**Course Name:** Advanced Statistical Methods

**Course Code:** STA 3105

**Credit Units:** 3

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**Course Description**

The course introduces students to regression models for data analysis and extends the methods to handle non-normal data. Particular attention is given to data that can be modeled by generalized linear models. Students are expected to “good”

**Course Objectives**

The course aims at:

* Illustrating inference methods based on the exponential family of densities.
* Introducing students to methods of analyzing data within the framework of generalized linear models.
* Illustrating the methods with data from real life problem.

**Detailed Course Outline**

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| **Unit** | **Content** |
| 1 | ***Exponential family of densities.***   * Definition, properties, Distributions in exponential family, examples |
| 2 | ***Maximum likelihood estimation***   * Review of MLE and Examples * Score vector and information matrix. * Information matrix. * Asymptotic properties of ML estimators |
| 3 | ***Bayesian Estimation***   * Introduction and review of Bayes Theorem * Example * Bayesian Estimation |
| 4 | ***Hypothesis Testing- More Theory and Practice***   * Power of a tests and size of a sample * Best critical region. * Likelihood ratio test. * Most powerful test. |
| 5 | ***Linear Regression Analysis -***   * Review- Simple Linear regression Analysis * Review- Multiple Linear Regression Analysis * Hypothesis testing and Diagnostics for model fit. |
| 6 | ***Generalized linear models (GLM). Special cases: Poisson and Binary Logistic Models***   * Estimation of parameters and their interpretation. |
| 6 | ***Project work on statistics*** |

**Reference List**

1. Agresti A. (2015). “Foundations of Linear and Generalized Linear Models”. Wiley Series in Probability and Statistics
2. Agresti, A. (2013) Categorical Data Analysis (3rd ed). New York: Wiley.
3. Hardin JW & Hilbe JM (2018). Generalized Linear Models and Extensions. Fourth Edition. A Stata Press Publication StataCorp LLC College Station, Texas
4. Lehmann, E. L., and George Casella (1998), *Theory of Point Estimation,*second edition, Springer.
5. Lehmann, E. L., and Joseph P. Romano (2005), *Testing Statistical Hypotheses,*third edition, Springer.
6. Shao, Jun (2003), *Mathematical Statistics,*second edition, Springer.
7. Shao, Jun (2005), *Mathematical Statistics: Exercises and Solutions,*Springer.