# UNIVERSITY OF MYSORE
## Department of Studies in Statistics
Manasagangotri, Mysore 570006

**PROCEEDINGS** of the meeting of the (composite) Board of Studies in Statistics held on November 23, 2013 at 11AM at the Office of the Chairman, Department of Studies in Statistics, University of Mysore, Manasagangotri, Mysore 570006.

Members present:
1. Prof. V.R.Padmawar, Stat-Math unit, Indian Statistical Institute,  Bangalore 560 059.

2. Prof. K.S. Mallesh, Department of Studies in Physics, University of Mysore, Manasagangotri, Mysore 570006.

3. Prof. D.D.Somashekara, Department of Studies in Mathematics, University of Mysore, Manasagangotri, Mysore 570006.

4. Mr. T.S.Venugopal, Associate Professor, Department of Statistics, Maharani's Science College for Women, Mysore 570001.

5. Mr. B.K.Shivanna, Assistant Professor, Department of Statistics, Maharani's Science College for Women, Mysore 570001.

6. Dr. G.Divanji, Associate Professor, Department of Studies in Statistics, University of Mysore, Manasagangotri, Mysore 570006.

7. Dr. B.S.Biradar, Associate Professor and Chairman of Department of Studies in Statistics, University of Mysore, Manasagangotri, Mysore 570006.

8. Dr. S.Ravi, Professor and Chairman of BoS in Statistics, Department    of Studies in Statistics, University of Mysore, Manasagangotri, Mysore 570006.

Members who could not be present:
1. Prof. N.Balakrishna, Department of Statistics, Cochin University of Science and Technology, CUSAT, Kochi, Kerala.

The Chairman welcomed the new members of the Board (composite) of Studies in Statistics and placed on record the appreciations of the Board for the work done by the earlier members of the Board. The Chairman also told the members that Professor N.Balakrishna has excused himself as he had other commitments.

**Agenda 1:** Confirmation of Proceedings of the last Board of Statistics meeting held on 28.11.2012.

**Resolution:** The Chairman read the Proceedings of the last Board of Studies meeting held on 28.11.2012 and the members ratified the same.

**Agenda 2:** Review of previous examination question papers.

The Chairman placed before the members the question papers of the three components $C_1$, $C_2$ and $C_3$ of assessments held during the year 2013 and asked the members to review the same.

**Resolution:** The members reviewed the question papers and suggested to continue to maintain minimum standards while setting question papers. The members also appreciated the Department faculty for reviewing the questions papers of the $C_1$ and $C_2$ component assessments before commencement of these assessments.

**Agenda 3:** Preparation of panel of examiners.

**Resolution:** The Board prepared panel of examiners for the B.Sc. and M.Sc. degree examinations and for Entrance Test and Course Work examinations for Ph.D. in Statistics to be held during the year 2013-14 and 2014-15. Further, the Board authorized the Chairman to send the panels to the Registrar (Evaluation).

**Agenda 4:** Desired changes, if any, in the CBCS-CAGP scheme for M.Sc.

One of the members Dr. Biradar proposed some changes in the existing syllabus of Inference II paper and another member Sri. Venugopal proposed some changes in the syllabus of Statistical Computing paper and also the LTP pattern of the paper from the existing L=3, T=0, P=1 to L=0, T=0, P=4. Since Statistical Computing is a paper where students learn to solve statistical problems using computing and learn to write programs for statistical problems, these changes are necessary. After discussing, these two proposals the board resolved as follows.

**Resolution:** The Board approved the proposed changes in syllabus of Inference – II paper and the proposed changes in the LTP pattern and the syllabus of Statistical Computing paper which are given as Appendix below.

**Agenda 5:** Desired changes in Syllabi, Examination pattern, Regulations of existing B.Sc. / M.Sc. Courses.

None.

**Agenda 6:** New courses, if any, to be started during the academic year 2014-15.
None.

Any other matter with the permission of the Chairman.
None.

The Chairman thanked the members for their valuable suggestions and comments.

# Appendix

1. Proposed changes in Inference II paper

| Exisiting syllabus | Proposed syllabus | Remarks / Justifications |
|---|---|---|
| **Hard Core / Compulsory Paper: (LTP=400)** | **Hard Core / Compulsory Paper: (LTP=400)** | |
| **Paper XII: Inference – II (4 Credits – 4 hours of Theory teaching per week)** | **Paper XII: Inference – II (4 Credits – 4 hours of Theory teaching per week)** | No change in LTP pattern |
| **Unit 1:** Consistency and asymptotic normality (CAN) of real and vector parameters. Invariance of consistency under continuous transformation. Invariance of CAN estimators under differentiable transformations, generation of CAN estimators using central limit theorem. | **Unit 1:** Consistency and asymptotic normality (CAN) of real and vector parameters. Invariance of consistency under continuous transformation. Invariance of CAN estimators under differentiable transformations, generation of CAN estimators using central limit theorem. | No change in Unit 1 |
| **Unit 2:** Method of moments, method of maximum likelihood, Special cases such as exponential class of densities and multinomial distribution, Cramer-Huzurbazar theorem, method of scoring. | **Unit 2:** Method of moments, method of maximum likelihood, Special cases such as exponential class of densities and multinomial distribution, Cramer-Huzurbazar theorem, method of scoring. | No change in Unit 2 |
| **Unit 3:** Tests based on MLEs. Likelihood ratio tests, asymptotic distribution of log likelihood ratio, Wald Test, Score Test, locally most powerful tests. Applications to categorical data analysis, three dimensional contingency tables, | **Unit 3:** Tests based on MLEs. Likelihood ratio tests, asymptotic distribution of log likelihood ratio, Wald Test, Score Test, locally most powerful tests. Applications to categorical data analysis,three dimensional contingency tables. Pearson's chi-square test and LR test. | The first topic in existing Unit 4 shifted to Unit 3 in the proposed one. |
| **Unit 4:** Pearson's chi-square test and LR test. Asymptotic comparison of tests. Asymptotic Relative Efficiency (Pitman's), asymptotic normality of posterior distributions. | **Unit 4:** Asymptotic comparison of tests. Asymptotic Relative Efficiency (Pitman's). Introduction to Nonparametric Methods, one sample tests; Kolmogorov-Smirnov test, sign test, Wilcoxon –signed rank test. Wilcoxon rank sum test for two sample problem**.** | Unit 4 has been modified with the addition of nonparametric methods as it was felt that the students will not be exposed to nonparametric methods in case they do not get to study the softcore paper on nonparametric methods. |
| **Books for Reference:**<br>1. Kale B.K. (2005). A First Course on Parametric Inference. Second Edition, Narosa.<br>2. Cramer, H.(1974). Mathematical Methods in Statistics, Princeton Univ. Press.<br>3. Rao, C. R.(1995). Linear Statistical Inference and its Applications, Wiley Eastern Ltd.<br>4. Silvey, S. D.(1975). Statistical Inference, Chapman- Hall.<br>5. Wilks, S.S.(1962). Mathematical Statistics, John Wiley.<br>6. Ferguson, T.S. (1996). A Course in Large Sample Theory, Chapman and Hall. | **Books for Reference:**<br>1. Casella, G. and Berger, R. L. (1990). *Statistical Inference.* Pacific Grove, CA: Wadsworth/Brooks Cole.<br>2. Cramer, H.(1974). Mathematical Methods in Statistics, Princeton Univ. Press.<br>3. Ferguson, T.S. (1996). A Course in Large Sample Theory, Chapman | |

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| | and Hall.<br>4. Gibbons,J.D., Chakraborti,S (2003). Nonparametric Statistical Inference, Fourth edition, CRC press.<br>5. Kale B.K. (2005). A First Course on Parametric Inference. Second Edition, Narosa.<br>6. Rao, C. R.(1995). Linear Statistical Inference and its Applications, Wiley Eastern Ltd.<br>7. Silvey, S. D.(1975). Statistical Inference, Chapman- Hall. | References have been updated with some new books |

2. Proposed changes in Statistical Computing paper

| Exisiting syllabus | Proposed syllabus | Remarks / Justifications |
|---|---|---|
| **Hard Core / Compulsory Paper: (LTP=301)**<br>**Paper V: Statistical Computing (4 Credits – 3 hours of Theory teaching per week + 2 hours of Practicals per week)**<br><br>**Unit 1:** Programming in C / R. (The purpose of this unit is to introduce programming with the eventual aim of developing skills required to .write statistical software. Should there be previous exposure to programming, this unit can be replaced with a more advanced unit in object oriented programming in C++ or Java. Topics should include Simple syntax, loops, pointers and arrays, functions, input/output, and linking to databases.<br><br>**Unit 2:** Numerical analysis and statistical applications. (The purpose of this unit is to apply programming skills in me1hods and algorithms useful in probability, statistics and data analysis. Topics should include numerical integration, root extraction, random number generation, Monte Carlo integration, matrix computations, drawing random samples : known univariate probability distributions -both discrete and continuous.<br><br>**Unit 3:** Analysis of interesting data sets using known techniques on a suitable statistical package<br>such as R / MINITAB / SAS / SPSS / | **Hard Core / Compulsory Paper: (LTP=004)**<br>**Paper V: Statistical Computing (4 Credits – 0 hours of Theory + 4 hours of Practicals per week)**<br><br>**Unit 1:** A general overview of R . Numeric/Character/logical; real /integer/complex string and the paste command matrices, dataframes, lists, setwd,read.table,read.csv.write. matrix, write.csv, creation of new variables, catergorization cut, factor,round, apply, creation of pattern variables, saving output files; source;print saving work space/ history. R-help command; help. search(), r mailing list, contributed documentation on cran. Descriptive statistics and Graphics in R: summary statistics for single group, the plot-command, histogram, box plot bar plot, lines, points, segments, arrows, paste, inserting math. symbols in a plot, pie diagram, customization of plot- setting graphical parameters text and m-text the pairs command. Graphical parameters such as mar/mai/mfrow/xlab/ylab/las/xaxp/xli m/ylim/cex/axis/tck/srt/main/title/lege nd/locator/ identity.<br><br>**Unit 2:** One and two sample t-tests, chi-squared tests, F- test for equality of variance, nonparametric tests, regression analysis,  checking the | LTP pattern to stress more on practical knowledge<br><br>Unit 1 consists of basics of R programming<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>Unit 2 introduces statistical methods. |

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| JMPIN; Topics should include graphics, descriptive statistics, representation of multivariate data, hypotheses testing, analysis of variance and linear regression.<br><br>**Books for Reference:**<br>Crawley, M. The R programming language, Shareware.<br>Keminghan, B. W. and Ritchie, D. M. (1988): The C Programming Language, Second Edition, Prentice Hall.<br>Press, W. H., Teukolsky, S. A., Vellering, W. T. and Flannery, B. P. (1993): Numerical recipes in C, Second Edition, Cambridge University Press.<br>Ryan, B. and Joiner, B. L. (2001):MINITAB Handbook, Fourth Edition, Duxbury.<br>Thisted, R. A. (1988): Elements of Statistical Computing. Chapman and Hall. | assumptions of normality, Q-Q plots, P-P plots. ANOVA. Matrix operations, addition, subtraction, multiplication, linear equation and eigenvalues, finding rank, inverse, g-inverse, determinant. R –functions; some useful built in r functions, attach, detach, sort, order, rank, ceiling, floor, round, trunc, signif, apply, lapply, by. Programming in R;fro/while/loops, functions, the source command.<br><br>**Unit 3:** Numerical analysis and statistical applications. Numerical integration, root extraction, random number generation, Monte Carlo integration, matrix computations, drawing random samples from known univariate probability distributions -both discrete and continuous and bivariate normal distribution - the inverse method, the accept- rejection method, decomposition of discrete mixtures, Classical Monte Carlo integration. R-functions for generating random variables and simulations; rnorm, rbinom, rpiosson, runif,rchisq,rt, etc.,; sample, set.seed.<br><br>**Unit 4:** Writing / performing programs using MATLAB /MINITAB/ SPSS/ Excel on problems from the following topics: Descriptive statistics and Graphs, One and two sample parametric and nonparametric tests, Chi-square tests, Regression and correlation analysis, Analysis of Variance and Kruskal-Wallis Test.<br><br>**References:**<br>1. Dalgaard, P. (2002). Introductory Statistics with R. Springer Verlag, New York.<br>2. Kerns, G.J. (2010). Introduction to Probability and Statistics Using R. Free Software Foundation.<br>3. Kunte, Sudhakar (1999). Statistical Computing: 1. Understanding Randomness and Random Numbers,Resonance, Vol.4, No.10, pp.16-21.<br>4. Kunte. Sudhakar (2000). | Unit 3 introduces numerical analysis and statistical applications , generation of random samples, etc.<br><br>Unit 4 is to expose students to one other software.<br><br>References have been updated with some new books |

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| | Statistical Computing: 2. Technique of Statistical *Simulation,Resonance,* Vo1.5, No.4, pp.18-27.<br>5. Robert, C. and Casella, G. (2010). Introducing Monte Carlo Methods with R. Springer Verlag, New York.<br>6.  Sudha G Purohit, Sharad D Gore, Shailaja R Deshmukh (2010) Statistics Using R, Alpha Science Intl. Publ.<br>Verzani, J. (2005). Using R for Introductory Statistics. Taylor & Francis | |