COURSE OUTLINE

Course No: MATH 223

Course Title: Numerical Analysis and Statistics

Credit hours: 3.0 Contact hours: Office Time

Level/Term: L-2/T-2

Academic Session: 2019-2020

Course Teacher(s):

Name:	**Office/Room**	**E-mail and Telephone:** *(optional)*	**Class routine**
Dr. Md. Shahidul Islam			
Khondoker Nazmoon Nabi	Ga-24, OAB Building (Ground Floor)	khnabi@math.buet.ac.bd	Saturday : 9.00-9.50 a.m

Course Contents: *(To be filled from the course handbook)*

Numerical Analysis: Interpolation. Simple difference. Newton's formulae for forward and backward interpolation. Divided differences. Tables of divided differences. Relation between divided differences and simple differences. Newton's general interpolation formula. Lagrange's interpolation formula. Inverse interpolation by Lagrange's formula and by successive approximations. Numerical differentiation using Newton's forward and backward formulae. Numerical integration. General quadrature formula for equidistant ordinates. Trapezoidal rule. Simpson's rule. Weddle's rule. Calculation of errors. Relative study of three rules. Gauss's quadrature formula. Legendre polynomials. Newton-Cotes formula. Principles of least squares. Curve fitting. Solution of algebraic and transcendental equations by graphical method. Regula-Falsi method. Newton-Raphson method. Geometrical significance. Convergence of iteration and Newton-Raphson methods. Newton-Raphson method and iteration method for the solution of simultaneous equations. Solution of ordinary first order differential equations by Picard's and Euler's method. Runge-Kutta method for solving differential equations.

Statistics: Frequency distribution. Mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion. Moments, skewness and kurtosis. Elementary probability theory and discontinuous probability distribution, e.g. Binomial, Poisson and Negative binomial distribution. Continuous probability distributions, e.g. Normal and Exponential distribution. Characteristics of distributions. Hypothesis testing and regression analysis. Time series analysis. Markov chain.

Learning Outcomes/Objectives:

At the end this course, students will be able to:

i. solve an algebraic or transcendental equation using an appropriate numerical method
ii. approximate a function using an appropriate numerical method
iii. solve a differential equation using an appropriate numerical method
iv. evaluate a derivative at a value using an appropriate numerical method
v. solve a linear system of equations using an appropriate numerical method
vi. perform an error analysis for a given numerical method
vii. prove results for numerical root finding methods
viii. calculate a definite integral using an appropriate numerical method
ix. provide the basics to measure the central tendency of statistical data
x. learn techniques to derive standard deviation and other measures of dispersion
xi. calculate moments, skewness and kurtosis of statistical data
xii. provide the basic idea of probability theory including discrete probability distributions and continuous probability distributions
xiii. provide the basics required for sampling theory including estimation
xiv. carry out Hypothesis testing.
xv. provide the elementary background for regression analysis, correlation coefficients

Assessment

Class Participation/Attendance: 10%

Homework Assignment and Quizzes: 20%

Term Final Exam: 70%

Text Book:

i. Numerical Analysis by Richard L. Burden and J. Douglas Faires.
ii. Probability and Statistics for Engineers and Scientists – Walpole, Myers, Myers, and Ye, Pearson Education, Inc., Ninth Edition, 2012.

Reference Books:

i. Introductory Methods of Numerical Analysis by S. S. Sastry.
ii. Numerical Methods for Mathematics, Science and Engineering by John H. Mathews.
iii. An Introduction to Numerical Analysis by Kendall E. Atkinson.
iv. Element of Probability and Statistics, By Frank L. Wolf.
v. Probability and Statistics with Applications, By Y. Leon Maksoudian.
vi. Probability and Statistics for Engineers, By Erwin Miller & John E. Freund.

Weekly schedule: For Numerical Analysis

Week	Topics	Teacher's Initial/Remarks
Week-1	Interpolation: simple difference. Newton's formulae for forward and backward interpolations. Divided differences. Relation divided difference and simple differences. Newton's general interpolation formula.	
Week-2	Lagrange's interpolation formula. Inverse interpolation by Lagrange's formula and by successive approximations.	
Week-3	Numerical differentiation of Newton's forward and backward formulae.	
Week-4	Numerical integration. General quadrature formula for equidistant ordinates. Trapezoidal rule. Simpson's rule. Weddle's rule.	
Week-5	Numerical integration. General quadrature formula for equidistant ordinates. Trapezoidal rule. Simpson's rule. Weddle's rule.	
Week-6	Calculation of errors. Relative study of three rules. Gauss's quadrature formula.	
Week-7	**Class Test**	
Week-8	Legendre polynomials.	
Week-9	Newton's cotes formula. Principles of least squares. Curve fitting.	
Week-10	Solution of algebraic and transcendental equations by graphical method. Regula-Falsi method. Newton Raphson method and iteration method for the solution of simultaneous equations.	
Week-11	Solution of algebraic and transcendental equations by graphical method. Regula-Falsi method. Newton Raphson method and iteration method for the solution of simultaneous equations.	
Week-12	Solution of ordinary first order differential equations by Picard's and Euler's method. Runge-Kutta method for solving differential equations.	
Week-13	Solution of ordinary first order differential equations by Picard's and Euler's method. Runge-Kutta method for solving	

	differential equations.	
Week-14	**Class Test**	

Weekly schedule: For Statistics

Week	Topics	Teacher's Initial/Remarks
Week-1	Frequency distribution. Mean median, mode and other measures of central tendency.	
Week-2		
Week-3	Standard deviation and other measures of dispersion.	
Week-4		
Week-5	Moments, skewness and kurtosis.	
Week-6	**Class Test**	
Week-7	Elementary probability theory and some discontinuous probability distributions.	
Week-8		
Week-9	Some continuous probability distributions.	
Week-10	Characteristics of distributions. Hypothesis testing and regression analysis.	
Week-11		
Week-12	Time series analysis. Markov chain.	
Week-13		
Week-14	**Class Test**	