STATISTICAL AND NUMERICAL METHODS (PCA107)

L	T	P	Cr
3	1	2	4.5

Prerequisite(s): None

Course Objective: The main objective of this course is to understand and implement various concepts of numerical analysis and statistics to solve real life problems.

Analysis of Statistical Data: Frequency distribution; Frequency curve and histogram; Measure of central tendency and dispersion.

Random Variables and probability distributions: Basic concepts of probability and its properties; Additive and multiplicative theorem of probability; Conditional probability and independent events; Random variable, Notion of sample space; distribution functions; Mathematical expectation, Binomial, Poisson, Rectangular, Exponential and Normal distributions.

Random Number Generation: Basic concepts in random number generation; Method for generating random numbers and their efficiency test; Methods for generating random numbers for probability distributions

Sampling distributions: Notion of random sample and sampling distributions; Parameter and statistics; Standard error; Chi-square, t, F distributions; Basic ideas of testing of hypothesis; Testing of significance based on normal, Chi-square, t and F distributions; Analysis of variance, One way ANOVA and two way ANOVA with fixed effect; interval estimation.

Floating-Point Numbers: Floating-point representation; Rounding, Chopping; Error analysis; Condition and Instability.

Non-Linear Equations: Bisection, Secant, Fixed-point iteration and Newton - Raphson methods; Order of convergence.

Linear Systems of equations: Gauss Elimination and LU- decomposition methods; Jacobi and Gauss-Seidel methods.
Interpolation: Newton form of polynomials; Finite differences, Newton's Forward, Lagrange and Newton's divided difference interpolation formula with error analysis; Introduction to Spline.

Principle of least Square: Curve fitting; correlation and regression coefficients (two variables only); Rank correlation.

Laboratory Work: Implementation of statistical and numerical techniques using C/C++ including Program to obtain frequency charts for large data set and fitting a distribution; Generation of Random Numbers for some distributions; Hypothesis of Testing; Solution of equation $f(x)=0$ using Bisection and Newton-Raphson methods; Solve system of linear equations using Gass elimination and Gauss-Seidel methods; Interpolation by Lagrange and Newton's divided difference methods; Regression analysis using least square approximation; Correlation analysis.

Course Outcome: Upon successful completion of the course the students will be able to

- Understand the various approaches dealing the data using theory of probability.

- Analyze the different samples of data at different level of significance using various hypothesis testing.
- Develop a framework for estimating and predicting the different sample of data for handling the uncertainties.
- Understand error, source of error and its affect on any numerical computation and also analyzing the efficiency of any numerical algorithm.
- Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
- Solve system of linear equations numerically using direct and iterative methods.
- Understand the methods to construct interpolating polynomials with practical exposure.

Text Books:

1. *Conte, S. D. and Boor, C. D., Elementary Numerical Analysis : An Algorithmic approach, (Third Edition), Tata McGraw Hill, New York (2006).*
2. *Hogg, Robert V, Elliot A Tanis and Rao, Jagan M., Probability and Statistical Inference, Pearson Education (2009).*

Reference Books:

1. *Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, New Age International Publishers (2008).*
2. *Meyer P. L., Introductory Probability and Statistical Applications, Oxford and IBH (2008).*