Course code	Course Name	L-T-P - Credits	Year of Introduction
RLMCA105	**Applied Probability and Statistics**	**3-1-0-4**	**2016**

Course Objectives

- To introduce probability theory and statistics from a computational perspective.
- To prepare students for learning advanced courses like machine learning and big data
- To do simulations using software packages like R, Excel, SPSS, PSPP or any other suitable software.

Syllabus

Introduction to Statistics, Concepts of probability theory, Probability Distributions, Mathematical expectations, Inferential statistics, Hypothesis testing

Expected Outcome

- The students will get an overall view of concepts in probability and statistics.

References

1. David S. Moore and George P. McCabe, "Introduction to practice of statistics", W.H. Freeman & Company, 5th Edition (2005).
2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley India, 5th Edition (2012).
3. G. Jay Kerns, "Introduction to Probability and Statistics Using R", Chapman & Hall (2010)
4. Gupta S.C and Kapoor V .K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons (2014).
   https://cran.r-project.org/web/packages/IPSUR/vignettes/IPSUR.pdf
5. Mendenhall, Beaver, Beaver, Introduction to Probability & Statistics, Cengage Learning, 14th Edition (2014)
6. Richard A .Johnson, Miller and Freunds, "Probability and Statistics for Engineers", Prentice Hall of India, 8th Edition (2015).

Web Resources

1. Probability and statistics EBook
   http://wiki.stat.ucla.edu/socr/index.php/EBook
2. https://www.openintro.org/stat/textbook.php
3. http://www.math.uah.edu/stat/index.html
4. Statistics Online Computational Resource
   http://www.socr.ucla.edu/

Suggested MOOCs

1. https://www.edx.org/course/explore-statistics-r-kix-kiexplorx-0
2. https://www.coursera.org/course/probability
3. http://www.math.uah.edu/stat/

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Statistics and Data, Types of Data - Quantitative Data, Qualitative Data, Logical Data, Multivariate Data etc. Features of Data distributions - Center, Spread, Shape, Symmetry, Skewness and Kurtosis (Definitions only), Stem and Leaf Diagrams, Frequency Distributions and Histogram, Measures of Center - Mean, Median, Mode, Measures of Spread - Range, Variance, Standard Deviation, Interquartile range, Measures of Relative Position: Quartiles, Percentiles.	8	15%

II	Introduction to Probability Theory - Classical empirical and subjective probabilities, Random Experiments, Sample Spaces & Events, Axioms of Probability, Addition Rules, Conditional Probability, Multiplication and Total Probability Rules, Independence, Bayes's Theorem (without proof).	8	15%
FIRST INTERNAL EXAMINATION			
III	Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution - Mean and Variance, Binomial Distribution - Mean and Variance, Geometric Distribution - Mean and Variance, Poisson Distribution - Mean and Variance.	10	20%
IV	Continuous Random Variables, Probability Distributions and Probability Density Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution, Mean and Variance, Normal Distribution, Mean and Variance (Proof not required), Standard Normal Distribution, Joint and Marginal Probability Distributions, Conditional Probability Distributions, Independent Random Variables.	10	20%
V	Statistical Inference, Types of sampling and sampling error, Random Sample & Statistic, Sampling Distribution, Central Limit Theorem (Statement Only), Distribution of sample mean and sample variance, t,$\chi^2 \wedge F$distributions (derivation not required), Confidence Interval on the Mean, Confidence Interval on the Variance, Confidence Interval for a Population Proportion, Confidence Interval on the Difference in Means, Confidence Interval on the Ratio of two Variances.	10	20%
SECOND INTERNAL EXAMINATION			
VI	Hypothesis Testing, General Procedure for Hypothesis Tests, Tests on the Mean, Tests on a population Proportion, Tests on the Difference in Means.	8	10%
END SEMESTER EXAM			
QUESTION PAPER PATTERN			

There will be two parts in the Question paper - **Part A and Part B.**

Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions.

Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M). The maximum number of sub part questions in **Part B** to be limited to 2.

The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module will not exceed the marks assigned to that module specified in the course plan.