Department of Mathematical Sciences
(गणितीय विज्ञान विभाग)
Rajiv Gandhi Institute of Petroleum Technology, Jais
(राजीव गांधी पेट्रोलियम प्रौद्योगिकी संस्थान, जायस)

Course Handout

Course Name and Code	**Statistical Methods and Data Analysis (MA 231)**
Course Credit C	**8 [LTP: 2-1-0]**
Program	**B. Tech.; AY: 2024-25 (Even Semester)**
Instructor	**Dr. Chanchal Kundu, Professor**

Course Objectives and Pedagogy:

The objective of this course is to develop an understanding of the central statistical models and methods that are widely used in modern applications. A balance is struck between the presentation of the statistical techniques and data analysis including their appropriate use in a variety of practical contexts. The students are given insight into the theoretical foundation of the methods for analyzing data, and learn to perform such analyses in practice by using the software R. Intuitive developments and practical use of the techniques are emphasized rather than theorem/proof developments.

Evaluation:

Participants would be assessed through their involvement in class discussions, quizzes, submission of assignments, mid-term and end-term examinations. The tentative weights (subject to change) for these segments would be as follows:

Quizzes/Class tests, Tutorials and Assignments	10%
Mid-Semester Examination	30%
End-Semester Examination	60%

Suggested Books:

Text Books

- *Probability and Statistics in Engineering* by Hines, Montgomery, Goldsman & Borror. Wiley.
- *An Introduction to Mathematical Statistics and its Applications* by Larsen & Marx. Pearson.
- *An Introduction to Probability and Statistics* by Rohatgi, V.K. & Saleh, A.K. Wiley Student Ed.

Supplementary Readings

- ✓ *Introduction to Probability Models* by Sheldon M. Ross, Academic Press.
- ✓ *Probability and Statistics* by Spiegel, Schiller and Srinivasan. Tata McGraw-Hill Pub. Co. Ltd.
- ✓ *Introduction to Probability and Statistics* by J. Susan Milton & J.C. Arnold, 4th Ed., Tata McGraw-Hill Pub. Co. Ltd.
- ✓ *Miller and Freund's Probability and Statistics for Engineers* by Johnson/Miller, Pearson Education India.
- ✓ *An Introduction to R*; manual from www.r-project.org

Detailed Session Plan for ***Statistical Methods and Data Analysis (MA 231)***

Lectures	Topic	Readings
1-10	**Random Variables and Some Special Distributions**	Various approaches of probability: classical, frequency and axiomatic, rules on probability, conditional probability, independence, Bayes' theorem. Univariate random variables: discrete and continuous, distribution functions and their properties, probability mass and density functions, expectation & moments, moment generating function & its properties. Multiple random variables: joint distributions, marginal and conditional distributions. Discrete probability distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric and Poisson distribution. Continuous probability distributions: Uniform, Exponential, Gamma, Normal & Log-normal distribution.
11-16	**Descriptive Statistics**	Statistical Terminology: Inferential statistics, population, sample, parameter, statistic, random sample, sampling techniques. Summarizing and Exploring Data: Concept of frequency distribution, measures of central tendency, moments, measures of dispersion/variability, measures of skewness and kurtosis. Introduction to R-software, different aspects of probability distribution and analysis of data in R.
17-20	**Estimation**	Sampling distributions, basic concepts of inference (estimation & hypothesis testing), point estimation & interval estimation.
21-26	**Testing of Hypotheses**	Null and alternate hypothesis, simple & composite hypotheses, critical region, N-P lemma, tests for mean, variance and proportion in one and two sample problems. Chi-square goodness of fit test. Introduction to non-parametric test, Contingency table, test of independence.
27-30	**Regression & Correlation**	Simple linear regression, least squares fit and correlation analysis. Tests for slope & correlation, prediction problem, residual plots. Multiple linear regression. Analysis of Variance. Statistical models in R.
31	**Course Review**	

Teaching Scheme: Lectures: 2 hrs./week; Tutorial: 1 hr./week

Make-up Examination: According to Rules and Regulations of the Institute.

Notices: All information regarding the course will be available in ftp folder (ftp://192.168.3.9).

Contact Address of Instructor: Room No.: 504 (5th floor), Academic Block-2
Consultation Hour: To be announced soon
Email: ckundu@rgipt.ac.in

Note:

- Each lecture/tutorial shall be of 55 minutes duration.
- The **Attendance Rule** laid down by the Institute will be strictly implemented.
- Students are expected to spend some time in the library in order to inculcate in themselves the habit of independent reading about the topic of lecture attended and to solve the assignments provided to them.