GENERIC ELECTIVE COURSE IN STATISTICS/DISCIPLINE SPECIFIC CORE COURSE IN STATISTICS

STATISTICS-GE-101: Descriptive Statistics and Probability /STATISTICS-DSC-101: Descriptive Statistics and Probability Theory
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The emphasis of course is on descriptive statistics. It gives an idea about the various statistical methods, measures of central tendency, correlation and basis of probability.

Unit I
Concepts of a statistical population and sample from a population, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and by diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods).

Unit II
Measures of location (or central tendency) and dispersion, moments, measures of skewness and kurtosis, cumulants.

Unit III
Bivariate data: Scatter diagram, principle of least-square and fitting of polynomials and exponential curves. Correlation and regression. Karl Pearson coefficient of correlation, Lines of regression, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only and without derivation).

Unit IV
Random experiment, sample point and sample space, event, algebra of events, Definition of Probability - classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given).

Unit V
Theorems on probability, conditional probability, independent events. Bayes' theorem and its applications.

SUGGESTED READINGS:

1. J.E. Freund (2009): *Mathematical Statistics with Applications*, 7th Ed., Pearson Education.

2. A.M. Goon, M.K. Gupta and B. Dasgupta (2005): *Fundamentals of Statistics*, Vol. I, 8th Ed., World Press, Kolkatta.
3. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
4. R.V. Hogg, A.T. Craig and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed., Pearson Education.
5. A.M. Mood, F.A. Graybill and D.C. Boes (2007): *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw Hill Publication.

STATISTICS-GE-101 LAB: Descriptive Statistics and Probability /STATISTICS-DSC-101 LAB: Descriptive Statistics and Probability Theory
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of descriptive statistics.

List of Practicals

1. Problems based on graphical representation of data: Histograms (equal class intervals and unequal class intervals), Frequency polygon, Ogive curve.
2. Problems based on measures of central tendency using raw data, grouped data and for change of origin and scale.
3. Problems based on measures of dispersion using raw data, grouped data and for change of origin and scale.
4. Problems based on combined mean and variance and coefficient of variation
5. Problems based on Moments using raw data, grouped data and for change of origin and scale.
6. Relationships between moments about origin and central moments
7. Problems based on Skewness and kurtosis
8. Karl Pearson correlation coefficient (with/ without change of scale and origin).
9. Lines of regression, angle between lines and estimated values of variables
10. Lines of regression and regression coefficients
11. Spearman rank correlation with /without ties
12. Fitting of polynomials and exponential curves

STATISTICS-GE-201: Statistical Methods /STATISTICS-DSC-201: Statistical Methods
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The course emphasizes on random variables, moments, and cumulant generating functions, bivariate probability distributions and limit theorems.

Unit I
Random variables: Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations of random variables and its properties, expectation of random variable and its properties.

Unit II
Moments and cumulants, moment generating function, cumulants generating function and characteristic function.

Unit III
Bivariate probability distributions, marginal and conditional distributions; independence of variates (only general idea to be given). Transformation in univariate and bivariate distributions.

Unit IV
Probability Distributions: Binomial, Poisson, Normal, Exponential.

Unit V
Chebychev's inequality, WLLN, Bernoulli's law of large number, Central limit theorem (CLT) (statements only).

SUGGESTED READINGS:

1. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
3. R.V. Hogg, A.T. Craig, and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed. Pearson Education.
4. V.K. Rohtagi and A.K. Md. E. Saleh (2009): *An Introduction to Probablity and Statistics*, 2nd Edition, John Wiley and Sons.
5. S.A. Ross (2007): *Introduction to Probability Models*, 9th Ed., Academic Press.

STATISTICS-GE-201 LAB: Statistical Methods /STATISTICS-DSC-201 LAB: Statistical Methods
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of probability distributions.

List of Practicals

1. Fitting of binomial distributions for n and p = q = ½ and for n and p given.
2. Fitting of binomial distributions computing mean and variance
3. Fitting of Poisson distributions for give n and λ and after estimating mean.
4. Fitting of Suitable distribution
5. Application Problems based on Binomial distribution
6. Application problems based on Poisson distribution
7. Problems based on Area property of normal distribution
8. Application based problems based on normal distribution
9. Fitting of normal distribution when parameters are given/ not given.

STATISTICS-GE-301: Statistical Inference / STATISTICS-DSC-301: Statistical Inference
(Credits: 04)

Contact Hours: 60

Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]

Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The emphasis of course is on sampling distributions, large sample tests and method of estimation.

Unit I

Definitions of random sample, parameter and statistic, null and alternative hypotheses, simple and composite hypotheses, level of significance and probabilities of Type I and Type II errors, power of a test and critical region (definition only).

Unit II

Sampling distribution of a statistic, sampling distribution of sample mean, standard error of sample mean. Large sample tests for single mean, difference of means**,** standard deviation and difference of standard deviations.

Unit III

Sampling distributions of chi-square, t and F: definitions, properties and relationships between them. Tests of Significance based on Chi-square (goodness of fit and independence of attributes), t- distribution and F- distribution.

Unit IV

Estimation: Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency, sufficiency, Minimum variance unbiased estimators.

Unit V

Cramer-Rao inequality: statement only, Methods of estimation: maximum likelihood. Concept of confidence interval. Neyman-Pearson lemma: statement and proof.

SUGGESTED READINGS:

1. G. Casella and R.L. Berger (2002): *Statistical Inference*, 2nd Ed., Thomson Duxbury.
2. E.J. Dudewicz and S.N. Mishra (1988):*Modern Mathematical Statistics*, John Wiley and Sons.
3. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An Outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.
4. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
5. R.V. Hogg, A.T. Craig and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed. Pearson Education.
6. V.K. Rohtagi and A.K. Md. E. Saleh (2009): *An Introduction to Probablity and Statistics*, 2nd Ed., John Wiley and Sons.

STATISTICS-GE-301 LAB: Statistical Inference / STATISTICS-DSC-301 LAB: Statistical Inference
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of large sample tests, testing goodness of fit and method of estimation.

List of Practicals

1. Large Sample Tests (Based on normal distribution)
2. Testing of goodness of fit
3. Testing of independence of attributes based on 2 X 2 contingency table
4. Testing of equality of two populations variances
5. Applying the paired t-test for difference of means
6. Maximum Likelihood Estimation
7. Confidence interval for difference of population means
8. Type I and Type II errors

STATISTICS-GE-401: Sample Surveys and Design of Experiments / STATISTICS-DSC-401: Sample Surveys and Design of Experiments
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The emphasis of course is based on the concept of sample survey and design of experiments.

Unit I
Sample Surveys: Basic concepts of sample survey: concept of sampling, need for sampling, complete enumeration v/s. sampling, principles of sampling theory, principal steps in a sample surveys, planning and organization of a sample survey, sampling and non-sampling errors.

Unit II
Simple random sampling (srswr and srswor): definition and procedures of selecting a sample, properties of simple random sample, estimation of mean and sampling variance of sample mean.
Stratified random sampling: introduction, estimation of population mean and its variance, choice of sample sizes in different strata, comparison of stratified sampling under proportional and Neyman allocation with SRSWOR in terms of precision.

Unit III
Systematic sampling: introduction to linear systematic sampling, estimation of sample mean and its variance (N=nk).
Analysis of variance: one-way and two-way classified data with one observation per cell only.

Unit IV
Design of experiments: Principles of Design of experiments, uniformity trails, completely randomized, Randomized block and Latin square designs. Missing plot technique (for one missing observation in RBD and LSD), 2^2 and 2^3 Factorial experiments: construction and analysis.

Unit V
Indian Official Statistics: Present Official Statistical System in India relating to census of population; methods of collection of official statistics, major publications. Agencies responsible for the data collection- C.S.O., N.S.S.O.

REFERENCES:

1. A.M. Goon, M.K. Gupta, and B. Dasgupta (2005): *Fundamentals of Statistics* (Vol. II), 8th Ed., World Press, Kolkata.
2. A.M. Goon, M.K. Gupta and B. Dasgupta (2005): *An Outline of Statistical Theory* (Vol. II), 3rd Ed., World Press, Kolkata.

3. S.C. Gupta and V.K. Kapoor, *Fundamentals of Applied Statistics*, 4th Ed., Sultan Chand and Sons, 2008.
4. D.C. Montgomery (2001): *Designs and Analysis of Experiments*, John Wiley and Sons, New York.
5. P. Mukhopadhyay (1998): *Theory and Methods of Surveys Sampling*, Prentice Hall of India.
6. P.V. Sukhatme, B.V. Sukhatme, S. Sukhatme and C. Ashok (1984): *Sampling Theory of Surveys with Applications*, Lowa State University Press, Lowa, USA.
7. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi. http://mospi.nic.in/

STATISTICS-GE-401 LAB: Sample Surveys and Design of Experiments / STATISTICS-DSC-401 LAB: Sample Surveys and Design of Experiments
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of survey sampling and design of experiments.

List of Practicals

1. To select a SRS with and without replacement
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by wr and wor and establish all properties relative to SRS
3. For srswor, estimate mean, standard error, the sample size
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS
5. Estimation of gain in precision in stratified sampling
6. Analysis of an one way/ two way ANOVA
7. Analysis of CRD, RBD.
8. Analysis of an LSD.
9. Analysis of an RBD with one missing observation
10. Analysis of an LSD with one missing observation
11. Analysis of 2^2 and2^3 factorial in RBD

DISCIPLINE SPECIFIC ELECTIVE COURSE IN STATISTICS

STATISTICS - DSE-501: Time Series Analysis
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

This paper emphasis on time series analysis

UNIT I
Introduction to times series data, application of time series from various fields, Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve (Method of least square)

UNIT II
Trend Cont.: Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend.

UNIT III
Seasonal Component cont: Ratio to Moving Averages and Link Relative method, Deseasonalization. Cyclic Component: Harmonic Analysis

UNIT IV
Some Special Processes: Moving average (MA) process and Autoregressive (AR) process of orders one and two. Fitting of Growth Curves.

UNIT V
Random Component: Variate component method. Forecasting: Exponential smoothing methods. Stationary Time series: Weak stationarity, autocorrelation function and correlogram of moving average.

SUGGESTED READING:

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
3. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

STATISTICS- DSE-501 LAB: Time Series Analysis
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of time series analysis.

List of Practicals

1. Fitting and plotting of modified exponential curve
2. Fitting and plotting of logistic curve
3. Fitting of trend by Moving Average Method
4. Measurement of Seasonal indices Ratio-to-Trend method
5. Measurement of Seasonal indices Ratio-to-Moving Average method
6. Measurement of seasonal indices Link Relative method

STATISTICS- DSE-502: Demography and Vital Statistics
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

This paper emphasizes on sources of collecting data on vital statistics and measurements of Fertility.

UNIT I
Population Theories: Coverage and content errors in demographic data, use of balancing equations. Population composition, dependency ratio, Sex ratio and its implication on a population.

UNIT II
Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

UNIT III
Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life(Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables.

UNIT IV
Abridged Life Tables; Concept and construction of abridged life tables by Reed-Merrell method.
Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR).

UNIT V
Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READING:

1. Mukhopadhyay P. (1999): Applied Statistics, Books and Allied (P) Ltd.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
5. Keyfitz N., Beckman John A.: Demography through Problems S-Verlag New York.

STATISTICS-DSE-502 LAB: Demography and Vital Statistics
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical on vital statistics.

List of Practicals

1. To calculate CDR and Age Specific death rate for a given set of data
2. To find Standardized death rate by:- (i) Direct method (ii) Indirect method
3. To construct a complete life table
4. To fill in the missing entries in a life table
5. To calculate probabilities of death at pivotal ages and use it construct abridged life table using Reed-Merrell Method
6. To calculate CBR, GFR, SFR, TFR for a given set of data
7. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set of data
8. Calculate GRR and NRR for a given set of data and compare them

STATISTICS- DSE-601: Econometrics
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The emphasis of course is on concept of econometrics.

UNIT I
Introduction: Objective behind building econometric models, nature of econometrics, model building, role of econometrics, structural and reduced forms. General linear model (GLM).

UNIT II
Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, tests and solutions of multicollinearity.

UNIT III
Generalized least squares estimation, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection of autocorrelation.

UNIT IV
Heteroscedastic disturbances: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity.

UNIT V
Tests and solutions of heteroscedasticity. Autoregressive and moving average models, Dummy variables.

SUGGESTED READING:

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Companies. Edition, McGraw-Hill
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Limited, Edition, Palgrave Macmillan
4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Wiley & Sons.

STATISTICS-DSE-601 LAB: Econometrics
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of econometrics.

List of Practicals

1. Testing of parameters of General linear model
2. Forecasting of General linear model
3. Problems related to consequences of Multicollinearity
4. Problems related to consequences of Autocorrelation (AR(I))
5. Estimation of problems of General linear model under Autocorrelation
6. Problems related to consequences Heteroscedasticity
7. Diagnostics of Heteroscedasticity
8. Estimation of problems of General linear model under Heteroscedastic distance terms
9. Problems related to General linear model under (Aitken Estimation)

STATISTICS- DSE-602(A): Operations Research
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

This paper is based on Introduction to Operations Research, Transportation Problem, game theory and inventory management.

UNIT I
Introduction to Operations Research, phases of O.R. Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex method for solving L.P.P.

UNIT II
Charne's M-technique for solving L.P.P. involving artificial variables. Concept of Duality in L.P.P: Dual simplex method.

UNIT III
Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution. Assignment problem: Hungarian method to find optimal assignment.

UNIT IV
Game theory: Rectangular game, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix
Networking: CPM and PERT.

UNIT V
Inventory Management: ABC inventory system, characteristics of inventory system. EOQ Model and its variations, with and without shortages.

SUGGESTED READING:

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Hall of India. Edition, Prentice
2. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications
4. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research-Concepts and cases, 9th Edition, Tata McGraw Hill

STATISTICS- DSE-602(A) LAB: Operations Research
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical of Operations Research, Transportation Problem, game theory and inventory management.

List of Practicals

1. Mathematical formulation of L.P.P and solving the problem using graphical method, Simplex technique and Charne's Big M method involving artificial variables.
2. Allocation problem using Transportation model
3. Allocation problem using Assignment model
4. Networking problem using CPM and PERT
5. Problems based on game matrix using Graphical solution to rectangular game

STATISTICS- DSE-602(B): Project Work
(Credits: 06)

Full marks= 100 [End Semester Exam (70) + CCA (30)]
Pass Marks= 40 [End Semester Exam (28) + CCA (12)]
Contact Hours: 90

The emphasis of the paper is on project work.

Objective: The aim of the course is to initiate students to write and present a statistical report, under the supervision of a faculty, on some area of human interest. The project work will provide hands on training to the students to deal with data emanating from some real life situation and propel them to dwell on some theory or relate it to some theoretical concepts.

SKILL ENHANCEMENT COURSE IN STATISTICS

STATISTICS- SEC-301: Statistical Data Analysis Using Software Packages/using R

(Credits: 04)

Contact Hours: 60

Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]

Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

This course will review and expand upon core topics in statistics and probability, particularly by initiating the beneficiaries of the course to R for statistical computing.

UNIT I

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

UNIT II

Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.

UNIT III

Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

UNIT IV

Simple analysis and create and manage statistical analysis projects, import data, code editing and data cleaning.

UNIT V

Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

SUGGESTED READING:

1. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York
3. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics, W.H. Freeman
4. Cunningham, B.J (2012):Using SPSS: An Interactive Hands-on approach
5. Cho, M,J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman and Hall/CRC

STATISTICS- SEC-401: Statistical Techniques for Research Methods
(Credits: 04)

Contact Hours: 60

Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]

Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies. The course aims at enabling students understand basic concepts and aspects related to research, data collection, analyses and interpretation.

UNIT I

Introduction: Meaning, objective and motivation in research, types of research, research approach, significance of research. Research problems: definition, selection and necessity of research problems.

UNIT II

Review of literature, identifying research gaps, framing of objectives of the survey, research questions and research hypothesis, framing of questionnaire, need of Pilot survey and its implications of its result

UNIT III

Survey Methodology and Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.

UNIT IV

Processing, Data Analysis and Interpretation: Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

UNIT V

Develop a questionnaire, collect survey data pertaining to a research problem (such as (not limited to) gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), interpret the results and draw inferences.

SUGGESTED READING:

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.

DISCIPLINE SPECIFIC ELECTIVE COURSE IN STATISTICS

STATISTICS-DSE-501: Vital Statistics
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]
(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

This paper emphasis on population theories, source of data collection on vital statistics and measurements of Fertility.

Unit I
Population Theories: Coverage and content errors in demographic data, use of balancing equations, Population composition, dependency ratio.

Unit II
Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

Unit III
Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life (Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables.

Unit IV
Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR).

Unit V
Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READINGS:

1. P. Mukhopadhyay (1999): Applied Statistics, Books and Allied (P) Ltd.
2. A.M. Goon, M.K. Gupta and B. Dasgupta (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. S. Biswas (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. Fredrick E. Croxton, Dudley J.Cowden, and S. Klein (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
5. N. Keyfitz and John A. Beckman ( ):Demogrphy through Problems S-Verlag New York.

STATISTICS-DSE-501 LAB: Vital Statistics
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical on vital statistics.

List of Practicals

1. To calculate CDR and Age Specific death rate for a given set of data
2. To find Standardized death rate by:- (i) Direct method (ii) Indirect method
3. To construct a complete life table
4. To fill in the missing entries in a life table
5. To calculate CBR, GFR, SFR, TFR for a given set of data
6. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set of data
7. Calculate GRR and NRR for a given set of data and compare them

STATISTICS-DSE-601: Index Number and Time Series Analysis

(Credits: 04)

Contact Hours: 60

Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]

Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Four questions of 5 marks each will be set from each unit, two questions need to be answered from each unit)

The course emphasizes on definition and construction of index numbers. The paper also introduces the concept of time series analysis.

Unit I

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher.

Unit II

Factor reversal and time reversal tests. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

Unit III

Introduction to times series data, application of time series from various fields. Components of a times series, Decomposition of time series.

Unit IV

Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve. Method of moving averages.

Unit V

Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend. Ratio to Moving Averages and Link Relative method.

REFERENCES:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Gupta, S.C. and Kapoor, V. K. (2008): Fundamentals of Applied Statistics, 4th Ed. (reprint), Sultan Chand and Sons.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Kendall M.G. (1976): Time Series, Charles Griffin.
5. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
6. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied.

STATISTICS-DSE-601 LAB: Index Number and Time Series Analysis
(Credits: 02)

Full marks= 30 [End Semester (30)]
Pass Marks= 12 [End Semester (12)]
Contact Hours: 30

This paper is based on practical on index numbers and time series.

LIST OF PRACTICALS:

1. Calculate price and quantity index numbers using Laspeyre's, Paasche's, Marshall-Edgeworth and Fisher's formulae
2. To calculate the Chain Base index numbers for a given series of Fixed Base index numbers and show that the two are same
3. To compute Chain Base index numbers for a given set of data
4. To convert the Chain Base index numbers to Fixed Base index numbers
5. Fitting of trend by Moving Average Method (for n even and n odd)
6. Measurement of Seasonal indices Ratio-to-Trend method
7. Measurement of Seasonal indices Ratio-to-Moving Average method
8. Measurement of seasonal indices Link Relative method

SKILL ENHANCEMENT COURSE IN STATISTICS

STATISTICS-SEC-301: Statistical Computing using C
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

This course will review and expand upon core topics in statistics and probability, particularly by initiating the beneficiaries of the course to C programming for statistical computing.

Unit I
C language: Structure of C program. Data type: Basic data types, Enumerated data types, Derived data types. Variable Declaration, Assignment of variables. Numeric, Character, real and string constants.

Unit II
Different type of operators and expressions, Basic input/output. Standard header files, Library functions. String functions.

Unit III
Conditional statements, if...else, Nesting of if....else, elseif ladder, switch statements, Loops in C: for, while, do... while loops. break, continue, exit( ), goto and label declarations.

Unit IV
Arrays, Functions, classification of functions, functions definition and declaration, assessing a function, return statement. Parameter Passing in functions, recursion in Functions.

Unit V
Programs in C should be based on computational techniques in Statistics.

REFERENCES:

1. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
2. Forouzan, B.A. and Gilberg, R.F. (2007): Computer Science – A Structured Programming Approach Using C. (3rd Edition). Thompson Course Technology
3. Gottfried, B.S. (1996): Schaum's Outline of Programming with C, 2nd Edition, McGraw Hill.
4. Kanetakar, Y. (2008): Let us C, BPB Publications.

STATISTICS-SEC-401: Statistical Data Analysis using R
(Credits: 04)

Contact Hours: 60

Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]

Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

This course will review and expand upon core topics in statistics and probability, particularly by initiating the beneficiaries of the course to R for statistical computing.

This course will review topics in probability and statistics studied in core for data analysis. Introduction to R for statistical computing, analysis and graphical interpretation would be done using software skills. The following problems can be done using the statistical software to enhance data analysis skills using software.

Unit I
Graphical representation of data by histograms, frequency polygon, Pie chart, ogives, boxplot and stem-leaf.

Unit II
Measures of central tendency, dispersion, measures of skewness and kurtosis.

Unit III
Fitting of polynomials, exponential curves and plotting of probability distributions.

Unit IV
Correlation and regression. Test of significance (t and F tests).

Unit V
Random number generation, ANOVA both one way and two way.

REFERENCES:

1. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York.

STATISTICS-SEC-501: Statistical Techniques for Research Methods
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies. The course aims at enabling students understand basic concepts and aspects related to research, data collection, analyses and interpretation.

Unit I
Introduction: meaning, objection and motivation in research, types of research, research approach, significance of research. Research problems: Definition, selection and necessity of research problems, techniques in defining a research problem.

Unit II
Survey methodology and data collection: introduction, inference and error in surveys, the target populations, sampling frames and coverage error,

Unit III
Methods of data collection, nonresponse, questions and answers in surveys, sample size determination.

Unit IV
Data analysis and interpretation: review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation,

Unit V
Data presentation and data cleaning
Report writing: layout of a research report, characteristics of a good research report.

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.

STATISTICS-SEC-601: Data Analysis using Software (SPSS or Microsoft Excel)
(Credits: 04)

Contact Hours: 60
Full Marks = 70 **[**End Semester Exam (50) + CCA (20)]
Pass Marks = 28 **[**End Semester Exam (20) + CCA (8)]

(Two questions of one mark each and two questions of two marks each from each unit to be answered without any alternative. Two questions of four marks each will be set from each unit and one question needs to be answered from each unit.)

This course will review topics in probability and statistics studied in core for data analysis. Introduction to SPSS/Excel for statistical computing, analysis and graphical interpretation would be done using software skills. The following problems can be done on the statistical software to enhance data analysis skills using software.

Unit I
Data view, variable view, data coding, data manipulation, graphical representation of data by histograms, frequency polygon, Pie chart, ogives, boxplot and line diagram.

Unit II
Measures of central tendency, dispersion, Measures of location, Measures of skewness and kurtosis

Unit III
Fitting of polynomials, exponential curves and plotting of probability distributions.

Unit IV
Correlation and regression. Test of significance (t and F tests)

Unit V
Chi square test, Analysis of variance (both one and two way)

REFERENCES:

1. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics, W.H. Freeman
2. Cunningham, B.J (2012):Using SPSS: An Interactive Hands-on approach
3. Levine D M, Berenson M L, and Krehbiel T C (2008) Statistics for Managers Using Microsoft Excel, Fifth Edition, Published by Prentice Hall.
4. Bhattacharjee D. (2010) Practical Statistics Using Microsoft Excel, Asian Books, New Delhi