4+0+4	4+2=6										
IV	DSC-1D	4+0+4	4+2=6							English-4	2+1=0	2+1=3	24
	DSC-2D	4+0+4	4+2=6							MIL-4	2+1=0	2+1=3	
	DSC-3D	4+0+4	4+2=6										
V				DSE-1E	4+0+4	4+2=6	SEC-1E	2+0+0	2				24
				DSE-2E	4+0+4	4+2=6	SEC-2E	2+0+0	2				
				DSE-3E	4+0+4	4+2=6	SEC-3E	2+0+0	2				
VI				DSE-1F	4+0+4	4+2=6	SEC-1F	2+0+0	2				24
				DSE-2F	4+0+4	4+2=6	SEC-2F	2+0+0	2				
				DSE-3F	4+0+4	4+2=6	SEC-3F	2+0+0	2				
TOTAL			72			36			12			28	148

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week (no tutorial for practical subject).

* If the core course is Mathematics, there shall be two papers of 75 marks each. Then L+T+P = (2x3)+(2x1)+0, but credit shall be 6 only.

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

*** SEC 1,2 & 3 shall be from all three DSC and student shall choose any three in each semester, but not more than two from same DSE (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks(40 Sem. End exam +10 IA Exam).

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/ Constitution of India / SEC shall have 30 hrs syllabus / semester for 50 marks in theory/ Practical (40 Sem. End exams +10 IA Exam).

Karnatak University, Dharwad
CBCS syllabus for Under Graduate Programme in Statistics (opt.) as **DISCIPLINE SPECIFIC COURSE (DSC)**
Effective from 2020-21
Part A Structure: DSC

Sem ester	Theory/ Practical	Subject Code	Title of the Paper	Instruction hour per week	Total Syllabus Hrs/ Sem	Duration of Exam.	Internal Assess- ment Marks	Sem final Exam. Marks	Total Marks	Credits
I	Theory	DSC (STT: A)	Descriptive Statistics and Elements of Probability	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (STPr: A)	Practicals based on theory using Excel and R-programming	04 hrs	52	03 hrs	10	40	50	02
II	Theory	DSC (STT: B)	Mathematical Expectation, Theoretical Distributions and Order Statistics	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (STPr: B)	Practicals based on theory using R-programming	04 hrs	52	03 hrs	10	40	50	02
III	Theory	DSC (STT: C)	Theory of Sampling and Estimation	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (STPr: C)	Practicals based on theory using R-programming	04 hrs	52	03 hrs	10	40	50	02
IV	Theory	DSC (STT: D)	Exact Sampling Distributions and Testing of Statistical Hypothesis	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (STPr: D)	Practicals based on theory using R-programming	04 hrs	52	03 hrs	10	40	50	02
Total of DSC				32 hrs	448		120	480	600	24

Part B Structure: DSE

Sem ester	Theory/ Practical	Subject Code	Title of the Paper	Instruction hour per week	Total Syllabus Hrs/ Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
V	*Theory P-I /P- II	DSE (STT:P-I E)	Design of experiment and Demography	04 hrs	60/60	03 hrs	20	80	100	04
		DSE (STT:P-II E)	Operations Research							
	*Practical P-I /P- II	DSE (STPr:P-I E)	Practicals based on STT:P-I E theory using R-programming	04 hrs	52/52	03 hrs	10	40	50	02
		DSE (STPr:P-II E)	Practicals based on STT:P-II E theory using R-programming and other OR software's							
VI	*Theory P-I /P- II	DSE (STT:P-I F)	Statistical Quality Management, Reliability and Simulation	04 hrs	60/60	03 hrs	20	80	100	04
		DSE (STT:P-II F)	Economic Statistics and Econometrics							
	*Practical P-I /P- II	DSE (STPr:P-I F)	Practicals based on STT:P-I F theory using R-programming	04 hrs	52/52	03 hrs	10	40	50	02
		DSE (STPr:P-II F)	Practicals based on STT:P-II F theory using R-programming							
Total of DSE				16 hrs	224	12 hrs	60	240	300	12

*Candidate shall choose either paper –I or P-II but not both in DSE theory and practical.

Part C Structure: SKILL ENHANCEMENT COURSE (SEC) for Statistics opted as DSC

Semester	Theory/ Practical	Subject Code	Title of Paper	Instruction hour per week	Total Syllabus Hrs/ Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
V	Theory and Practical	(SEC-ST-1E)	Data Analysis with SPSS	04 hrs practical	52	3 hrs	10	40	50	02
V	Theory and Practical	(SEC-ST-2E)	Data Science with R-programming	04 hrs practical	52	3 hrs	10	40	50	02
V	Theory and Practical	(SEC-ST-3E)	Indian Official Statistics	02 hrs theory	30	1.5 hrs	10	40	50	02
VI	Theory and Practical	(SEC-ST-1F)	Simulation	04 hrs practical	52	3 hrs	10	40	50	02
VI	Theory	(SEC-ST-2F)	Data Science with Python	04 hrs practical	52	1.5 hrs	10	40	50	02
VI	Theory and Practical	(SEC-ST-3F)	Statistical Techniques for Research	02 hrs theory	30	3 hrs	10	40	50	02
Total for SEC				22 hrs	268 hrs		60	240	300	12

Overall Credits for Statistics opted as DSC

Semester	Details of Structure	Total Marks	Total Credits
Semester I to semester IV	Part A	600	24
Semester V and VI	Part B	300	12
Semester V and VI	Part C	300	12
Course Total		1200	48

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester – I

STATISTICS : STT:A

Descriptive Statistics and Elements of Probability

Unit I: Basics: Introduction, meaning, definition, functions, limitations, applications of statistics, variable, attribute, types of variables, types of data: Quantitative data and Qualitative data, cross-sectional and time series, discrete and continuous. Scales of measurement: nominal, ordinal, interval, ratio. Describing data with tables: formation of a uni-variate and bi-variate frequency distribution, marginal and conditional distributions, relative frequency distributions, cumulative frequency distributions. Describing data with graphs: Graphical presentation of a frequency distribution- Histogram, Frequency polygon, frequency curve and ogives.

(10 hours)

Unit II: Uni-Variate data Analysis: Describing data with averages: Measures of central tendency – Arithmetic mean, Geometric mean, Harmonic mean, Median & Mode. Definition, formulae, properties, merits and demerits. Describing positions: Measures of partition values – Quartiles, Deciles & Percentiles, definition, formulae. Describing Variability: Measures of dispersion – Absolute & relative measures, Range, Quartile Deviation, Mean Deviation and Standard Deviation, definition, formulae, properties, merits and demerits. Describing shape: Measures of Skewness: Meaning, need, types of skewness, absolute and relative measures, properties, Measures of Kurtosis: Need, types of kurtosis, measurement of kurtosis, properties, standard theoretical examples.(20 hours)

Unit III: Bi-Variate data Analysis: Describing Relationship: Correlation and Regression: Correlation: Definition, Types of correlation, Methods of measuring correlation, Scatter diagram, Correlation Coefficient for quantitative data: Prof. Karl Pearson's coefficient of linear correlation, its properties, Correlation Coefficient for qualitative data: Spearman's rank correlation coefficient, its properties, Simple regression analysis- regression equations by method of least squares, linear regression coefficients and its properties. Angle between the regression lines. (8 hours)

Unit IV: Multivariate data Analysis: Introduction: Yule's notations, distribution of two variables, distribution of three or more variables, primary and secondary subscripts, Plane of regression and its derivation, estimation of regression coefficients a and b in case of three variables, partial regression

coefficient in terms of delta, Residual, properties of residuals, Standard deviation of residuals, Multiple and partial correlation, definition, derivation and their standard properties. (10 hours)

Unit V: Elements of Probability: Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, definition of probability: Classical, Statistical and Axiomatic, Addition, Multiplication and Conditional probability theorems with proofs, theoretical examples, with replacement and without replacement selection, Independent and dependent events, Bayes' theorem and its applications. (12 hours)

STATISTICS LAB: STPr:A

Descriptive Statistics and Elements of Probability

Practicals based on theory using Excel and R-programming

The first 3 practicals are to become skilled at R-programming and R packages. Practical 4 to 13 has to be first solved manually then results should be verified using Excel and R-programming.

1. Demonstration of Installation of R-programming language, command line environment, overview of capabilities, brief mention of open source philosophy, of R Data Types and Variables in R, Operators in R, Loading data from a file: read.table () and read.csv (), writing data to a file.
2. Demonstration of Conditional Statements in R, Loops in R, R script, Functions in R and R packages.
3. Demonstration of Graphics in R: use of built-in functions Plot(), lines(), abline(), etc. Practice for drawing Barplot, Pie chart and Histogram. Box plot. Scatter plot.
4. Formation of a frequency distribution uni-variate frequency distributions, cumulative frequency distributions and bi-variate frequency distributions.
5. Graphical presentation of a frequency distribution.
6. Measures of Central Tendency- Mean and its properties, Weighted mean, Median, Mode, Geometric mean and Harmonic mean.
7. Partition values
8. Measures of Dispersion – Range, coefficient of range, Quartile deviation, coefficient of QD, Mean Deviation, coefficient of MD, Standard Deviation, Coefficient of Variation.

9. Correlation-Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.
10. Simple Regression.
11. Plane of Regression, Multiple and Partial Correlation.
12. Problems on probability.
13. Problems on Bayes' theorem

Books for Study:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Kalyan Kumar Mukherjee: Probability and Statistics, New Central Book Agency (P) Ltd., Calcutta.
3. Bansilal & Arora, S.R.: Mathematics of Probability & Statistics, R. Chand & Co., New Delhi.
4. Chatterji, P.N.: Mathematical Statistics, Rajhans Prakashana Mandir, Educational Publishers, Meerut.
5. Ray & Sharma: Mathematical Statistics, Ram Prasad & Sons, Agra.
6. Dr. Goel, B.S., Prof. Satyaprakash and Dr. Roshan Lal: Mathematical Statistics, Pragati Prakashana, Meerut.

Books for reference:

7. Robert V. Hogg and Allen T. Craig: Introduction to Mathematical Statistics (Fifth Edition), Pearson Education Inc, New Delhi.
8. Goon, A.M., Gupta, M.K. and Dasgupta, B.: Fundamentals of Statistics Volume I and II. The World Press Private Limited, Calcutta.
9. Mathai, A.M.: Introduction to Statistical Methods, MacMillan Company Ltd.,
10. Lindgren: Introduction to Probability & Statistics, MacMillan Publishers.
11. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi.
12. Parzen: Modern Probability Theory & its Applications, Wiley Eastern.
13. A.M. Mood and Graybill: Introduction to the theory of Statistics.

14. Goon A.M., Gupta M.K. and Dasgupta B. : Basic Statistics.

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester – II

STATISTICS : STT:B

Mathematical Expectation, Theoretical Distributions and Order Statistics

Unit I: Random Variable and Mathematical Expectation: Definition of a random variable, discrete & continuous, probability mass function, probability density function, distribution function and its properties, Marginal and conditional distributions, joint probability functions, independence of random variables, Transformation of Random Variables and Jacobian of transformation with illustrations, Mathematical expectation of a random variable, Addition theorem and Multiplication theorem on mathematical expectations. (10 hours)

Unit II : Generating functions and their applications: Moments - raw and central moments and their interrelationships and properties, Moment generating functions, cumulant generating functions, probability generating functions and their applications, theorems associated with MGF, Chebyshev's inequality and its applications, Weak Law of Large Numbers. (10 hours)

Unit III: Standard discrete distributions: Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hyper geometric distributions, definition, mean, variance, moments, moment generating functions, recurrence relation for probabilities and moments for binomial, Poisson, and Negative binomial distributions, additive property, Cumulant generating function, theoretical examples. (15 Hours)

Unit IV: Standard Uni-variate continuous distributions: Rectangular, Beta, Gamma, and Exponential distributions, definitions through p.d.f's, Mean, variance, moments, recurrence relations, Additive property of exponential and gamma variates, Normal distribution and its properties, Cauchy distribution, Uni-variate and Bi-variate transformation of variables of discrete and continuous random variables. (20 Hours)

Unit V: Order statistics: Definition of ordered statistic and their distributions, Derivation of first order statistic, highest order statistic, r^{th} order statistics, joint distribution of order statistics and their derivations, simple examples to obtain the distributions of order statistics. (05 Hours)

STATISTICS LAB : STPr: B

Mathematical Expectation, Theoretical Distributions and order Statistics

Practicals based on theory using R-programming

The first 2 practicals are to become skilled at R-programming and R packages. Practical 3 to 13 have to be first solved manually then results should be verified using R-programming.

1. Demonstration of R functions to compute probabilities, cumulative probabilities, etc., for standard distributions.
2. Demonstration of MASS R package fitting standard distributions and use of the fitdistrplus R package for the same.
3. Bivariate Probability Distributions, Marginal & Conditional distributions, Conditional Mean, Conditional Variance, Correlation.
4. Transformation of discrete random variables.
5. Transformation of continuous random variables.
6. Problems on Mathematical Expectation.
7. Problems on Moments.
8. Application problems based on Standard Discrete Distributions-Binomial, Poisson, Negative Binomial.
9. Application problems based on Discrete Distributions-Geometric, Hyper-Geometric.
10. Fitting Standard Discrete Distributions: Binomial, Poisson, Geometric and Negative Binomial.
11. Application problems based on Standard continuous distributions.
12. To find the ordinate for a given area for normal distribution and Problems based on area property of normal distribution and Application problems based on Normal Distribution.
13. Fitting of Standard Continuous Distributions distribution.

Books for Study and Reference:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Kalyan Kumar Mukherjee: Probability and Statistics, New Central Book Agency (P) Ltd., Calcutta.
3. Bansilal & Arora, S.R.: Mathematics of Probability & Statistics, R. Chand & Co., New Delhi.
4. Chatterji, P.N.: Mathematical Statistics, Rajhans Prakashana Mandir, Educational Publishers, Meerut.
5. Ray & Sharma: Mathematical Statistics, Ram Prasad & Sons, Agra.
6. Dr. Goel, B.S., Prof. Satyaprakash and Dr. Roshan Lal: Mathematical Statistics, Pragati Prakashana, Meerut.
7. Mukhopadhaya, P. (1996). Mathematical Statistics. New Central Book Agency (P) Ltd., Calcutta.
8. Sundarapandian.V : Probability, Statistics and Queueing theory, PHI learning Private Limited, New Delhi.

Books for reference:

1. Robert V. Hogg and Allen T. Craig: Introduction to Mathematical Statistics (Fifth Edition), Pearson Education Inc, New Delhi.
2. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi.
3. Lindgren: Introduction to Probability & Statistics, MacMillan Publishers.
4. Parzen: Modern Probability Theory & its Applications, Wiley Eastern.
5. A.M. Mood and Graybill: Introduction to the theory of Statistics.
6. Mathai, A.M.: Introduction to Statistical Methods, MacMillan Company Ltd, India.
7. John E Freund: Mathematical Statistics (Sixth Edition), Pearson Education (India), New Delhi.
8. Probability and Statistical Inference: R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester – III

STATISTICS : STT:C

THEORY OF SAMPLING AND ESTIMATION

Unit I: Introduction to Sampling, Survey methods and Simple Random Sampling: Concept of population and sample. Need for sampling, Complete Enumeration versus Sample Surveys, Merits and Demerits, Non – Probability and Probability Sampling, Need and illustrations. Use of random numbers, Principal steps in sample survey. Requisites of a good questionnaire. Pilot surveys, Sampling and non – sampling errors, Description of SRS, simple random sampling according to with and without replacement procedures, Unbiased estimates of population mean and totals, Derivation of sampling variances, standard errors of estimators, Simple random sampling for proportions, derivation of variances of estimators and their estimation, determination of sample size for estimation of population mean and population proportion, Merits and demerits of Simple random sampling.

(15

Hours)

Unit II: Stratified random sampling and Systematic random sampling: Need for stratification, stratifying factors, improvement of method over SRS, unbiased estimators of population mean and total in a stratified random sampling, derivation of standard errors, estimation of parameters, Allocation of sample size under Bowley’s proportional method, Neyman’s optimum allocations (for fixed sample size and for fixed cost), Variance of stratified sample mean in these cases, comparison of $\text{Var}(\text{ran})$, $\text{Var}(\text{prop})$ and $\text{Var}(\text{opt})$ ignoring finite population correction, estimation of gain in

precision due to stratification over proportional, optimum and random methods, Merits and demerits of stratified random sampling.

Systematic random sampling procedure of obtaining sample, unbiased estimators of population mean and its variance. Expression for variance of systematic sample mean with comparisons over within systematic sample, within stratum and with intra class correlation, Comparison systematic random sampling with stratified and simple random sampling under the assumption that the population has linear trend, Merits and demerits of systematic random sampling.

(15

Hours)

Unit III: Sampling distribution: Basic concepts – Population, Sample, Parameter, Statistic. Definition of a Random Sample, Sampling distribution of a Statistic and its standard Error. Statement of Central limit theorem: Derivation of Lindeberg & Levy Central Limit Theorem by MGF method, Simple examples.

(04 Hours)

Unit – IV: Point Estimation:

Concepts of the terms: Estimator, Estimate and Standard Error of an estimator. Unbiasedness, Mean squared error as a criterion for comparing estimators. Relative efficiency, Most efficient estimator, Minimum variance unbiased estimator (MVUE). Consistency: Definition and criteria for consistency. Proof of Sufficient condition for consistency using Chebyshev's inequality. Sufficient statistic, Fisher – Neyman criterion and Neyman – Factorization theorem (without proof), Measure of information – Fisher information function. Cramer – Rao inequality (with proof) and its applications in the construction of minimum variance unbiased estimators. Methods of Estimation: Maximum Likelihood and Moment estimation methods. Standard examples from theoretical distributions, Illustration for non uniqueness of MLE's. Properties of ML Estimator and Moment Estimator. Examples illustrating properties of MLE. (18 hours)

Unit – V: Interval Estimation:

Meaning of confidence interval and pivotal quantity, Confidence interval based on pivotal quantity. Confidence coefficient. Confidence intervals for mean, difference between means for large and

small samples, Confidence intervals for variance and ratio of variances under normality. Large sample confidence intervals for a proportion and difference between two proportions and correlation coefficient. (08

hours)

STATISTICS LAB : STPr:C

THEORY OF SAMPLING AND ESTIMATION

Practicals based on theory using R-programming

The first practical is based to become skilled at R-programming using package. Practicals 2 to 13 have to be first solved manually then results should be verified using R-programming.

1. Demonstration of essential R functions and R packages for application of sampling and estimation theory.
2. To select a Simple random sample with and without replacement from a finite population.
3. Simple Random Sampling for variables.
4. Simple Random Sampling for attributes.
5. Stratified Random Sampling.
6. Systematic Random Sampling.
7. Computation of mean square errors of estimators and comparison.
8. Maximum Likelihood Estimation.
9. Maximum Likelihood Estimation by Analytical Method.
10. Method of Moment Estimation.
11. Confidence Intervals for single mean and difference of two means.
12. Confidence Intervals for single proportion and difference of two proportions.
13. Confidence Intervals – for single variance and ratio of two variances.

Books for Study:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Kalyan Kumar Mukherjee: Probability and Statistics, New Central Book Agency (P) Ltd., Calcutta.
3. Bansilal & Arora, S.R.: Mathematics of Probability & Statistics, R. Chand & Co., New Delhi.
4. Ray & Sharma: Mathematical Statistics, Ram Prasad & Sons, Agra.
5. Gupta, S.C.: Fundamentals of Statistics, Himalaya Publishing House, Bombay.

6. Goon, A.M., Gupta, M.K. and Dasgupta, B.: Fundamentals of Statistics Volume I and II. The World Press Private Limited, Calcutta.
7. Mukhopadhaya, P. (1996). Mathematical Statistics. New Central Book Agency (P) Ltd., Calcutta.
8. Cochran, W.G. (1977). Sampling Techniques. Wiley Eastern Ltd., New Delhi.

Books for reference:

1. Robert V. Hogg and Allen T. Craig: Introduction to Mathematical Statistics (Fifth Edition), Pearson Education Inc, New Delhi.
2. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi.
3. Rohatgi, V. K and Saleh, A.K.MD. (2001). *An Introduction to Probability and Statistics*, 2nd edition. John Wiley & Sons, Inc., New York.
4. Lindgren: Introduction to Probability & Statistics, MacMillan Publishers.
5. Mathai, A.M.: Introduction to Statistical Methods, MacMillan Company Ltd, India.
6. John E Freund: Mathematical Statistics (Sixth Edition), Pearson Education (India), New Delhi.
7. Probability and Statistical Inference: R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester – IV

STATISTICS : STT:D

EXACT SAMPLING DISTRIBUTION AND TESTING OF STATISTICAL HYPOTHESIS

Unit – I: Chi-Square, t and F Sampling Distributions: Chi-square Distribution: Definition, Derivation of Chi-distribution by Moment Generating Function method, Properties, Moments, Recurrence relation for moments about origin and mean, limiting form of Chi- distribution. Independence of sample mean and sample variance in random sampling from a normal distribution, Theoretical examples, Definition of students t – variate and Fisher’s t – variate, Derivation of students t – distribution, Moments and Recurrence relation for t – distribution, Limiting form of t – distribution, Theoretical examples. Snedecor’s F – distribution: Definition, Derivation of F - distribution, Properties, Moments and recurrence relation for moments, Inter relationship between t, F and χ^2 distributions, Theoretical examples. (15 hours)

Unit – II: Tests of Significance and Testing of Hypothesis: Definitions of some important terms: Statistical Hypothesis, Simple & Composite, Null and Alternative hypothesis, Critical Region, Type I and Type II errors, Level of Significance, Power function and Power of the test, One tailed and Two tailed tests, Large sample test for mean and difference of means, Proportion and difference of proportions. Applications of χ^2 , t and F distributions.

Definitions of Most powerful test, Uniformly most powerful test. Statement and proof of Neyman - Pearson Lemma and its use in the construction of most powerful test, Standard examples for computation of Type I and Type II errors and Power of the test. Standard examples for NP lemma to determine most powerful Critical Region for one sided and two sided alternatives, and for Power Curves. Idea of randomized and non – randomized tests and critical function.

(15 hours)

Unit III: Likelihood Ratio Test & MLR property: Likelihood ratio tests (LRT). Large sample approximations to the distribution of the likelihood ratio statistics (without proof). LRT for single mean for normal case (large and small samples). Definition of a monotone likelihood ratio property,

verification of the property for some standard distributions for existence of one sided UMP tests.

(08 hours)

Unit IV: Non –Parametric tests: Need for Non-Parametric Tests, Advantages and Dis-advantage of non-parametric methods over parametric methods. Assumptions in non-parametric methods. Sign test for quantiles, Sign test based on paired observations, Wilcoxon signed rank test for one sample and paired samples. Comparison of the sign-test and Wilcoxon signed– rank test, Kolmogorov – Smirnov one-sample test, Comparison of it with chi-square test, Wald-Wolfowitz runs test, Median test and Mann-Whitney-Wilcoxon –test for two sample problems, Run test for randomness, Test for independence based on Spearman’s rank correlation coefficient. (12

Hours)

Unit- V: - Sequential Testing: Need for sequential tests, Wald’s SPRT, Graphical procedure of SPRT, Determination of stopping bounds, Construction of SPRT of strength (α, β) for Binomial, Poisson, Normal and Exponential distributions. Approximate expressions for OC and AS N functions for Binomial, Poisson and Normal distributions. Difference between SPRT and NP-test. Merits and demerits of SPRT.

(10 hours)

STATISTICS LAB : STPr:D

EXACT SAMPLING DISTRIBUTION AND TESTING OF STATISTICAL HYPOTHESIS

Practicals based on theory using R-programming

The first practical is based to become skilled at using R-programming using package. Practical 2 to 13 has to be first solved manually then results should be verified using R-programming.

1. Demonstration of essential R functions and R packages for application of Testing of Statistical Hypothesis.
2. Large Sample Tests for mean and difference of mean.
3. Large Sample Tests for proportion and difference of proportion.
4. Applications of Chi-square distribution-test for variance and independence of attributes.
5. Applications of Chi-square distribution-Goodness of fit.

6. Applications of Students t – distribution.
7. Applications of Snedecor’s F – distribution.
8. Testing of Statistical Hypothesis – Type I ,Type II errors , critical region and power function.
9. Testing of Statistical Hypothesis – Most powerful tests and Power curves.
10. Non – Parametric Tests for single sample(sign test, wilcoxon signed rank test), Randomness test, Kolmogorov-Smirnov goodness of fit.
11. Non – Parametric Tests for two independent samples(sign test, wilcoxon signed rank test ,median test, wilcoxon mann whitney test), Run test, Rank Correlation Coefficient.
12. Sequential Probability Ratio Test for discrete distribution.
13. Sequential Probability Ratio Test for continuous distribution.

Books for Study:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Ray & Sharma: Mathematical Statistics, Ram Prasad & Sons, Agra.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B.: Fundamentals of Statistics Volume I and II. The World Press Private Limited, Calcutta.
4. Gibbons J.D.: Non parametric Methods for Quantitative Analysis, McGraw Hill.
5. Agarwal B.L.: Basic Statistics, Wiley Eastern Ltd., New Delhi.

Books for reference:

1. Robert V. Hogg and Allen T. Craig: Introduction to Mathematical Statistics (Fifth Edition), Pearson Education Inc, New Delhi.
2. Lindgren: Introduction to Probability & Statistics, MacMillan Publishers.
3. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi.
4. Randles, R.H. and Wolfe, D.A.: Introduction to the Theory of Non-parametric Statistics, John Wiley & Sons, New York.

5. Sidney Siegel: Non parametric Statistics, for behavioral sciences, International Student Edition, McGraw Hill Ltd, India.
6. Abraham Wald: Sequential Analysis, John Wiley & Sons, New York.
7. John E Freund: Mathematical Statistics (Sixth Edition), Pearson Education (India), New Delhi.

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – V

STATISTICS: Paper-I (STT:P-I E)

DESIGN OF EXPERIMENTS AND DEMOGRAPHY

Unit I: Analysis of variance: Definition, Chance and Assignable causes of variation, object of analysis of variance, basic assumptions, Analysis of variance for one way, two way classified data with one observation per cell (fixed effect models only), Statement of linear model, assumptions in the model, splitting the sum of squares in to various component parts, expected mean squares of various sums of squares, preparation of ANOVA tables, least significant difference, Two way classified data with interaction, case of multiple but equal number of observations per cell in two-way and three way classification, linear mathematical model, splitting sum of squares, expectation of various sums of squares, ANOVA table, interpretations. (10

Hours)

Unit II: Design of Experiments: Meaning, Important terms used in designs of experiments. Basic principles: Randomization, Replication and Local Control. Completely randomized design, Randomized block design and Latin Square designs – layout, models, least square estimates of parameters, hypothesis, test procedures and ANOVA tables. Merits and Demerits of the designs studied, Efficiency of design. Missing plot technique for RBD and LSD – Estimation of single missing observation. (18

Hours)

Unit III: Factorial Experiments: Need for factorial experiments, 2^2 and 2^3 factorial experiments, Main effects and Interaction effects, their best estimates, idea of contrasts, orthogonal contrasts, Yates' method of computing factorial effect totals, Confounding, Partial and Total confounding,

analysis of confounded designs in 2^2 , 2^3 designs with RBD layout. (10 Hours)

Unit IV : Measures of Mortality and Fertility : Sources of demographic data, measurement of mortality, crude death rate, specific death rates, and standardized death rates, infant mortality rate, maternal mortality rate, neo natal mortality rates, merits and demerits and comparisons of various mortality rates. Fecundity, fertility, measurement of fertility, crude birth rate, general fertility rate, age specific fertility rate and total fertility rates, merits and demerits of each measure of fertility, comparative study of these measures of fertility, Growth rates: Gross reproduction rate and Net reproduction rates, their definition, distinctions, merits and demerits. (12 Hours)

Unit V : Life tables: Components of a life table, force of mortality and expectation of life, construction of life tables, relationship between various components of a life table, derivation of appropriate formulae for components, abridged life tables, Uses of life tables. (10 Hours)

STATISTICS LAB: STPr: P-I E

Practicals based on **Design of experiments and Demography** using R-programming

1. Demonstration of R-programming packages which are essential for the analysis of Design of experiments and Demography
2. One way Analysis of Variance
3. Two way Analysis of Variance
4. Completely Randomized Design
5. Randomized Block Design
6. Latin Square Design
7. Missing Plot Technique for RBD & LSD
8. Factorial Experiment – I.
9. Factorial Experiment – II

10. Measures Mortality
11. Measures Fertility
12. Gross and Net reproduction rates
13. Life tables.

Books for Study:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Volume I and II. The World Press Private Limited, Calcutta.
3. Gupta, S.C.: Fundamentals of Statistics, Himalaya Publishing House, Bombay.

Books for reference:

1. Montgomery, D.C.: Design and Analysis of Experiments, John Wiley & Sons, New York.
2. Das M.N. and Giri, N: Design of Experiments, Theory and Applications, Wiley Eastern Ltd. New Delhi.

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – V

STATISTICS: Paper-II (STT:P-II E)

OPERATIONS RESEARCH

Unit I: Introduction to operations research and LPP: Introduction, Meaning, and definition of operation research, phases of O.R., O.R. Models, Scope of O.R., Linear Programming Problem: Definition of general linear programming problem, Basic concepts, and formulation of LPP, Graphical solution, Simplex method of solving an LPP, Slack, Surplus and Artificial variables, Charne's M- technique of solving LPP, Two phase simplex method, Concept of Duality of an LPP, Conversion of Standard Primal and Dual problems and vice versa. (20 Hours)

Unit II: Transportation Problem & Assignment Problem: Definition, mathematical model, balanced and unbalanced TP, Methods of obtaining Initial basic feasible solution: North West corner rule, Lowest Cost Entry Method, Vogel's Approximation Method (VAM), Test for optimality by MODI method, Determination of optimal solution. Assignment problem: definition, mathematical model, balanced and unbalanced assignment problem, maximization and minimization problems under assignment, Hungarian method of solving an AP, Distinction between Transportation Problem & Assignment Problem.

(14 Hours)

Unit III: Game theory: Introduction, two person zero sum games, Pure and mixed strategies, maximin and minimax principle, games with saddle point and without saddle points, solution of 2×2 rectangular games, $2 \times n$ and $m \times 2$ graphical method of solving game problems, dominance rule, matrix oddments method for 3×3 games.

(10 Hours)

Unit IV: Inventory Theory: Description of an inventory system, Inventory system, inventory cost, demand and lead time, EOQ model with and without shortages, EOQ model with finite replenishment, Probabilistic demand, News paper boy problem. (8Hours)

Unit V: Sequencing problems: Principle assumptions, Johnson's procedure for determining an optimal sequence, Problems of two machines and 'n' jobs, Three machines and 'n' jobs reducible to two machines and 'n' jobs, calculation of total elapsed time and idle time, Traveling Salesman problem and its solution. (8 Hours)

STATISTICS LAB: STPr: P-II E

Practicals based on **OPERATIONS RESEARCH** using R-programming and other OR software's.

The first two practicals are based on become skilled at using R-programming using package *lpSolve for solving* LLP, TP and AP and acquire skill to solve LLP, TP and AP using any one of free optimization software's (e.g. GAMS, AMPL, TORA, WINQSB/LINGO LINDO).

Practicals 3 to 13 has to be first solve manually then results should be verified using R-programming and others software's.

1. Demonstration of R-programming package *lpSolve for solving* LLP, TP and AP.
2. Demonstration of other free optimization software's (e.g. GAMS, AMPL, TORA, LINDO).
3. Formulation and solution of LPP using Graphical method - I
4. Formulation and solution of LPP using Graphical method - II
5. Solving LPP using Simplex algorithm.
6. Solving LPP using Charn's Big-M method.
7. Solving LPP using Two-Phase method.
8. Determination of optimal solution of Transportation Problem using MODI method (Use Initial Basic feasible solution obtained from North West corner rule, Lowest Cost Entry and Vogel's Approximation (VAM) Methods).
9. Determination of optimal solution of Assignment Problem using Hungarian method.
10. Solving Game Theory Problems (Problems based on game matrix and Mixed strategy)
11. Graphical solution to $m \times 2 / 2 \times n$ rectangular games
12. Solving Inventory Problems.
13. Solving Sequencing Problems.

Books for study:

1. Kanti Swarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.

2. Gupta, P.K. and Hira, D.S.: Operations Research, S. Chand & Company Ltd., New Delhi.
3. Gupta, R.K.: Operations Research, Krishna Prakashana Mandir, Meerut.
4. Sharma, S.D.: Operations Research, Kedarnath Ramnath & Co. Publishers, Meerut.
5. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.
6. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.
7. Dr. Goel, B.S. and Dr. Mittal, S.K.: Operations Research, Pragati Prakashan, Meerut.

Books for reference:

1. Frederick S. Hillier & Gerals J. Liberman: Introduction to Operations Research (Eighth Edition), Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Mustafi, C.K.: Operations Research Methods and Practice, New Age Pub. New Delhi.
3. Churchman, C.W., Ackoff, R.L., and Arnoff, E.L.: Introduction to Operations Research, John Wiley Pub. New York.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – V

STATISTICS: SEC-ST- 1E

Data Analysis with SPSS

Unit I : Introduction

Need of SPSS, preparation of coding sheet of the questionnaire, defining the type of variable and data, constructing the database – defining variable name, type of variable, width of variable name, labeling, assigning the numeric value to the characteristic, declare measurement of scale of data.

Unit 2 Data Editing in SPSS

Enter the data based on type of data case wise for different variables, defining the grouping of variable for repeated measures. Replacing the missing value, transforming the data into same variable and different variable, use of commands –Compute variables using different operators and functions and saving of the data.

Unit 3 Tabulation and Graphical representation :

Formation of frequency distribution, representation of frequency distribution by graphs, construction cross table, P-P plots and Q-Q Plots.

Unit 4 Univariate and Bivariate Data analysis

Calculation of Measures of central tendency, Dispersion, Karl-Pearson's correlation, Regression, fitting different curves, testing of hypothesis- t-test for single mean, difference of means for independent samples, paired sample and one way ANOVA.

Unit 5 Advanced Statistical Tools :

Two way ANOVA, more than two factor analysis, Multiple Regression, Logistics Regression, loglinear models, Factor Analysis and Non-parametric tests.

List of Practicals

1. Demonstration of SPSS : Overviews of SPSS
2. Construct the SPSS database containing 20 variables with String characters for 10 observations.
3. Construct the SPSS database containing 20 variables with Numeric characters for 10 observations.
4. Construct the SPSS database containing 20 variables with Numeric characters for 10 observations and use the command Transpose and Compute.
5. Construct the SPSS database containing 20 variables with Numeric characters for 10 observations and use the command Transpose and Compute.
6. Obtain the descriptive statistics along with graphical representations
7. Construct database for 10 attributes for 50 observations and obtain cross tabulation with two or more attributes with suitable test statistic.
8. Obtain the t-test for single mean , difference of two means for independent samples, paired samples and One Way ANOVA.
9. Obtain Two factor and more than two factor analysis using SPSS
10. Construct database for 10 variables for 20 observations and obtain Karl Pearson's correlation coefficients, Spearman Rank correlations and interpret the results.
11. Obtain the Simple and Multiple Regression analysis using SPSS
12. Obtain Logistic Regression analysis using SPSS
13. Perform Principle component Analysis Using SPSS

REFERENCES:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig (2007), *Introduction to Mathematical Statistics*, Pearson Education, Asia.
2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Applications*, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross (2007): *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint.
4. Gardner, M (2012) *Beginning R: The Statistical Programming Language*, Wiley Publications.
5. Cunningham, B.J (2012): *Using SPSS: An Interactive Hands-on approach*.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – V

STATISTICS: SEC-ST- 2E

Data Science with R programming

Data Science with R programming makes students an expert in data analytics using the R programming language. This course enables students to take students Data Science skills into a variety of companies, serving them analyze data and make more well-versed business decisions.

Unit I Introduction to Business Analytics: Business Decisions and Analytics, Types of Business Analytics, Applications of Business Analytics, Data Science Overview.

Unit II Introduction to R Programming: Importance of R, Data Types and Variables in R, Operators in R, Conditional Statements in R, Loops in R, R script, Functions in R.

Unit III Data Structures: Identifying Data Structures, Assigning Values to Data Structures and applying functions, Data Manipulation.

Unit IV Data Visualization: Introduction to Data Visualization, Data Visualization using Graphics in R, ggplot2, File Formats of Graphic Outputs. Basic and Specialized Visualization Tools.

Unit V Specialized Visualization Tools: Word Clouds, Radar Charts, Waffle Charts and Box Plots. Creating Maps, building interactive Webpages using Shiny, Creating and Customizing Shiny Apps.

List Practicals

The first practical is of Overview of Case Studies and Demonstration of *Shiny* R package. Shiny is an R package that makes it easy to build interactive web applications (apps) straight from R.

Students has to apply their knowledge in statistics and R-programming to solve business problems. Students has to select 6 Case studies and discuss the selected 6 Case studies business problems and construct R-code by using required statistical tools, data visualization tools and create Shiny Apps. One case study problem has to be completed within two practicals each of 4 hours duration,

The following are some examples of case study problems

1. Sales Forecasting.
2. Production Forecasting.
3. Investigate linear relationship between variables.
4. Tabular report in presence of 2 class variable & different statistics needed.
5. Predicting Stock Market Returns.
6. Inflation Forecasting.
7. Analyse GDP of Asian Countries.
8. Analyse London Olympics Dataset.
9. Analyse the Federal Aviation Authority Dataset
10. Analyse New York city fire department Dataset
11. Analysing Cause of Death.

Reference Books:

1. V.K. Jain, Data Science and Analytics (with Python, R and SPSS Programming), Khanna Books, 2018.
2. Dr. Bharti Motwani, Data Analytics with R, Wiley, 2019.
3. Seema Acharya, Data Analytics Using R, Mc Graw Hill Education.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – V

STATISTICS: SEC-ST- 3E

Indian Official Statistics

Unit-1 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.
(7 Hours)

Unit-2 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 2001 and 2011 census.
(8 Hours)

Unit 3 Central Statistical Organization (CSO):

Central Statistical organization : Department of Statistics, Ministry of Statistics and Programme Implementation, Central Statistical Organization (CSO)- functions of CSO, divisions of CSO, advantages and limitations of the organization. (5 Hours)

Unit 4 National Sample Survey Organization (NSSO):

Introductions of National Sample Survey Organization, functions and working of NSSO, Advantages and dis-advantages of NSSO data.
(5 Hours)

Unit 5 Population Statistics :

Various Secondary sources of population statistics –Various data from World Bank www.worldbank.org, World Health Organization-www.who.int, Population Reference Bureau-www.prb.org, Asian development Bank- www.adb.org and Various organizations. Reserve Bank of India – www.rbi.org.in . (5 Hours)

References :

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Volume I and II. The World Press Private Limited, Calcutta.
3. Gupta, S.C.: Fundamentals of Statistics, Himalaya Publishing House, Bombay.
4. Gupta C. B.,(2004) Introduction to Statistical Mehods, Vikas Publishing House, PVT. Ltd,
5. Gupta S. P., Statistical Methods, Sultan Chand and sons, New Delhi
6. S. G Gani , Sankhyshastra and Ganakayantra- Publication, Bjapur.

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – VI

STATISTICS: Paper-I (STT:P-I F)

Statistical Quality Management and Reliability

Unit I: Statistical Quality Control: Concept of quality and its management - quality planning, quality control and quality improvement, quality pioneers, quality costs. Meaning, aims and objectives of statistical quality control. Concept of variations and its impact, chance & assignable causes of variation. Relevance of exploratory data analysis, run plot, lag plot, frequency distribution and other QC tools. Statistical quality control, Process control, Product control, Importance & uses of statistical quality control in industry. Introduction to control charts.

(14 Hours)

Unit II: Control charts for variables: Theoretical basis and practical background of control charts for variables. 3σ - Limits, Warning limits and Probability limits. Derivation of control limits and construction of \bar{X} & R charts and \bar{X} & S charts. Interpretation Criteria for detecting lack of control. Rational subgroups, group control charts and sloping control charts, Natural tolerance limits and specification limits, Process capability studies.

(16 Hours)

Unit III: Control charts for attributes: Theoretical basis and practical background of control charts for attributes. Fraction defective p-chart, number of defectives np-chart, number of defects per unit C – chart, and U – chart, derivation of control limits and interpretations.

(10 Hours)

Unit IV: Reliability: Definitions of Reliability Theory, reliability function, failure rate (hazard rate), cumulative failure rate. Distributions useful in modeling the life length (Exponential, Weibull, Gamma, Pareto, Truncated Normal and Log Normal). Monotone failure rates, Classes of life Distributions (IFR, IFRA, NBU, NBUE, DMRL) and their geometric characterization. (12

Hours)

Unit V: System Reliability: Series System, Parallel System and Standby Redundant System in case of exponential distributions. (8 Hours)

STATISTICS LAB: STPr: P-I F

Practicals based on (STT:P-I F) **Statistical Quality Management and Reliability** theory using R-programming.

The first three practicals are based on become skilled at R-programming using package *qicharts for constructing control charts* and acquire skill for *constructing control charts* using any others packages developed in R or other software's.

Practicals 4 to 13 has to be first solve manually then results should be verified using R-programming and others software's.

1. Demonstration of R-programming packages which are essential for constructing control charts *in particular qichart package*.
2. Demonstration of R-programming packages for constructing control charts (*qcc package, etc.*).
3. Demonstration of construction and interpretation of statistical control charts using MS Excel.
4. Exploratory data analysis, run plot, lag plot, frequency distribution and other QC tools for detecting lack of control.
5. Construction and interpretation of statistical control charts for Variables, X-bar & R-chart.
6. Construction and interpretation of statistical control charts for Variables, X-bar & S-chart.
7. Construction and interpretation of group control charts.
8. Construction and interpretation of sloping control charts.
9. Construction and interpretation of natural tolerance limits and specification limits, Process capability studies.
10. Construction and interpretation of statistical control charts for attributes, np-chart, and p-chart.
11. Construction and interpretation of statistical control charts for attributes, c-chart and u-chart.
12. Computation and interpretation of reliability function, failure rate (hazard rate), cumulative failure rate, etc.
13. Computation and interpretation of system reliability, failure rate (hazard rate), and cumulative failure rate, etc.

Books for Study:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

2. Gupta, S.C.: Fundamentals of Statistics, Himalaya Publishing House, Bombay.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Volume I and II. The World Press Private Limited, Calcutta.
4. S. K. Sinha, Life Testing & Reliability Estimation, John Wiley & Sons, 1980.
5. S. K. Sinha and B. K. Kale, Life Testing & Reliability, Wiley Eastern, New Delhi 1990.

Books for reference:

1. Montgomery Douglas C.: Introduction to Statistical Quality Control, John Wiley & Sons, Inc. (Wiley Student Edition).
2. Grant, E.L. and Richard S. Leavenworth: Statistical Quality Control, McGraw-Hill Book Company Inc., New York.
3. Gupta, R.C.: Statistical Quality Control, Khanna Publishers, New Delhi.
4. Jerry Banks: Quality Control, John Wiley Pub. New York.
5. Mahajan, M: Statistical Quality Control, Dhanpat Rai & Co. Ltd. New Delhi.
6. Trivedi K. S., Probability and Statistics with Reliability, Queuing and Computer Science Applications, PHI, 1997.

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – VI

STATISTICS: Paper-II (STT:P-II F)

Economic Statistics and Econometrics.

Unit 1 : Index Numbers : Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test, factor reversal test, and Circular test for index numbers, Uses and limitations of index numbers. Consumer price index number : Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers.

(10 Hours)

Unit II Time Series Analysis :

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series : Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations. (10

Hours)

Unit III Introduction to Econometrics and Simple Linear Regression : Definition and scope of econometrics, Relationship between econometrics, mathematical economics and Statistics, goals of econometrics, limitations. Simple linear regression model, role of disturbance term in the model, ordinary least square method (OLS), Statistical assumptions, desirable small sample properties of least square estimators, Large sample properties of estimators, Linearity, unbiasedness, minimum

variance property, Sampling distribution of least square estimators.

(10

Hours)

Unit IV Multiple Linear Regression: Introduction of Multiple Linear Regression model, Relation between simple and multiple regression coefficients, Model with two explanatory variables, statistical properties of the least squares estimates of multiple linear regression model with two explanatory variables – Linearity, Unbiasedness and sampling variance. Test of significance of parameter estimates. The General Linear regression model, Matrix Approach to linear regression model, statistical properties of the estimates. Regression Analysis and Analysis of Variance, Concepts of analysis of variance, comparison between Regression Analysis and Analysis of Variance, test based on Analysis of Variance.

(15 Hours)

Unit V Multicollinearity, Autocorrelation and Heteroscedasticity : Introduction and concepts, detection of multicollinearity, consequences and solutions of multicollinearity, Autocorrelation : Concept, consequences of auto correlated disturbances, detection and solution of autocorrelation. Generalized least squares estimation. Heteroscedastic disturbances: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity. Tests and solutions of heteroscedasticity. Errors in variables: Correlation between error and regressors. Instrumental variable method (Single-equation model with one explanatory variable).

(15

Hours)

Books for Study :

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition McGraw Hill
2. Companies 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. G.M.K. Madanani (1980) : Introduction to Econometrics, second edition, Oxford & IBH Publishing company, New Delhi.
6. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Books for Reference :

1. Gupta, S.C.: Fundamentals of Statistics, Himalaya Publishing House, Bombay.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Volume I and II. The World Press Private Limited, Calcutta.
3. S. Shyamala, Navdeep Kaur, T Arul Pragasam: A text book on Econometrics, Theory and Applications, Vishal Publishing Company, New Delhi.
4. Grant, E.L. and Richard S. Leavenworth: Statistical Quality Control, McGraw-Hill Book Company Inc., New York.
5. Croxton, F.E., Cowden, D.J. and Klein, S. (1982): Applied General Statistics, 3rd Edn. Prentice Hall of India (P) Ltd.
6. Soni, R.S. (1996): Business Mathematics with Application in Business and Economics. Pitamber Publishing Co.

STATISTICS LAB: STPr: P-II F

Practicals based on **(STT:P-I F) Economic Statistics and Econometrics** theory using R-programming.

Practicals 2 to 13 has to be first solve manually then results should be verified using R-programming and others software's.

1. Demonstration of R-programming packages which are essential for the analysis of Economic Statistics and Econometrics.
2. Price and Quantity Index Numbers
3. Cost of living Index Numbers
4. Time Series : Secular Trend Estimation
5. Time Series : Measurement of seasonal Indices
6. Estimation parameters of simple linear regression model by Method of ordinary least squares.
7. Estimation parameters of Multiple linear regression model by Method of ordinary least squares.

8. Problem related to Analysis of variance in Multiple regression model
9. Problems related to consequences of Multicollinearity and Diagnostics of Multicollinearity.
10. Problems related to consequences of Autocorrelation (AR(I)) and Diagnostics of Autocorrelation.
11. Problems related to consequences Heteroscedasticity and Diagnostics of Heteroscedasticity.
12. Estimation of problems of General linear model under Heteroscedastic disturbance terms.
Problems on Autoregressive models.
13. Problems on Instrumental variable.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – VI

STATISTICS: SEC-ST- 1F

SIMULATION

Simulation is a powerful tool to analyze the complex systems. Simulation is a method to mimic the behavior of real systems. This course introduces computer based simulation and become skilled at simulating random variables from standard discrete and continuous distributions and Monte Carlo integration.

Unit I Introduction: Aims of simulation, history and philosophy of generating random numbers and generation of pseudo random-numbers Use of computer for random number generation and use of built function in R-programming for random number generation.

Unit II Simulating continuous random variables: The inverse transformation method, the rejection method, the hazard rate method.

Unit III Special techniques for simulating continuous random variables: Normal distribution (Box-Muller approach, polar method), Gamma distribution, Chi-squared distribution, Beta distribution, Exponential distribution (Von Neumann algorithm).

Unit IV Simulating from discrete distribution: Geometric distribution, Binomial distribution, Poisson distribution. The use Alias method to generate Poisson random variables.

Unit V Variance reduction techniques: Monte Carlo integration. Use of Antithetic variables, Variance reduction by conditioning, Basic idea of importance sampling.

List Practicals

The first three practical are of Overview Demonstration of simulation techniques outlined in Unit I to Unit V. Students have to apply their knowledge in statistics, simulation and R-programming to write algorithms using various methods for generating random variables in R without using R built-in functions, execute R-code and write the conclusion.

The following are the practical assignments.

1. Algorithm and R-code for generating random numbers.
2. Simulating continuous Uniform ($U(-u, u)$) and Exponential random variables (Algorithm and R-code) using inverse transformation method.

3. Simulating continuous Exponential random variables (Algorithm and R-code) using Von Neumann algorithm.
4. Simulating continuous random variables (Algorithm and R-code) using rejection method (Normal and other probability distributions).
5. Simulating Normal random variables (Algorithm and R-code) using Box-Muller approach.
6. Simulating Normal random variables (Algorithm and R-code) using polar method.
7. Simulating continuous random variables (Algorithm and R-code) using special techniques (Gamma, Chi-squared and Beta distributions).
8. Simulating discrete Uniform and Geometric random variables (Algorithm and R-code) using inverse transformation method.
9. Simulating discrete Binomial and Poisson random variables (Algorithm and R-code) using inverse transformation method.
10. Monte Carlo integration of simple and multiple integrals (Algorithm and R-code).

Reference Books:

1. Sheldon M. Ross, Introduction to probability models, 11th Edition, Academic Press, 2014.
2. Brian D. Ripley, Stochastic Simulation, Wiley Series in Probability and Statistics, John Wiley & Sons, 2009.
3. Søren Asmussen, Peter W. Glynn, Stochastic Simulation: Algorithms and Analysis, Springer Science & Business Media, 2007.
4. Thomas M. Carsey and Jeffrey J. Harden, Monte Carlo Simulation and Resampling Methods for Social Science, SAGE Publications, Inc2014.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – VI

STATISTICS: SEC-ST- 2F

Data Science with Python

Data Science with Python makes students an expert in data analytics using the Python. This course enables students to take students Data Science skills into a variety of companies, serving them analyze data and make more well-versed business decisions.

Unit VI Introduction to Python and Data Analytics Overview: Purpose and Components of Python, Data Analytics Process, Exploratory Data Analysis(EDA), EDA-Quantitative Technique, EDA - Graphical Technique, Data Analytics Conclusion or Predictions, Data Analytics Communication, Data Types for Plotting.

Unit VII Python Environment Setup and Essentials: Anaconda, Installation of Anaconda Python Distribution, Data Types with Python, Basic Operators and Functions,

Unit VIII Mathematical Computing with Python (NumPy): Creating and Printing an ndarray, Class and Attributes of ndarray, Basic Operations, Mathematical Functions of Numpy, Scientific computing with Python (Scipy), SciPy Sub Package - Statistics, Weave and IO, Perform CDF and PDF using Scipy.

Unit IX Data Manipulation with Pandas: Introduction to Pandas, Understanding DataFrame, View and Select Data Demo, Missing Values, Data Operations, File Read and Write Support, Pandas Sql Operation, .

Unit X Data Visualization in Python using matplotlib: Introduction to Data Visualization, Line Properties, (x,y) Plot and Subplots, Types of Plots, Drawing a pair plot using seaborn library.

List Practicals

The first three practical are of Overview Demonstration of Python environment outlined in Unit I to Unit V. Students have to apply their knowledge in statistics, and Python to write algorithms and Python scripts using various methods for analyzing business data. Students has to select 6 Case studies and discuss the selected 6 Case studies business problems and construct R-code by using required statistical tools, data visualization tools and create Shiny Apps. One case study problem has to be completed within two practicals each of 4 hours duration,

The following are some examples of case study problems

1. Sales Forecasting.
2. Production Forecasting.
3. Investigate linear relationship between variables.
4. Tabular report in presence of 2 class variable & different statistics needed.
5. Predicting Stock Market Returns.
6. Inflation Forecasting.
7. Analyse GDP of Asian Countries.
8. Analyse London Olympics Dataset.
9. Analyse the Federal Aviation Authority Dataset using Pandas
10. Analyse New York city fire department Dataset
11. Analysing Cause of Death.

Reference Books:

1. Samir Madhavan, Mastering Python for Data Science, PACKT publishers.
2. Henley A.J., Learn Data Analysis with, APress, 2018.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Shroff / O'Reilly Reprints, 2017.

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

B.Sc. Semester – VI

STATISTICS: SEC-ST- 3F

Statistical Techniques for Research

Statistics is the science and practice of developing human knowledge through the use of empirical data expressed in quantitative form. There are basic steps depending on the subject matter and researcher. Research is structural and to conduct researchers use pre-collected data, called secondary data analysis. This course would help the student to understand the use of both primary as well as secondary data and various techniques to collect the data, analyze the data and interpret the results thereafter.

Unit 1 : Introduction to Research Methods

What is Research? Role of Research in important areas. Characteristics of Scientific Method. Process of research: Stating Hypothesis or Research question, Concepts & Constructs, Units of analysis & characteristics of interest, Independent and Dependent variables, Extraneous or Confounding variables. Measurements and scales of Measurements. Types of research: Qualitative & Quantitative Research, Longitudinal Research, Survey & Experimental Research.

(10 Hours)

Unit 2 : Data Collection

Survey Methodology and Data Collection, sampling frames and coverage error, non-response errors

(08

Hours)

Unit 3 : Statistical Tools for research analysis

Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

(5 Hours)

Unit 4 : Drafting of Questionnaire and Report writing

Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy,

impact on service class v/s unorganized sectors), questions and answers in surveys, Internal & External validity, interpret the results and draw inferences. Formats and presentations of Reports – an overview.

(7 Hours)

References:

1. Kothari, C.R. (2004): Research Methodology: Methods and Techniques, 2nd Revised Edition, New Age International Publishers.
2. Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners, SAGE publications.



KARNATAK UNIVERSITY DHARWAD

KARNATAK UNIVERSITY, DHARWAD

B. A. Programme

SYLLABUS FOR

APPLIED STATISTICS

(OPTIONAL)

**AS DISCIPLINE SPECIFIC COURSE (DSC),
DISCIPLINE SPECIFIC ELECTIVE (DSE),
SKILL ENHANCEMENT COURSE (SEC) and
GENERIC ELECTIVE (GE)**

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from 2020-21

KARNATAK UNIVERSITY, DHARWAD

Regulations and Syllabus

For APPLIED STATISTICS In Three Year B. A. Course (CBCS : 2020-21)

Regulations and Scheme of Instructions :

Regulations for governing three years semester Under Graduate Programme of Karnatak University Dharwad in B. A. Applied Statistics optional subject with effect from academic year 2020-2021 and onwards.

I. Goals and Objectives:

The following aims have been kept in view while designing the syllabus of Under Graduate Programme (B.A.) in Applied Statistics as one of the optional paper.

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+1 hours per week in each paper.

VI. General Pattern of Theory Question paper for all semesters of DSC and DSE

1. Question number 1-12 carries 2 marks to answer any 10 questions : 20 marks
 2. Question number 13-20 carries 5 marks to answer any 6 questions : 30 marks
 3. Question number 21-26 carries 10 marks, candidate has the following choice
 - a) Question number 21 or Question number 22 :10 marks
 - b) Question number 23 or Question number 24 :10 marks
 - c) Question number 25 or Question number 26 :10 marks
- | | |
|---|-------------------|
| Sub total | : <u>30 marks</u> |
| Total semester end examination marks | : 80 marks |
| Internal examination and assignment marks | : <u>20marks</u> |
| Total course paper marks | :100 marks |

VII. General Pattern of Theory Question paper for all semesters of SEC and GE

- | | |
|---|---------------------|
| 4. Question number 1-6 carries 2 marks to answer any 5 questions | : 10 marks |
| 5. Question number 7-12 carries 5 marks to answer any 4 questions | : 20 marks |
| 6. Question number 13-14 carries 10 marks to answer any 1 questions | : <u>10 marks</u> |
| 7. Total semester end examination marks | : 40 marks Internal |
| examination and assignment marks | : <u>10 marks</u> |
| Total course paper marks | :50 marks |

Annexure: 1 B: Programme structure: B.A.

Seme ster	*Core			Elective						Ability Enhancement Course						Total Credi
	DSC			**DSE			***GE			****SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	5+1+0	5+1=6										English-1	2+1+0	2+1=3	26
	DSC-2A	5+1+0	5+1=6										MIL-1	2+1+0	2+1=3	
	DSC-3A	5+1+0	5+1=6										ENVIRONMEN TAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	5+1+0	5+1=6										English-2	2+1+0	2+1=3	26
	DSC-2B	5+1+0	5+1=6										MIL-2	2+1+0	2+1=3	
	DSC-3B	5+1+0	5+1=6										CONSTITUTI ON OF INDIA	2+0+0	2+0=2	
III	DSC-1C	5+1+0	5+1=6										English-3	2+1+0	2+1=3	24
	DSC-2C	5+1+0	5+1=6										MIL-3	2+1+0	2+1=3	
	DSC-3C	5+1+0	5+1=6													
IV	DSC-1D	5+1+0	5+1=6										English-4	2+1=0	2+1=3	24
	DSC-2D	5+1+0	5+1=6										MIL-4	2+1=0	2+1=3	
	DSC-3D	5+1+0	5+1=6													
V				DSE-1E	5+1+0	5+1=6	GE-1E	2+0+0	2	SEC-1E	2+0+0	2				22
				DSE-2E	5+1+0	5+1=6										
				DSE-3E	5+1+0	5+1=6										
VI				DSE-1F	5+1+0	5+1=6	GE-1F	2+0+0	2	SEC-1F	2+0+0	2				22
				DSE-2F	5+1+0	5+1=6										
				DSE-3F	5+1+0	5+1=6										
TOTAL			72			36			4			4			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week

*If the core course is having practical. Hence, L+T+P = 4+0+2=6 credits (no tutorial for practical subject).

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

***GE shall be from other than the discipline.

**** SEC shall be from any one DSC and study one each in 5th and 6th semesters (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks (40 Sem. End exam +10 IA Exam) wherever applicable.

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/Constitution of India/SEC/GE shall have 30 hrs syllabus/sem for 50 marks in theory/Practical(40 Sem. End exams+10 IA Exam).

Karnatak University, Dharwad
CBCS syllabus for Under Graduate Programme in Applied Statistics (opt.)
as **DISCIPLINE SPECIFIC COURSE (DSC)**
Effective from 2020-21

Part A Structure: DSC

Sem	Course Code	Title of the Paper	Teaching Hrs Per week	Total Syllabus Hrs/	Duration of Exam	Marks			Credits
						Sem Exam	IA	Total	
I	DSC (AST A)	Basics Statistics	5+1 = 6 hrs	60	3 hrs	80	20	100	6
II	DSC (AST B)	Bivariate Analysis, Theory of Probability and Index Number	5+1 = 6 hrs	60	3 hrs	80	20	100	6
III	DSC (AST C)	Standard Probability Distributions and Data Analysis	5+1 = 6 hrs	60	3 hrs	80	20	100	6
IV	DSC (AST D)	Inference and Exact Sampling Distributions	5+1 = 6 hrs	60	3 hrs	80	20	100	6
			24						24

Part B Structure: DSE

Sem	Course Code	Title of the Paper	Teaching Hours Per week	Total Syllabus Hrs/ Sem	Duration of Exam	Marks			Credits
						Sem Exam	IA	Total	
V	DSE (AST:P-I E)	Theory of Sampling	5+1 = 6 hours	60	3 hrs	80	20	100	6
	DSE (AST:P-II)	Operations Research							

VI	DSE (AST:P-I E)	ANOVA and Design of Experiments	5+1 = 6 hours	60	3 hrs	80	20	100	6
	DSE (AST:P-II F)	Population Study and Statistical Quality Control							
Total			12 hours						12

Part C Structure: SEC

Sem	Course Code	Title of the Paper	Teaching Hours Per week	Total Syllabus Hrs/ Sem	Duration of Exam	Marks			Credits
V	SEC (AST:1E)	Research Methodology	2 hours	30	2 hours	40	10	50	2
VI	SEC (AST:1F)	Statistics for Psychology and Education	2 hours	30	2 hours	40	10	50	2
Total			4 hours	60	4 hours	80	20	100	4

Part D Structure: GE

Sem	Course Code	Title of the Paper	Teaching Hrs Per week	Total Syllabus Hrs/ Sem	Duration of Exam	Marks			Credits
V	GE 1E	Statistics for Competitive Examinations	2 hours	30	2 hours	40	10	50	2
VI	GE 1F	Quantitative Aptitude for Competitive Examinations	2 hours	30	2 hours	40	10	50	2
Total			4 hours	60	4 hours	80	20	100	4

Overall Credits for Statistics opted as DSC

Semester	Details of Structure	Total Marks	Total Credits
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Semester I to semester IV	Part A	400	24
Semester V and VI	Part B	200	12
Semester V and VI	Part C	100	04
Semester V and VI	Part D	100	04
Course Total		800	44

**Discipline Specific Course (DSC) under CBCS
B.A. Semester – I**

APPLIED STATISTICS : AST:A

Basic Statistics

Unit I. Introduction to Statistics and Basic Concepts:

Meaning, origin, definition, functions, limitations and applications of Statistics. Primary and secondary data, different methods of collection of primary data with merits and demerits. Sources of secondary data. Classification: meaning, objectives, types of classifications- Chronological, Geographical, Qualitative and Quantitative classifications with illustrations. Definition of some important terms - class, class limits, class intervals, width of class interval, open-end classes, inclusive and exclusive classes. Formation of discrete and continuous frequency distributions.

Tabulation: meaning, objectives and rules of tabulation, format of a statistical table and its parts. Types of table, examples of preparation of a 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 diagrams with simple illustrations.

Graphs: Types of Graphs – Histogram, frequency Polygon, frequency curve and Ogives, simple problems, location of mode, median and partition values from the graphs. Difference between diagrams and graphs. **(10 Hours)**

Unit III. Measures of Central Tendency:

Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency : Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures.

Partition values-definition and types of partition values: 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. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.

(15 Hours)

Unit V. Skewness and Kurtosis:

Skewness- Definition, objectives and types of skewness, explanation of positive 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 Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Discipline Specific Course (DSC) under CBCS

B.A. Semester – II

APPLIED STATISTICS : AST:B

Bivariate Analysis, Theory of Probability and Index Number

Unit I. Correlation:

Definition and meaning of correlation, types of correlation- positive, negative, linear and non-linear correlation with examples. Uses of correlation. Methods of studying correlation- Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's Rank correlation coefficient. Properties of Karl Pearson coefficient of correlation. Simple problems based on ungrouped data.

(10 Hours)

Unit II. 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 III. Theory of Probability:

Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.

(15 Hours) Unit-IV. Random Variable and Mathematical Expectation:

Definition of a random variable, discrete & continuous random variable, probability mass function, probability density function, distribution function. Definition of mathematical expectation, expected mean and variance of discrete random variable. Properties of Mathematical expectation. Statement of addition and multiplication theorem of expectation. Numerical problems on mathematical expectation. **(15**

Hours)

Unit-V. Index Numbers:

Definition, uses and limitations of index numbers. Problems involved in the construction of index numbers, methods of constructing index numbers of price and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests of a consistency 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.

Consumer price index number: Problems involved in the construction of cost of living index number, uses, advantages and limitations, method of aggregative expenditure method and family budget method for the construction of consumer price index numbers.

(12

Hours)

Books for Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Discipline Specific Course (DSC) under CBCS
B.A. Semester – III

APPLIED STATISTICS : AST:C

Standard Probability Distributions and Data Analysis

Unit I. Binomial Distribution :

Definition of Binomial Distribution, mean and Variance of Binomial distribution, numerical problems on binomial distribution. Uses of binomial distribution. Fitting of Binomial distribution and obtaining expected probabilities. Simple problems. **(10 Hours)**

Unit II. Poisson Distribution:

Definition of Poisson distribution. Mean, Variance and its properties of Poisson variate. Uses of Poisson distribution. Simple problems on 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. Fitting of Poisson distribution.

(10 Hours)

Unit III. Normal Distribution:

Definition of normal variate. Application of Normal distribution Definition of standard normal variate, standard normal distribution and properties of normal curve. Conditions under which binomial distribution tend to normal distribution (Statement only). Finding probabilities and expected numbers when mean and variance are given quartile deviation, mean deviation and standard deviation and problems.

(15 Hours)

Unit IV : Time Series:

Definition, uses and components of time series, illustrations, Additive and Multiplicative models of time series, analysis of time series, determination of secular trend : Graphic method, Method of semi-averages and Method of moving averages, simple illustrations, Least squares method – linear, quadratic, exponential trend fittings to the data.

(15 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.

(10 Hours)

Books for Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

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2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

**Discipline Specific Course (DSC) under CBCS
B.A. Semester – IV**

APPLIED STATISTICS : AST:D

Inference and Exact Sampling Distributions

Unit I. Sampling distribution:

Definition of basic concepts : population, sample, parameter and statistic. Definition of a Random Sample, Sampling distribution of a Statistic along with examples. Definition of 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:

Definition of the terms – Estimator, Estimate, Point estimation and interval estimation. Meaning of confidence interval, confidence limits and confidence co-efficient with examples. Construction of 95% and 99% confidence intervals - mean, difference of means, proportion and difference of proportions for large samples only and their numerical problems on the construction of 95% and 99% confidence limits.

(15 Hours)

Unit III. Testing of Hypothesis:

Definition of terms – Statistical hypothesis, Simple hypothesis, Composite hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, critical region, size of the test and 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 two population means, test of significance of population proportion and test of significance of equality of two population 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 and independence of attributes.

(10 Hours)

Unit V t - test and F-test :

Definition, assumption and properties of t -test. Applications of t -test. t -test for testing population mean, equality of two population means and paired t -test. Simple problems

Definition, assumption and properties of F-statistic. Applications of F-test. F-test for equality of variances. Numerical problems.

(15 Hours)

Books for Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

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2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – V

STATISTICS : AST P-I E

Theory of Sampling

Unit I. Indian Official Statistics:

Statistical organization at the Centre, National Sample Survey–historical background and its 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 over complete census, examples of sampling. Types of errors in sample survey, sampling errors and non-sampling errors, response errors, non response errors and tabulation errors. Limitation of sampling. Planning of sample survey and its execution.

(10 Hours)

Unit III. Simple Random Sampling:

Introduction and Definition of Simple Random Sampling (SRS), Notations and formulae for estimating population mean, total and estimate of variance. Methods of obtaining simple random sample-Lottery method and Random numbers table method. Merits and demerits of Simple Random Sampling. Simple problems on simple random sampling method.

(15 Hours)

Unit IV. Stratified Random Sampling:

Need for stratification, stratifying factors, improvement of method over SRS, Definition of strata, stratification, and stratified random sampling. Notations and

formulae for estimating population mean, total and estimate of variance. Methods of allocation of sample size in different strata- Equal allocation, Proportional allocation and Optimum allocation. Determination of Bowley's formula for proportional allocation and Neyman's formula for optimum 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 samples. Examples of systematic random sample. Formulae for estimating population mean, total and variance. 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 Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S P. and V K Kapoor Fundamentals of Applied Statistics, Sultan Chand, New Delhi

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester – V

STATISTICS : AST P-II E

Operations Research

Unit I. Linear Programming Problem:

Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Definition 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:

Introduction, definition of Transportation Problem (TP), balanced and unbalanced TP. Feasible solution, basic solution, basic feasible solution, degenerate solution, non-degenerate solution and optimal solution. Methods of finding initial basic feasible solution-North West Corner Rule, Matrix Minima method (lowest cost entry method) and Vogel's approximation method (Unit cost penalty method) and simple problems.

(15 Hours)

Unit III. Assignment Problem:

Introduction and definition of Assignment problem, mathematical model, balanced and unbalanced assignment problem, Hungarian method of solving an AP, Distinction between Transportation Problem & Assignment Problem. Simple numerical problems on assignment.

(10 Hours)

Unit IV. Game Theory:

Introduction, two person zero sum games, Pure and mixed strategies, maximin and minimax principle, games with saddle point and without saddle points, solution of 2×2 rectangular games, $2 \times n$ and $m \times 2$ graphical method of solving game problems, dominance rule. Simple numerical problems.

(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. Goel B. S. and Mittal S. K.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay

4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Kanti Swarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.
2. Gupta, P.K. and Hira, D.S.: Operations Research, S. Chand & Company Ltd., New Delhi.
3. Gupta, R.K.: Operations Research, Krishna Prakashana Mandir, Meerut.
4. Sharma, S.D.: Operations Research, Kedarnath Ramnath & Co. Publishers, Meerut.
5. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.
6. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.

SKILL ENHANCEMENT COURSE (SEC) IN APPLIED STATISTICS

B. A. Semester – V

STATISTICS: SEC-AST- 1E

Research Methodology

Unit 1. Introduction :

What is Research? Role of Research in important areas. Characteristics of Scientific Method. Process of research: Stating Hypothesis or Research question, Concepts & Constructs, Units of analysis & characteristics of interest, Independent and Dependent variables, Extraneous or Confounding variables. Measurements and scales of Measurements. Types of research: Qualitative & Quantitative Research, Longitudinal Research, Survey & Experimental Research.

(7 Hours)

Unit II. Methodology and Data collection

Survey Methodology and Data Collection, sampling frames and coverage error, non-response. **(7**

Hours)

Unit III. Statistical Tools for Research Analysis :

Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation. **(7**

Hours)

Unit IV Organization of Survey and Reporting :

Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), questions and answers in surveys, Internal & External validity, , interpret the results and draw inferences. Formats and presentations of Reports – an overview.

(9 Hours)

Books for Study and Reference:

1. Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.
2. Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners, SAGE publications.
3. Wali B.M, N.V. Gudaganavar and P.V. Pandit, Research Methodology and Statistical Approach, Serial publication ISBN:978-81-8387-352-9.

GENERIC ELECTIVE (GE 1E) IN APPLIED STATISTICS

B.A. Semester – V

Statistics for Competitive Examinations

Unit I Collection Classification and Presentation of Statistical Data:

Primary and Secondary data, Methods of data collection; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of frequency distributions

(6 hours)

Unit II Measures of Central Tendency:

Common measures of central tendency – mean median and mode; Partition values- quartiles, deciles, percentiles.

(7

hours)

Unit III Aptitude Ability:

Area, Banker's Discount, Surds and Indices, Ratio and Proportion Simple Interest, Problems on Trains, Profit and Loss, Compound Interest.

(8 Hours)

Unit IV Reasoning:

Number series, Analogy, Classifications, Blood relations Coding-decoding, Puzzle test, Logical Venn diagram. Alphabet-test, Alpha-numerical sequence puzzle, Mathematical operations, Numbers, ranking & time sequence test, Logical sequence test, Arithmetical operations.

(9 Hours)

Books for Reference:

- 1. Computer Application in Business:** by T D Malhotra. Kalyani Pubkishers, New Delhi.

2. Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.

Discipline Specific Elective (DSE) under CBCS

B.A. Semester – VI

STATISTICS : AST P-I F

Analysis of Variance and Design of Experiments

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

Definition of analysis of variance and its basic assumptions. 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 component sum of squares, 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 component sum of squares. Degrees of freedom and ANOVA table. Simple numerical problems on two way classified data.

(10

Hours)

Unit-III. Design of Experiments: Completely Randomized Design:

Definition of terms - Experiment, treatment, experimental unit, experimental material, yield, block, precision, experimental error, uniformity trials, and efficiency. Basic principles of design of experiments - Replication Randomization and Local control. Completely Randomized Design (CRD) -definition, layout, linear mathematical model, assumptions, hypothesis, splitting up of sum of squares into various component sum of squares, degrees of freedom and ANOVA table. Merits, demerits and applications of CRD. Simple numerical problems. **(20**

Hours)

Unit-IV. Randomized Block Design :

Introduction and definition of Randomized Block Design (RBD), layout, linear mathematical model, assumptions, statistical hypothesis, splitting up of total sum of squares into various component sum of squares, degree of freedom, and ANOVA table. Merits and demerits of RBD. Applications of RBD. Comparison between CRD and RBD. Simple problems. **(10**

Hours)

Unit-V. Latin Square Design:

Introduction and 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.

(10

Hours)

Books for Study :

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
3. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
3. Gupta S C. and V K Kapoor Fundamentals of Applied Statistics, Sultan Chand, New Delhi

Discipline Specific Elective (DSE) under CBCS

B.A. Semester – VI

STATISTICS : AST P-II F

Population Studies and Industrial Statistics

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 hold schedule of 2001 and 2011 census.

(10 Hours)

Unit III. Population Studies and Measures of Fertility :

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- Distinction between fertility and fecundity. Measures of fertility- Crude Birth Rate (CBR), General fertility Rate (GFR), Age Specific Fertility Rate (ASFR) and Total fertility Rate (TFR)- definition, merits and demerits, computation and interpretation.

Growth Rate – Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR) – definition, merits and demerits, calculations of these measures and interpretation, difference between GRR and NRR. Simple numerical problems.

(15 Hours)

Unit IV. Measurement of Mortality:

Introduction of Mortality, Mortality rates – Crude Death Rate (CDR), Age Specific Death Rate (ASDR) and Standardized Death Rate (STDR) - Definition, uses, merits and demerits, Computation of these measures and interpretation, Infant mortality rate (IMR), Neo-Natal Mortality Rate (NNMR) and Maternal Mortality Rate (MMR) –

meaning and simple problems.
(10 Hours)

Unit V. Industrial Statistics:

Meaning of Statistical Quality Control and its uses and limitations. Causes of variations- chance causes and assignable causes with illustrations. Process and Product control with examples. Explanation of control chart and control limits, general procedure for drawing control charts (3-sigma limits). Types of control charts- control chart for variables -Construction of \bar{X} and R charts when standards are given and not given. Simple problems. Control charts for attributes – Fraction defective p-chart, No. of defectives np-chart, No. of defects per unit C – chart, and U – chart, Basis of construction. Simple numerical problems.

(15 Hours)

Books for Study :

- 1.Gani S.G. Sankhyshastra and Ganakayantra:
- 2.Gupta S.P., Fundamentals of Statistics, Himalaya Publishing House, Bombay
- 3.Gupta S.P., Statistical Methods, Himalaya Publishing House, Bombay

Books for Study

1. Gupta S P. and V K Kapoor Fundamentals of Applied Statistics, Sultan Chand, New Delhi.
2. Mukhopadhyay. P, Applied Statistics, New Central Book agency, Calcutta.

Skill Enhancement Course (SEC) under CBCS

B.A. Semester – VI

STATISTICS: SEC-AST- 1F

Statistics for Psychology and Education

Course Objectives: Students will obtain the basic skills required to conduct and interpret psychological research

Course Outcomes :

Students knows the methods used in psychology, apply their knowledge in data analysis

Unit I Introduction:

Scales of measurement, Scaling procedures: Scaling test items of difficulty, Scaling of test-scores in several tests.

(9 Hours)

Unit II Scaling :

Scaling of rankings in terms of Normal Probability curves. **(7**

Hours)

Unit III :Reliability of test :

Reliability of test scores, effect of test length and different ranges on reliability of a test. **(8**

Hours)

Unit IV Validity of test :

Validity of test scores, comparison between reliability and validity. **(6**

Hours)

Books for Study and Reference:

1. Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.
2. Gupta S.C. and Kapoor V.K., Fundamentals of Applied Statistics: Sultan Chand & Sons, New Delhi.
3. Mukhopadhyay P, Applied Statistics, New Central Book agency, Calcutta.
4. Kerlinger F. N., Foundation of Behavioral Research, Surjeet Publication, Delhi,

GENERIC ELECTIVE (GE 1F) IN APPLIED STATISTICS

B.A. Semester – VI

Quantitative Aptitude for Competitive Examinations

Course Objectives: Students will obtain the general skills required to Competitive Examinations..

Unit I Numerical Aptitude I:

Number Systems, Computation of Whole Numbers, Decimals and Fractions and relationship between Numbers, Fundamental arithmetical operations. (7 Marks)

Unit II Numerical Aptitude II:

Percentages, Ratios and Proportions, Average, interest, Profit and Loss, Discount use of Tables and Graphs Time and Distance, Ratio and Time, Time and Work. (8 Marks)

Unit III Reasoning and Mental Ability I:

Coding-Decoding, Symbol notations, Number Series, Analogy & Classification ,
Blood relations, Direction Sense, Liner arrangement. (7

Marks)

Unit IV Reasoning and Mental Ability II:

Ranking and Comparison, Input & output, Assumptions, Conclusion &
Inferences.

(8

Marks)

Books for Study and Reference :

1. Aggarwal R.S., Quantitative Aptitude: by, Publication by S, Chand
2. Ningappa A H ,Mental Ability: Ashok Publication



KARNATAK UNIVERSITY DHARWAD

KARNATAK UNIVERSITY, DHARWAD

B. A. Programme

SYLLABUS FOR

ELEMENTS OF MATHEMATICS AND STATISTICS

(OPTIONAL)

**AS DISCIPLINE SPECIFIC COURSE (DSC),
DISCIPLINE SPECIFIC ELECTIVE (DSE),
SKILL ENHANCEMENT COURSE (SEC) and**

GENERIC ELECTIVE (GE)

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from 2020-21

Regulations and Syllabus
For
ELEMENTS OF MATHEMATICS AND STATISTICS
In
Three Year B.A. Course (CBCS 2020-21)

Regulation and Scheme of Instructions:

Regulations for governing three years semester Under Graduate Programme of Karnatak University, Dharwad in Elements of Mathematics and Statistics optional subject with effect from academic year 2020-2021 and onwards.

I. Goals and Objectives:

The following aims have been kept in view while designing the syllabus of Under Graduate Programme (B.A.) in Elements of Mathematics and Statistics as one of the optional paper.

6. To create an aptitude and bring statistical awareness among the students.
7. To train promising learners to teach Elements of Mathematics and Statistics effectively at various level in the educational institutions.
8. To provide adequate Statistical knowledge and skills as required for the competitive examination.
9. To enrich and enhance analytical skill through Statistical techniques.

10. 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 Elements of Mathematics and Statistics as one of the optional subjects at the under graduate course. The other rules for admission are as per the Government and University 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:

3. The M.A/M.Sc./M.Stat. Master degree holders in Statistics or Mathematics can only teach Elements of Mathematics and Statistics optional subject at UG level.
4. Elements of Mathematics and 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, however students has to opt one among them. The duration of teaching hours will be 6 hours per week in each paper. The syllabus and teaching hours in each paper of all the semesters are equally shared by both subjects namely Mathematics and Statistics.

VI. Scheme of Examination:

1. Theory course shall carry 100 marks of which 80 marks allotted for semester end examination (40 marks for Mathematics and 40 marks for Statistics) and 20 marks for internal assessment (10 marks for Mathematics and 10 marks for Statistics) and half of the syllabus is Mathematics and remaining half of the syllabus is Statistics.
2. The semester end examination will be conducted by the University which will be of 3 hours duration and maximum 80 marks. The minimum passing marks in the examination is of 40 percent.
3. There shall be two Parts, one on Mathematics and other on Statistics in every question paper. Each part shall have 3 sections namely A, B and C. Section A will have 6 questions of each 2 marks and candidates have to solve 5 questions ($5 \times 2 = 10$ marks). Section B shall have 6 questions of each 5 marks and the candidate has to solve 4 questions only ($4 \times 5 = 20$ marks). Section C shall have 2 questions of each 10 marks and the candidate has to solve 1 question ($1 \times 10 = 10$ marks).

Annexure: 1 B: Programme structure: B.A.

Semester	*Core			Elective						Ability Enhancement Course						Total Credit
	DSC			**DSE			***GE			****SEC			AEC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	5+1+0	5+1=6										English-1	2+1+0	2+1=3	26
	DSC-2A	5+1+0	5+1=6										MIL-1	2+1+0	2+1=3	
	DSC-3A	5+1+0	5+1=6										ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	5+1+0	5+1=6										English-2	2+1+0	2+1=3	26
	DSC-2B	5+1+0	5+1=6										MIL-2	2+1+0	2+1=3	
	DSC-3B	5+1+0	5+1=6										CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	5+1+0	5+1=6										English-3	2+1+0	2+1=3	24
	DSC-2C	5+1+0	5+1=6										MIL-3	2+1+0	2+1=3	
	DSC-3C	5+1+0	5+1=6													
IV	DSC-1D	5+1+0	5+1=6										English-4	2+1=0	2+1=3	24
	DSC-2D	5+1+0	5+1=6										MIL-4	2+1=0	2+1=3	
	DSC-3D	5+1+0	5+1=6													
V				DSE-1E	5+1+0	5+1=6	GE-1E	2+0+0	2	SEC-1E	2+0+0	2				22
				DSE-2E	5+1+0	5+1=6										
				DSE-3E	5+1+0	5+1=6										
VI				DSE-1F	5+1+0	5+1=6	GE-1F	2+0+0	2	SEC-1F	2+0+0	2				22
				DSE-2F	5+1+0	5+1=6										
				DSE-3F	5+1+0	5+1=6										
TOTAL			72			36			4			4			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week

*If the core course is having practical. Hence, L+T+P = 4+0+2=6 credits (no tutorial for practical subject).

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

***GE shall be from other than the discipline.

**** SEC shall be from any one DSC and study one each in 5th and 6th semesters (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks (40 Sem. End exam +10 IA Exam) wherever applicable.

4. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

5. Environmental Science/Constitution of India/SEC/GE shall have 30 hrs syllabus/sem for 50 marks in theory/Practical(40 Sem. End exams+10IA Exam).

Karnatak University, Dharwad

CBCS syllabus for Under Graduate Programme in Elements of Mathematics and Statistics (Optional) as **DISCIPLINE SPECIFIC COURSE (DSC)**

Effective from 2020-21

Part A Structure: DSC

Sem	Course Code	Title of the Paper	Teaching Hrs Per week	Total Syllabus	Duration of Exam	Marks			Credits
						Sem Exam	IA	Total	
I	DSC (EMS A)	Progression, Straight Line and Basic Statistics	5+1 = 6 hrs	60	3 hrs	80	20	100	6
II	DSC (EMS B)	Partial Fractions, Trigonometric Functions and Univariate Data Analysis	5+1 = 6 hrs	60	3 hrs	80	20	100	6
III	DSC (EMS C)	Matrices, Differentiation, Probability and Distribution	5+1 = 6 hrs	60	3 hrs	80	20	100	6
IV	DSC (EMS D)	Determinants, Integration, Theory of Sampling and Demography	5+1 = 6 hrs	60	3 hrs	80	20	100	6
			24						24

Part B Structure: DSE

Sem	Course Code	Title of the Paper	Teaching Hrs Per week	Total Syllabus Hrs/	Duration of Exam	Marks			Credits
						Sem Exam	IA	Total	
V	DSE (EMS:P-I E)	Calculus, Sampling Distribution, Theory of Estimation and Testing of Hypothesis	5+1 = 6 hours	60	3 hrs	80	20	100	6
	DSE (EMS:P-II E)	Differential Calculus and Statistical Quality Control							
VI	DSE (EMS:P-I F)	Conic Section, Complex Number, Analysis of Variance and Designs of Experiments	5+1 = 6	60	3 hrs	80	20	100	6

	DSE (EMS:P-II F)	Differential Equations, Mathematical reasoning, Index Number, Correlation and Regression	hours						
Total			12 hours						12

Part C Structure: SEC

Sem	Course Code	Title of the Paper	Teaching Hours	Total Syllabus	Duration of Exam	Marks			Credits
V	SEC (EMS:1E)	Set Theory and Operations Research	2 hours	30	2 hours	40	10	50	2
VI	SEC (EMS:1F)	Number Theory and Time Series	2 hours	30	2 hours	40	10	50	2
Total			4 hours						4

Part D Structure: GE

Sem	Course Code	Title of the Paper	Teaching Hrs	Total Syllabus	Duration of Exam	Marks			Credits
V	GE 1E	Statistics for Competitive Examinations	2 hours	30	2 hours	40	10	50	2
VI	GE 1F	Quantitative Aptitude for Competitive Examinations	2 hours	30	2 hours	40	10	50	2
Total			4 hours						4

Overall Credits for Elements of Mathematics and Statistics (Optional) opted as DSC

Semester	Details of Structure	Total Marks	Total Credits
Semester I to semester IV	Part A	400	24
Semester V and VI	Part B	200	12
Semester V and VI	Part C	100	04

Semester V and VI	Part D	100	04
Course Total		800	44

KARNATAK UNIVERSITY, DHARWAD

DEPARTMENT OF STATISTICS

Discipline Specific Course (DSC) under CBCS

B.A Semester – I

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS A

Progression, Straight Line and Basic Statistics

SECTION 1 (MATHEMATICS)

Unit-I Logarithms and Progression :

Definition, Laws of logarithms, Change of base and Numerical problems. Brief recall of A.P. from earlier classes. Definition of G.P., H.P., nth term of G.P., H.P. Sum to n terms of G.P. (with proof)-problems. Sum to infinity to a G.P.-problems, A.M., G.M. and H.M. of two numbers and their relations-problems

(18 Hours)

Unit-II Straight Lines :

Brief recall of 2-D from earlier classes. Slope of a line, Slopes of parallel and perpendicular lines, Collinearity of two points and problems. Various forms of equations of a line

(12Hours)

SECTION 2 (STATISTICS)

Unit-III Introduction to Statistics and Basic Concepts:

Meaning, origin, definition, functions, limitations and applications of Statistics. Primary and secondary data, different methods of collection of primary data with merits and demerits. Sources of secondary data. Classification: meaning, objectives, types of classifications- Chronological, Geographical, Qualitative and Quantitative classifications with illustrations. Definition of some important terms - class, class limits, class intervals, width of class interval, open-end classes, inclusive and exclusive classes. Formation of discrete and continuous frequency distributions.

Tabulation: meaning, objectives and rules of tabulation, format of a statistical table and its parts. Types of table, examples of preparation of a blank table and tables with numerical information

(15 Hours)

Unit-IV 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 diagrams with simple illustrations.

Graphs: Types of Graphs – Histogram, frequency Polygon, frequency curve and Ogives, simple problems, location of mode, median and partition values from the graphs. Difference between diagrams and graphs.

(15 Hours)

Books for Study :

4. D.C. Pavate., Modern College Algebra, Macmillan and Co.
5. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
6. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
7. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga.

Books for Reference:

4. N. Rudraiah and Others: College Mathematics for B.Sc Series I and II SBS Publication Co. Bangalore.
5. Shanti Narayan, Analytical Solid Geometry-S. Chand & Co.
6. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
7. Mukhopadhyaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
8. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Discipline Specific Course (DSC) under CBCS

B.A Semester – II

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS B

Partial Fractions, Trigonometric Functions and Univariate Data Analysis

SECTION 1 (MATHEMATICS)

Unit-I Partial Fractions :

Rational

fractions, proper and improper fractions, Reduction of an improper fraction into a sum of a polynomial and a proper fraction-problems. Rules for resolving a proper fraction into partial fractions-problems
(10 Hours)

Unit-II Trigonometric Functions:

Recapitulation of basic Definitions of trigonometric functions. Signs of trigonometric functions and sketch of their graphs. Trigonometric functions of sum and difference of two angles. Trigonometric ratios of multiple angles(Simple problems)

(20 Hours)

SECTION 2 (STATISTICS)

Unit-III Measures of Central Tendency:

Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency : Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures.

Partition values-definition and types of partition values: 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. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.

(15 Hours)

Books for Study :

1. D.C. Pavate., Modern College Algebra, Macmillan and Co.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. N. Rudraiah and Others: College Mathematics for B.Sc Series I and II SBS Publication Co. Bangalore.

2. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay
3. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
4. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Matrices, Differentiation, Probability and Distributions

SECTION 1 (MATHEMATICS)

Unit-I. Matrices :

Types of matrices, Algebra of matrices-problems, Definitions and properties of symmetric and skew symmetric matrices **(10 Hours)**

Unit-II: Limits and derivatives :

Simple

inequalities. The concepts of limit and continuity of a function. The concept of derivatives. Rules for finding derivatives. Derivatives of algebraic, exponential and logarithmic functions from first principle- problems. Derivative of composite functions using chain rule, problems. Derivative of functions expressed in parametric forms and problems. **(20Hours)**

SECTION 2 (STATISTICS)

Unit-III: Elements of Probability:

Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems. Definition of a random variable, discrete & continuous random variable, probability mass function, probability density function, distribution function. Definition of mathematical expectation, expected mean and variance of discrete random variable. Properties of Mathematical expectation. Statement of addition and

multiplication theorem of expectation. Numerical problems on mathematical expectation.

(15 Hours)

Unit-IV: Probability Distributions:

Discrete distributions- Bernoulli, Binomial, Poisson, Hyper geometric distributions – definition, mean and variance of the distribution, simple problems.

Continuous distributions- Normal distribution and its properties. Simple illustrations.

(15 Hours)

Books for Study :

1. D.C.Pavate, Modern College Calculus, Macmillan and Co.
2. D.C.Pavate, Modern College Algebra, Macmillan and Co.
3. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
4. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
5. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
3. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
4. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
5. Gupta, S.C. and Kapoor, V.K.: Elements of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
6. Mukhopadhyaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

7. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi

Discipline Specific Course (DSC) under CBCS

B.A Semester – IV

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS D

Determinants, Integration, Theory of Sampling and Demography

SECTION 1 (MATHEMATICS)

Unit-I. Determinants : Properties of determinants, Minors and cofactors, Cramers Rule, Singular and non-singular matrices. Adjoint and Inverse of a matrix, Matrix method, Eigen Values. **(15 Hours)**

Unit-II. Integration : Concept of integration, Formulae of integration, Integration by partial fractions, Integration by parts, Fundamental Theorem of Calculus (without proof).

Definite integral: Definition, Basic properties of definite integrals and evaluation of definite integrals. **(15 Hours)**

SECTION 2 (STATISTICS)

Unit-III: 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, need for sampling, advantages of sampling over census survey, types of errors in sample survey-sampling errors and non-sampling errors, planning of sample survey and its execution. Methods of sampling- Simple random sampling, Stratified random sampling and Systematic random sampling.

(15 Hours)

Unit-IV: Demography:

Vital Statistics: Measurement of mortality: crude death rate, age specific death rates and standardized death rates, infant mortality rate, maternal mortality rate, neo-natal mortality rates, merits and demerits. Measurement of fertility: crude birth rate, general fertility rate, age specific fertility rate and total fertility rates, merits and demerits.

(15

Hours)

Books for Study :

1. D.C.Pavate, Modern College Calculus, Macmillan and Co.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
3. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
4. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
5. Gupta, S.C. and Kapoor, V.K.: Elements of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
6. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta
7. Gupta S P. and V K Kapoor Fundamentals of Applied Statistics, Sultan Chand, New Delhi

Discipline Specific Elective (DSE) under CBCS

B.A Semester – V

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS P-I E

Calculus, Sampling Distribution, Theory of Estimation and Testing of Hypothesis

SECTION 1 (MATHEMATICS)

Unit-I. Calculus I:

Functions of two variables. Partial derivatives of first and second order, Second order total differential. (15 Hours)

Unit-II Calculus II :

Maxima and minima of functions of two variables, Lagrange's multiplier method, Homogeneous function and Euler's, Theorem-problems. (15 Hours)

Unit-III. Sampling distribution and Theory of Estimation:

Definition of basic concepts : population, sample, parameter and statistic. Definition of a Random Sample, Sampling distribution of a Statistic along with examples Definition of standard

error, Standard error of mean, standard deviation, proportion, difference of means and difference of proportions. Uses of standard error and simple problems.

Definition of the terms – Estimator, Estimate, Point estimation and interval estimation. Meaning of confidence interval, confidence limits and confidence co-efficient with examples. Construction of 95% and 99% confidence intervals - mean, difference of means, proportion and difference of proportions for large samples only and their numerical problems on the construction of 95% and 99% confidence limits. **(10 Hours)**

Unit-IV. Testing of Hypothesis and Chi-Square Distribution :

Definition of terms – Statistical hypothesis, Simple hypothesis, Composite hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, critical region, size of the test and 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 two population means, test of significance of population proportion and test of significance of equality of two population populations.

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 and independence of attributes.

(20 Hours)

Books for Study :

1. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.

3. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
4. Gupta, S.C. and Kapoor, V.K.: Elements of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
5. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

B.A Semester – V

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS P-II E

Differential Calculus and Statistical Quality Control

Unit I Differential Calculus I : Differentiation in polar Co-ordinates, Angle between the radius vector and the tangent, Angle of intersection of curves (Polar form). Pedal equations. **(15 Hours)**

Unit II. Differential Calculus II : Points of inflexion, Concavity and convexity of curves, Curvature of plane curves, Formulae of radius of curvature in Cartesian, parametric and polar forms-Problems **(15 Hours)**

Unit III. Statistical Quality Control

Meaning of Statistical Quality Control and its uses and limitations. Causes of variations- chance causes and assignable causes with illustrations. Process and Product control with examples. Explanation of control chart and control limits, general procedure for drawing control charts (3-sigma limits). **(10 Hours)**

Unit IV. Control Charts for Variable and Attributes

Types of control charts- control chart for variables -Construction of \bar{X} and R charts when standards are given and not given. Simple problems. Control charts for attributes – Fraction defective p-chart, No. of defectives np-chart, No. of defects per unit C – chart, and U – chart, basis of construction. Simple numerical problems.

(20 Hours)

Books for Study :

1. N. Rudraiah and Others: College Mathematics for B.Sc Series I and II SBS Publication Co. Bangalore.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
4. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

SKILL ENHANCEMENT COURSE (SEC)
ELEMENTS OF MATHEMATICS AND STATISTICS

B.A Semester – V

Set Theory and Operations Research : EMS I E

Unit I Sets :

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. (**8 Hours**)

Unit II Operations of Sets :

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations.

(7 Hours)

Unit-III Linear Programming Problem :

Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Definition 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. (**8 Hours**)

Unit-IV Transportation and Assignment Problem :

Introduction, definition of Transportation Problem (TP), balanced and unbalanced TP. Feasible solution, basic solution, basic feasible solution, degenerate solution, non-degenerate solution and optimal solution. Methods of finding initial basic feasible solution-North West Corner Rule, Matrix Minima method (lowest cost entry method) and Vogel's approximation method (Unit cost penalty method) and simple problems.

Introduction and definition of Assignment problem, mathematical model, balanced and unbalanced assignment problem, Hungarian method of solving an AP, Distinction between

Transportation Problem & Assignment Problem. Simple numerical problems on assignment.

(7 Hours)

Books for Study :

1. Grimaldi R.P., Discrete Mathematics and Combinatorial Mathematics, Pearson Education.
2. Kamke E., Theory of Sets, Dover Publishers, 1950.
3. Kanti Swarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.
4. Gupta, P.K. and Hira, D.S.: Operations Research, S. Chand & Company Ltd., New Delhi.
5. Gupta, R.K.: Operations Research, Krishna Prakashana Mandir, Meerut.
6. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Books for Reference:

1. Rudraiah N. and Others: College Mathematics for B.Sc Series I and II –SBS Publication co. Bangalore.
2. Sharma, S.D.: Operations Research, Kedarnath Ramnath & Co. Publishers, Meerut.
3. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.
4. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi

GENERIC ELECTIVE (GE 1E)

B.A. Semester – V

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS I E

Statistics for Competitive Examinations

Course Objectives: Students will obtain the general skills required to Competitive Examinations..

Unit I Numerical Aptitude I: Number Systems, Computation of Whole Numbers, Decimals and Fractions and relationship between Numbers, Fundamental arithmetical operations. **(7 hours)**

Unit II Numerical Aptitude II: Percentages, Ratios and Proportions, Average, interest, Profit and Loss, Discount use of Tables and Graphs Time and Distance ,Ratio and Time, Time and Work. **(8 hours)**

Unit III Reasoning and Mental Ability I: Coding- Decoding, Symbol notations, Number Series, Analogy & Classification, Blood relations, Direction Sense, Linear arrangement. **(7 hours)**

Unit IV Reasoning and Mental Ability II: Ranking and Comparison, Input & out put, Assumptions, Conclusion & Inferences.

(8 hours)

Books for Reference:

3. Aggarwal R.S., Quantitative Aptitude: by, Publication by S, Chand

4. Ningappa A H ,Mental Ability: Ashok Publication

Discipline Specific Elective (DSE) under CBCS

B.A Semester – VI

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS P-I F

Conic Section, Complex Number, Analysis of Variance and Designs of Experiments

Unit I Conic Section :

Standard

forms of the equations to Parabola, Ellipse and Hyperbola to determine the equation when focus, directrix are given and determine the focus, directrix, eccentricity etc. when the equation of the conic is given (simple problems). Equation of tangent and normal.

(15 Hours)

Unit II Complex Numbers :

Polar representation of complex numbers. Algebra of complex numbers. DeMoivre's Theorem with proof .Simple Problems on cube roots of a complex number and argand diagram.

(15 Hours)

Unit-III. Analysis of Variance:

Definition of analysis of variance and its basic assumptions. 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 component sum of squares, degrees of freedom and ANOVA table. Simple numerical problems one-way classified data.

Analysis of variance for two way classification –

definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various component sum of squares. Degrees of freedom and ANOVA table. Simple numerical problems on two way classified data. **(15 Hours)**

Unit-IV. Design of Experiments

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

Introduction and definition of Randomized Block Design (RBD), layout, linear mathematical model, assumptions, statistical hypothesis, splitting up of total sum of squares into various component sum of squares, degree of freedom, and ANOVA table. Merits and demerits of RBD. Applications of RBD. Comparison between CRD and RBD. Simple problems.

(15 Hours)

Books for Study :

1. Shanti Narayan, Analytical Solid Geometry-S.Chand& Co.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. Gupta S. P., Statistical Methods, **Himalaya Publishing House, Bombay.**
2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

Discipline Specific Elective (DSE) under CBCS

B.A Semester – VI

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS P-II F

**Differential Equations, Mathematical reasoning, Index Number, Correlation
and Regression**

Unit I. Differential Equations : Differential Equations and their formulation. Solution of Differential Equations of the first order and first degree. Homogeneous, Non-homogeneous, exact, linear and Bernoulli's equations. Simple equations of the first order and higher degree. Equations solvable for P, x, y . Clairaut's equations, Linear differential equations of the n th order with constant coefficients. Particular Integral when the RHS is of the form e^{ax} , $\sin ax$, $\cos ax$ and x^n .

(25 Hours)

Unit II MATHEMATICAL REASONING: Definition of proposition and problems,

Logical connectives, compound proposition, problems, Quantifiers, negation, consequences of implication-contrapositive and converse-problems. **(5 Hours)**

Unit-III. Index Numbers:

Definition, uses and limitations of index numbers. Problems involved in the construction of index numbers, methods of constructing index numbers of price and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests of a consistency 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.

Consumer price index number: Problems involved in the construction of cost of living index number, uses, advantages and limitations, method of aggregative expenditure method and family budget method for the construction of consumer price index numbers.

(15 Hours)

Unit-IV Correlation and Regression:

Definition and meaning of correlation, types of correlation- positive, negative, linear and non-linear correlation with examples. Uses of correlation. Methods of studying correlation- Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's Rank correlation coefficient. Properties of Karl Pearson coefficient of correlation. Simple problems based on ungrouped data.

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.

(15 Hours)

Books for Study :

1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education,1998.

2. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
3. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
4. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
5. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga

Books for Reference:

1. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
2. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
3. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

ELEMENTS OF MATHEMATICS AND STATISTICS : EMS I F

B.A Semester – VI

Number Theory and Time Series

Unit I Basic Properties of Number Theory:

Definition of divisibility, properties of divisibility, GCD, The Euclidean Algorithm, Congruence, Fundamental theorem of arithmetic. **(7 hours)**

Unit II Standard Results in Number Theory

Euler's function. Number of positive divisors and their sum, Fermat's and Wilson's theorems. **(8 Hours)**

Unit III Introduction and Measurement of 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. **(5 Hours)**

Unit III least square method of Fitting trend :

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. **(10 hours)**

Books for Study :

1. David M. Burton, Elementary Number Theory 6th Ed., Tata McGraw-Hill Edition, Indian reprint, 2007.
2. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
3. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
4. Gudaganavar S. V., Gudaganavar N. V. and Gudaganavar R. S., Business Statistics, Anupama Publication, Ramadurga.

Books for Reference:

1. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.
2. Rudraiah N. and Others: College Mathematics for B.Sc Series I and II –SBS Publication Co. Bangalore
3. Gupta S. P., Statistical Methods, Himalaya Publishing House, Bombay.
4. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

GENERIC ELECTIVE (GE)

B.A. Semester – VI

Quantitative Aptitude for Competitive Examinations

Course Objectives: Students will obtain the general skills required to Competitive Examinations..

Unit I Numerical Aptitude I: Number Systems, Computation of Whole Numbers, Decimals and Fractions and relationship between Numbers, Fundamental arithmetical operations. **(7 Marks)**

Unit II Numerical Aptitude II: Percentages, Ratios and Proportions, Average, interest, Profit and Loss, Discount use of Tables and Graphs Time and Distance ,Ratio and Time, Time and Work. **(8 Marks)**

Unit III Reasoning and Mental Ability I: Coding-Decoding,Symbol notations, Number Series,Analogy & Classification , Blood relations, Direction Sense, Liner arrangement. **(7 Marks)**

Unit IV Reasoning and Mental Ability II: Ranking and Comparison, Input & output, Assumptions, Conclusion & Inferences. **(8 Marks)**

Books for Reference:

1. Aggarwal R.S., Quantitative Aptitude: Publication by S, Chand
2. Ningappa A H, Mental Ability: Ashok Publication

