MANGALORE UNIVERSITY

Office of the Registrar
Mangalagangothri – 574 199

No.: MU/ACC/CR.28/SLB(Stat)/2012-13/A2 Date: 22.04.2013

NOTIFICATION

Sub: Revised Syllabus of Statistics, optional subject for B.Sc. degree programme.
Ref: Academic Council decision No.3:15 (2012) dated 22.12.2012.

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The revised Syllabus of Statistics, optional subject for B.Sc. degree programme, which was approved by the Academic Council at its meeting held on 22.12.2012, is hereby notified for implementation with effect from the academic year 2013-14.

REGISTRAR.

To:

1) The Principals of the Colleges concerned.
2) The Registrar (Evaluation), Mangalore University.
3) The Chairman, UG BOS in Statistics, Mangalore University.
4) The Superintendent (ACC), O/o the Registrar, Mangalore University.
5) Guard File.
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Revised syllabus for Statistics optional subject in B. Sc., Mangalore University

PREAMBLE

The credit based semester scheme introduced for under graduate courses of Mangalore University in the year 2006-07. The board felt that a revision in the B.Sc. curriculum is needed and time is appropriate now. It is felt that the syllabi should cover the core topics of the subject in the first four semesters and provide the students with adequate knowledge of the subject. In the fifth and sixth semesters along with the core topics, it is proposed to introduce electives on diverse fields of applications of statistics in the meeting to be held in the next year.

We propose to introduce an elective paper on official statistics. The teachers teaching statistics at the under graduate colleges feel that the same scheme of instruction could be maintained where as some changes in the pattern of questions could be considered for the benefit of students. The following question paper pattern is proposed.

With regard to the practical examination it was suggested to have the question paper pattern and the method of conducting the practical examinations same as the existing system. (one internal and one external examiner from the approved list of examiners of Statistics)

There is no change in the scheme and course pattern.

Theory question paper pattern:

1. Part A

   Answer any ten of the following. 2x10=20

   (Three questions from each unit. Total number of questions to be asked is 12)

2 Part B

   Answer any five questions of the following. 5x6=30

   (Two questions from each unit. Total number of questions=8)

3 Part C

   Answer any three of the following 10x3=30

   (Part C can have sub questions like a and b.)

Practical question papers pattern:

One question should be asked from each of exercise. Students shall answer any four questions carrying equal marks.

Scheme of Instruction and Examination: B.Sc. Statistics Optional Subject

Sem Ester	Title of the Paper	Hrs. Of Instruction	Duration of Exam	Maximum Marks Theory + IA	Number of Credits
I	ST 101 : Descriptive Statistics and Probability Theory	04	03	80+20=100	2
	ST 102 : Descriptive Statistics and Probability theory – Practical	03	03	40+10=50	1
II	ST 151 : Regression Analysis and Discrete Distributions.	04	03	80+20=100	2
	ST 152 : Regression Analysis and Discrete Distributions – Practical	03	03	40+10=50	1
III	ST 201: Continuous Probability Distributions	04	03	80+20=100	2
	ST 202: Continuous Probability Distributions – Practical	03	03	40+10=50	1
IV	ST 251 : Sampling Theory	04	03	80+20=100	2
	ST 252: Sampling Theory - Practical	03	03	40+10=50	1
V	ST 301 : Statistical Inference I	03	03	80+20=100	2
	ST 302(a) : Statistical Quality Control	03	03	80+20=100	2
	ST 303: Practical based on ST 301 and ST 302	04	03	80+20=100	2
VI	ST 351: Statistical Inference II	03	03	80+20=100	2
	ST 352(a) : Operations Research	03	03	80+20=100	2
	ST 353: Practical based on ST 351 and ST 352	04	03	80+20=100	2

B.Sc. DEGREE – FIRST SEMESTER

ST 101 : Descriptive Statistics and Probability Theory

UNIT I

Basic Statistics Concepts : Population and parameter , sample ,variable and attribute. Statistical data. Primary and secondary data. Methods of collection of primary data and sources of secondary data. Scales of measurement Nominal, ordinal data, interval and ratio scales. (5 hrs)

Classification and presentation of data : Objectives and types of classification , construction of frequency ontingency tables. Histogram, frequency polygon, frequency curve s, stem and leaves, box plot.

(7hrs)

UNIT II

Analysis of quantified data (grouped and ungrouped) : Concept of central tendency , measures of central tendency- A.M. , G.M .,H.M .,median ,mode and weighted means- partition values – derivation of formulae for locating median and mode.

Concept of dispersion – measures of dispersion – range, quartile deviation, mean deviation and standard deviation and their relative measures and properties. Moments – relationship between central and raw moment – Skewness, Kurtosis and their measure. (12 hrs)

UNIT III

Probability : Random experiments ,sample space (discrete and continuous). Simple events, compound events, types of events, relative frequency approach. Axioms of probability, some examples and properties. Sample space having finite equally likely simple events. Addition theorem, conditional probability and Independence. Multiplication theorem of probability. Bayes' theorem and its applications. (12 hrs)

UNIT IV

Random variables: Random variables (discrete and continuous),its properties. Probability mass function (p.m.f); probability density function (p.d.f)- their properties. Distribution function-its properties bivariate p.m.f's,p.d.f's , marginal and conditional probability distributions for two random variables –

independence of random variables. Expectation of random variables – Rules of expectation, Addition and Multiplication theorems of expectation, variance and covariance. Mean and variance of linear combination of random variables, moment's measures of location – dispersion – skewness and kurtosis for a probability distribution. Expectation of functions of r.v's. M.G.F. and its properties c.g.f., cumulants. (12 hrs)

References:

1. J. Medhi : Statistical Methods – An Introductory Text, New Age International Pvt Ltd, Publishers, Bangalore (2006).
2. Robert V Hogg and Elliot A Tanis: Probability and Statistical Inference, Prentice Hall (1993)
3. Richard A Johnson : Miller & Freund's Probability and Statistics for Engineers, PHI Learning Private Limited, New Delhi (2011)
4. Shedon M Ross: A first course in Probability Macmillan Publishing Company (1984)
5. Hogg R.V. and Craig AT: Introduction to Mathematical Statistics, Mac Milan, New York.
6. Mood A.M., Graybill F. A. and Boes D.C.: Introduction to the theory of Statistics, McGraw Hill (1974)

B.Sc. DEGREE – FIRST SEMESTER

ST 102 : Descriptive Statistics and Probability theory -Practical

1. Exercises on graphical representation of data.
2. Computation of measures of central tendency – 1: A.M,G.M.,H.M. and weighted mean.
3. Computation of measures of central tendency – 2: Median , Mode, partition Values.
4. Computation of measures of dispersion – 1: M.D. ,Q.D. and their coefficients.
5. Computation of measures of dispersion – 2: S.D. ,andC.V.
6. Computation of moments , measures of skeweness and kurtosis.
7. Curve fitting – 1: Fitting linear and quadratic curves.
8. Curve fitting – 2: Fitting curves of the functional form $y=ab^x$, $y=aeb^x$,$y=ax^b$.
9. Computation of probabilities using combinatorial methods.
10. Application of addition and multiplication theorems of probabilities.
11. Application of Bayes' theorem.
12. Mean, variance and moments of random variables.

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B.Sc. DEGREE – SECOND SEMESTER

ST 151 : Regression Analysis and Discrete Distributions.

UNIT I

Correlation Analysis : Concept of correlation – Scatter diagram –Karl Pearson's coefficient and properties. Rank correlation coefficient – derivation of the expression for the case where there are no ties. Curve fitting - method of least squares, fitting of linear quadratic, exponential and geometric curves. (12 hrs)

UNIT II

Regression Analysis : Simple linear regression – concept of errors, fitting of regression lines and properties, derivation of expression for standard error of estimate and it's interpretation, testing the significance of regression coefficient. Correlation between observed and theoretical value obtained from the linear regression estimates.

Multiple linear regression for three variates. Multiple and partial correlations. Partial regression coefficients and Standards errors of estimates from the multiple regression –properties. (12 hrs)

UNIT III

Standard discrete distributions : Bernoulli, Binomial ,Poisson ,Negative binomial, Geometric and Hyper geometric distributions, discrete uniform distribution – Definition , examples of variates following these distributions. Mean and variance of these distributions. Mode of binomial ,Poisson .Moment Generating Function (M.G.F.) and Cumulant Generating Functions (C.G.F.), M.G.F.(wherever they exist) and C.G.F. of Poisson distribution. (12 hrs)

UNIT IV

Some properties of discrete distributions : Lack of memory property of Geometric distribution and its physical interpretation. Recurrence relation for central moments of Binomial ,Poisson and Negative Binomial distribution.

Inter relationship between these discrete distributions. Application of all these distributions.Aditive property of Binomial and Poisson distributions . Limiting distribution of Binomial , Negative binomial and hyper geometric distribution.

(12hrs)

References:

1. Richard A Johnson : Miller & Freund's Probability and Statistics for Engineers, PHI Learning Private Limited, New Delhi (2011)
2. Vijay K Rohatgi & A.K.MD Ehsanes Saleh: An Introduction to Probability & Statistics, Wiley India (2001)
3. Shedon M Ross: A first course in Probability Macmillan Publishing Company (1984)
4. Mood A.M., Graybill F. A. and Boes D.C.: Introduction to the theory of Statistics, McGraw Hill (1974)
5. D.W.Wackerly, L. Mendenhall, R.L. Scheafres: Mathematical Statistics with Applications, Duxbury Advance Series. (2002).
6. R.V. Hegg and E.A. Tanis: Probability and Statistics, Pearson Education Asia (2001).

B.Sc. DEGREE – SECOND SEMESTER

ST 152 : Correlation Analysis and Discrete Distributions - Practical

1. Correlation – Spearman's rank correlation coefficient and Karl Pearson's product moment correlation coefficient.
2. Bivariate regression.
3. Trivariate regression.
4. Computation of multiple ,partial correlation coefficients and residual in a trivariate data.
5. Exercises on discrete probability distributions.
6. Fitting of Binomial distribution.
7. Fitting of Poisson distribution.
8. Fitting of Negative binomial distribution.
9. Generating random observations from Binomial and Poisson .
10. Generating random observations from Negative binomial and Geometric distributions.

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B.Sc. DEGREE – THIRD SEMESTER

ST 201: Continuous Probability Distributions

Unit I

Continuous Univariate Distributions: Uniform, Exponential, Gamma, Beta. Normal and Cauchy distributions – Definition through p.d.f. Distribution function of uniform, exponential and Cauchy distribution. Computation of moments (wherever they exist). M.G.F. and C.G.F. for exponential, gamma and Normal distributions. (12 hrs.)

Unit II

Finding mode of normal and Cauchy distributions. Finding median for uniform, exponential, normal and Cauchy distributions.

Transformation of random variables: Continuous distribution function techniques, M.G.F. techniques, use of Jacobian of transformations.

Statistics and Order statistics: Concept of statistic, sampling distribution of statistic and its standard error. Order statistics – sampling distribution of extreme order statistics. (12 hrs.)

Unit III

Sampling distributions: Definition and derivation of Students' t, Chi-square and F-distributions -- their properties, mean and variance. Distribution of sample mean, sample variance under normality assumption. Distribution of $\frac{ns^2}{\sigma^2}$ under the assumption of independence of $\overline{X}$ and s^2 when sampling from normal population. Inter relationship between the distributions. (12 hrs.)

Unit IV

Probability inequalities and convergence concepts: Morkov's inequality, Statement & proof of Tchebycheff's inequality. Sequence of random variables. Convergence in probability -- basic results (without proof). WLLN for i.i.d r.v's - applications. Convergence in distribution. Limiting distributions of Binomial, Negative binomial, Hyper geometric, χ^2 & Student's t - distributions Central limit theorem for iid random variables and its application

(12 hrs.)

References:

1. Robert V Hogg and Elliot A Tanis: Probability and Statistical Inference, Prentice Hall (1993)
2. Richard A Johnson : Miller & Freund's Probability and Statistics for Engineers, PHI Learning Private Limited, New Delhi (2011)
3. Vijay K Rohatgi & A.K.MD Ehsanes Saleh: An Introduction to Probability & Statistics, Wiley India (2001)
4. Shedon M Ross: A first course in Probability Macmillan Publishing Company (1984)
5. Mood A.M., Graybill F. A. and Boes D.C.: Introduction to the theory of Statistics, McGraw Hill (1974)
6. R.V. Hegg and E.A. Tanis: Probability and Statistics, Pearson Education Asia (2001).

B.Sc. DEGREE – THIRD SEMESTER

ST 202: Continuous Probability Distributions – Practical

1. Exercises on Normal distribution.
2. Fitting of Normal distribution.
3. Generating random observations from normal distribution.
4. Generating random observations from exponential distributions.
5. Generating random observations from Cauchy distributions.
6. Exercises on Poisson distributions as approximation to binomial
7. Fitting of exponential distribution.
8. Application of Techebycheff's inequality.
9. Application of C.L.T. in computing probabilities.

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B.Sc DEGREE – FOURTH SEMESTER

ST 251 : SAMPLING THEORY

UNIT I

Statistical Investigation – Complete enumeration v/s sample surveys – merits and demerits. Probability sampling and judgement sampling. Principles of sample surveys. Principal steps in sample survey. Errors in sampling. Concepts of parameters and estimators. Bias, mean square error, accuracy and precision of estimators. (6 hrs)

Selection of sample using random numbers, drawing samples from finite populations with and without replacement . Sampling from frequency distributions and contingency tables. (6 hrs)

UNIT II

Simple random sampling with (SRSWR) and without replacement (SRSWOR) . Unbiased estimators of mean , variance and population total. Sampling variances , standard errors and their estimation, comparison of SRSWR with SRSWOR. (12 hrs)

UNIT III

Stratified random sampling. Need for stratification, Stratified sampling under SRSWR and SRSWOR , Unbiased estimators of mean and total. Variances of these estimators and their estimation. Allocation of sample size – proportional and optimum allocation (w.r.t. SRSWOR stratification only), Neyman's allocation, allocation with cost functions . Comparison of SRSWOR and stratified sampling. Gain in efficiency due to stratification. (12 hrs)

UNIT IV

Linear systematic sampling. Estimation of mean. Variance of the estimator of mean in terms of S^2w and intraclass correlation. Comparison of SRSWOR and systematic sampling. (7 hrs)

Sampling of attributes - sampling for proportions, Estimation of population proportion and its std. error. (5 hrs)

References:

1. Parimal Mukhopadhyay :Theory and Methods of Survey Sampling Prentice Hall of India Pvt Ltd (1998)
2. V.G. Cochran : Sampling Techniques, Wiley Eastern Pvt Ltd (1974)
3. J. Medhi : Statistical Methods – An Introductory Text, New Age International Pvt Ltd, Publishers, Bangalore (2006).
4. D.W.Wackerly, L. Mendenhall, R.L. Scheafres: Mathematical Statistics with Applications, Duxbury Advance Series. (2002).

ST 252: Sampling Theory - Practical

1. Drawing random samples from frequency tables and contingency tables. Estimation of mean and variance,
2. Drawing random samples from finite population – estimation of mean , total and variance of the estimate.
3. SRSWOR
4. Stratified sampling under SRSWOR
5. Stratified random sampling – proportional allocation and optimum allocation.
6. Linear systematic sampling.
7. Exercise on sampling proportions

B.Sc. DEGREE- FIFTH SEMESTER

ST 301 : Statistical Inference I

Unit I

Point Estimation: Estimator and estimate. Unbiasedness, asymptotic unbiasedness and consistency of estimators. Sufficient condition for consistency. Relative efficiency. Sufficiency. Statement of Fisher Neyman criterion and its applications.

Maximum likelihood and moment methods of estimation-properties of these methods (without proof)- (discussion of examples to be restricted to the standard distributions studied during 2^{nd} and 3^{rd} semesters.) (7 hrs.)

Interval estimation: Confidence coefficient, confidence interval using Pivotal Quantity method. Confidence interval for mean, difference between means, variance and ratio of variances under normality. Large sample confidence interval for proportion and difference between proportions. (3 hrs.)

Unit II

Testing of Hypotheses: Statistical Hypotheses – Null and alternative, Simple and composite hypotheses.

Critical region. Concepts of type I and type II errors, level of significance and p-value, power of test. Power function – power curve. Relationship between testing of hypothesis and interval estimation. Most powerful - test, and best critical region. Statement of Neyman and Pearson Lemma and its use. Consistent tests (definition only). (10 hrs.)

Unit III

Likelihood ratio tests(LRT) - Derivation of tests for normal distribution only with testing for mean and variance - one sample and two sample tests -two sided and one sided alternatives, Paired t test. Test for significance of correlation coefficient, properties of LRT(without proof). (10 hrs.)

Unit IV

Large Sample test and Chi-square tests

Large Sample test: Large sample test for mean, difference between two means, test for proportion , difference Between proportions. Fisher's Z transformation and its applications.

Chi-square test of goodness of fit and for independence of attributes in contingency tables. Derivation of Brandt-Snedecor formula. Chi-square test for 2x2 contingency table. Yates correction for continuity. (10 hrs.)

References:

1. Vijay K Rohatgi & A.K.MD Ehsanes Saleh: An Introduction to Probability & Statistics, Wiley India (2001)
2. Hogg R.V. and Craig AT: Introduction to Mathematical Statistics, Mac Milan, New York.
3. Mood A.M., Graybill F. A. and Boes D.C.: Introduction to the theory of Statistics, McGraw Hill (1974)
4. D.W.Wackerly, L. Mendenhall, R.L. Scheafres: Mathematical Statistics with Applications, Duxbury Advance Series. (2002)
5. R.V. Hegg and E.A. Tanis: Probability and Statistics, Pearson Education Asia (2001).

B.Sc. DEGREE- FIFTH SEMESTER

ST- 302(a) : Statistical Quality Control

Unit I

Tools and Techniques of TQM : Meaning of quality , quality characteristics – variables and attributes . causes of variation –Assignable and Chance Causes . Quality control – process control and product control. Control limits, specification limits, Natural Tolerance limits, action limits, warning limits, Probability limits. General theory of control charts. Criteria for lack of Control. Selection of rational subgroups. (10 hrs.)

Unit II

Control chart for variables : $\bar{X} - R$ charts, $\bar{X}$ - s charts , σ–charts - control limits with and without standard values. Revised control charts. Construction and working of these charts. Interpretation , process capability studies. Modified control limits.

Control chart for attributes : Need for attribute charts p, np, C and U charts, analysis and interpretation. (10 hrs.)

Unit III

Special Type of Control Charts : Moving average and Moving range chart, sloping control chart, Group control chart, Chart for individual observation. (10 hrs.)

Unit IV

Acceptance sampling Plans: Single sample plan by attributes, P.R, C.R, AQL, LTPD. Derivation of AOQ , O.C. ATI functions and their graphs , AOQL and indiffence Quality. Construction of SSP. Given AQL, LTPD, P.R. C.R. Minimum ATI . Method-Double sampling plan. SSP by variables-single specification σ known and unknown plans. O.C. function. Construction of these plans. (10 hrs.)

References:

1. Grant E.L. : Statistical Quality Control, McGraw Hill
2. Duncan A.J.: Quality Control and Industrial Statistics, Taraporewala Sons
3. Montgomery D.C: Introduction to Statistical Quality Control, Wiley

B.Sc. DEGREE- SIXTH SEMESTER
ST 351 : Statistical Inference II

Unit I

Sequential testing : Need for sequential test. Wald's sequential probability ratio test(SPRT) Strength of sequential tests. Wald's SPRT applied to Bernoulli, Poisson and Normal distributions. Expressions to constants to be given without proof. (4 hrs.)

Non parametric tests: Advantages and limitations. Sign test for one sample problem and for pairs of observations. Two sample median test. Run test for randomness. Two sample run test. Null distribution of test statistic to be derived in each case. Large sample approximation to these tests. (6 hrs.)

Unit II

Analysis of variance : Meaning , basic assumptions, fixed effect model. Analysis of one way, two way and three way classified data with one observation per cell – mathematical model. Least square estimates, splitting of total sum of squares, expectation of sums of squares and mean sums of squares (under appropriate hypotheses) and ANOVA table. (10 hrs.)

Unit III

Designs of experiments : Meaning and terminology – experiment, treatment, experimental unit, experimental error and precision . Principles of experimental design. Randomisation, Replication, Local control.

CRD, RBD and LSD : Layout model, splitting of various sums of squares, least square estimates of effects, ANOVA tables, comparison of any two treatment means. Advantages and limitations of each design. (10 hrs.)

Unit IV

Missing plot technique : Estimation of one or two missing observations in RBD and LSD (least square estimates). ANOVA in case of missing observations. (4 hrs.)

Factorial experiments: Meaning and advantages. 2^2 and 2^3 factorial experiments in RBD and LSD, main and interaction effects. Yates' method of computing factorial effect totals , ANOVA table and inferences. Contrasts and orthogonal contrasts. (6 hrs.)

References:

1. Richard A Johnson : Miller & Freund's Probability and Statistics for Engineers, PHI Learning Private Limited, New Delhi (2011)
2. Vijay K Rohatgi & A.K.MD Ehsanes Saleh: An Introduction to Probability & Statistics, Wiley India (2001)
3. Mood A.M., Graybill F. A. and Boes D.C.: Introduction to the theory of Statistics, McGraw Hill (1974).
4. M N Das and N C Giri: Design and Analysis of Experiments, New Age International Publishers, Bangalore.
5. Douglas Montgomery: Design and Analysis of Experiments, Wiley India (2004).
6. Vijay K Rohatgi & A.K.MD Ehsanes Saleh: An Introduction to Probability & Statistics, Wiley India (2001).
7. Gary W. Oehlert: A First Course in Design and Analysis of Experiments (Available on Web).

B.Sc. DEGREE- SIXTH SEMESTER

ST 352(a) : Operations Research :

Unit I

Operations Research (OR) : Origin, definition, phases of OR- types of models.

Linear Programming Problem (LPP): General model, assumptions, formulation , graphical solution, Matrix form and standard form of LPP. Simplex algorithm (without proof), Charne's big M method – indication of unique solution, multiple solution, unbounded solution, no solution and degeneracy- dual LPP and its properties. Dual simplex method- Dual Simplex Algorithm. (10 hrs.)

Unit II

Transportation Problem (T.P.): General description and Statement of T.P. , Balanced and unbalanced T.P. – initial solution by north west corner rule , matrix minima and Vogel's method, MODI method of optimization (without proof), degeneracy. Unbalanced transportation problems and its solution.

(10 hrs.)

Unit III

Assignment Problem : General description and Statement of assignment problem , Hungarian method, maximization and minimization problems.

Game theory: Nature of games , Two person zero sum games – Pay off Matrix – Pure and mixed strategies- Showing A's Problem as the Dual of the B's problem – Principles of Dominance – Algebraic solution of rectangular games (Zero sum) – solution of 2 x 2 games – Graphic solution of 2 x n and m x 2 games. Reducing the game problem to an LPP. (10 hrs.)

Unit IV

Inventory Theory : Basic concepts, costs involved in inventory problems, deterministic models with instantaneous / finite production with / without shortages (derivations for continuous case) , Models with one / two price breaks, stochastic model -single period problem. Newspaper boy problem.

(10 hrs.)

References:

1. Hamdy A Taha: Operations Research –An Introduction Printice Hall of India (2003)
2. M Sasieni, A. Yaspan, L. Friedman: Operations Research Methods and Problems, John Wiely (1959)
3. S.D. Sharma : Introductions to Operations Research, Kedar Nath Ram Nath & Co.(1999).
4. Kanthi Swarup, P.K. Gupta, Manmohan, Operations Research, Sultan Chand and Sons.

17/12/2012

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