Programme	BSCP	**Course Code**	ACS 302	**Credit Hours**	3
Course Title	Numerical Computing				

Course Introduction
This course introduces the numerical analysis technique, an area of mathematics and computer science that is used to creates, analyzes, and implements algorithms for obtaining numerical solutions to problems involving continuous variables.

Learning Outcomes
The course introduces the subject of numerical analysis. Its objectives are as following.   1. Studying different methods of numerical differentiation and integrations.   2. Learning different numerical methods of solving ordinary differential equations and partial differential equations.   3. Numerical study of boundary and characteristic value problems.   4. Get experience of developing computer programs to implement various numerical methods.

Course Content	
Week 1	Non-Linear equations; Bisection Method; Linear interpolation method; Newton's Method, Multiple roots
Week 2	System of equations; Matrix notation; Elimination method; Gauss and Gauss-Jordan Methods; Other Direct Methods
Week 3	Numerical Differentiation and Integration: Getting Derivatives and Integrals
Week 4	Higher-Order derivatives, Extrapolation techniques, Newton- Cotes Integration Formulas
Week 5	The Trapezoidal, Simpson's, Gaussian Quadrature, Adaptive Integration,
Week 6	Multiple Integrals, Applications of Cubic Splines, Monte-Carlo integration, Importance sampling, VEGAS method.
Week 7	Numerical Solution of Ordinary Differential Equations
Week 8	Taylor-Series Method, Euler and Modified Euler Methods, The Runge-Kutta Methods, Multistep Method, Milne's Method.
Week 9	The Adams-Moulton Method, Multivalued Methods, Convergence Criteria
Week 10	Numerical Integration, Sums and Products, Interpolations functions
Week 11	Curve Fitting, Boundary-Value Problems and Characteristic-Value Problems: Introduction.
Week 12	The 'Shooting Method', Solution Through a Set of Equations , Derivative Boundary conditions

Week 13	The Finite-Element method, Numerical Solution of Partial-Differential Equations
Week 14	Finite difference method, Representation as a difference equation
Week 15	Finite-element method, Laplace's equation on a rectangular region,
Week 16	Numerical solutions of Poisson Equation

Textbooks and Reading Material

1. Applied Numerical Analysis, Curtis F. Gerald, Addison-Wesley (1994).
2. Introduction to Numerical Methods and FORTRAN Programming, Thomas Richard McCalla, John Wiley & Sons (1964).
3. Elementary Numerical Analysis, An Algorithmic Approach (3rdedition), Samuel D. Conte, McGraw-Hill International Edition (1981).
4. Numerical Analysis: Mathematics of Scientific Computing (3rdEdition), David Kincaid, American Mathematical Society (2010).
5. Numerical Recipes in C: The Art of Scientific Computing (2ndEdition), W. H. Press, B. P. Teukolsky, W. T. Vetterling, Cambridge University Press (1992).

Teaching Learning Strategies

The instructor is required is discuss computer codes to implement the algorithims for numerical computing and compare them with standard libraries like scipi in python and gsl in C/C++.

Assignments: Types and Number with Calendar

At least two assignments and two quizzes. A course project may also be assigned.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. At least fifty percent of the question paper would involve new problems related to the concepts learned in the course. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.