Semester	**TWO**
Paper Number	**5**
Paper Code	**MDTS 4211**
Paper Title	**Statistical Inference**
No. of Credits	**6**
Course description	CORE Composite Paper Module 1: 2 classes/week Module 2**:** 2classes/week No. of classes assigned Theory: 4 classes per weekPractical: 4 classes per week
Course Objective	At the end of the course, the students should be able to 1. Apply likelihood and moment methods to obtain estimates of parameters. 2. Construct tests of hypotheses based on the likelihood function. 3. Apply the chi-square to test goodness of fit and homogeneity on real life data. 4. Apply resampling techniques to obtain estimates, standard errors of estimates and confidence intervals ofparameters. 5. Identify the parameters of a Gauss Markov model. 6. Differentiate between ANOVA and regression models. 7. Apply the theorems of least squares to carry out tests in ANOVA and regression models and identifyworth of a concomitant variable in an ANOCOVA Model. 8. Apply nonparametric tests to data where the parent distribution is unknown in structure. 9. Differentiate between classical and Bayesian school of thoughts. 10. Ideas of priors and posteriors.
Syllabus	**Module-1** **Unit 1 : Parametric Methods (14 L)** *Parametric Methods:* Method of Moments, Maximum Likelihood Estimators. Likelihood Ratio, Rao's Score and Wald Tests. Statements of their large sample properties. Pearsonian Chi-square and its uses. (14) **Unit2: Bayesian Inferential Methods and Resampling Techniques(12 L)**

	Overview and comparison of two paradigms – Classical statistical analysis and Bayesian analysis, Beta-Bernoulli model, Gamma-Exponential model, Gamma-Poisson model, ideas of Prior and posterior distributions. (6) Concept of Jackniffe and Bootstrap. Resampling methods in estimation. Bootstrap Confidence Intervals. Cross-validation studies. Illustrations with R. (6) **Module-2** **Unit 1 : Nonparametric Methods (10 L)** Basic tests of location and scale. Tests of Goodness of fit, Homogeneity and Associations. (10) **Unit 2 : Linear Models (16 L)** *The Gauss-Markov Model*: Least Square Estimators. Normal Equations and their solutions. Best Linear UnbiasedEstimators. The Gauss Markov Theorem. Error and Error Variance. (3) *Linear Models:* ANOVA, Regression and ANOCOVA Models and some related testing problems. (10) *Simultaneous confidence intervals*: Bonferroni, Scheffe, Tukey, HSU and Duncan's Methods. Comparisons.(3)
Practical	Based on the theory topics
Reading/Reference Lists	1) Goon A.M., Gupta M.K., Das Gupta.B.: Fundamentals of Statistics, Vol. 1, World Press, 2010. 2) Christensen R., Johnson W., Branscum A., Bayesian Ideas and Data Analysis: An Introduction for scientistsand statisticians, Chapman & Hall, 2010. 3) Faraway, J., Linear Models with R, CRC Press, Second Edition. 2014. 4) Faraway, J., Extending the Linear Model with R, CRC Press, Second Edition. 2016. 5) Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning,Second Edition. 6) Ismay, C. and Kim, A.Y., Statistical Inference via Data Science, A ModernDive into R and theTidyverse, CRC Press Talor and Francis group, 2020. 7) Moulin, P. and Venugopal, V.V., Statistical Inference for Engineers and Data Scientists, CambridgeUniversity Press.

	8) Caffo, B., Statistical Inference for Data Science, Leanpub, 2016. 9) Nonparametric Statistical Inference, Gibbons and Chakraborty, CRC Press, First Edition.	
Evaluation	Theory CIA: 10 End Sem Exam: 50 (25+25) Total : 60	Practical Continuous Assessment: 30 End Sem Viva: 10 Total: 40
Paper Structure for End Semester Theory	Short questions: 5 marks each	Long questions: 10 marks each
Module I	1 out of 2	2 out of 3
Module II	1 out of 2	2 out of 3