

Course code: Course Title	Course Structure			Pre-Requisite
EP102: Computational Methods	L	T	P	NIL
	3	1	0	

Course Objective: This course is designed for the second semester (first year) students of the B. Tech. (Engineering Physics). This course is offer to familiarize the students with the numerical techniques to solve the problems related to science and engineering.

S. NO	Course Outcomes (CO)
CO1	Approximate the complex problem into well-known numerical form.
CO2	Analyse the variety of errors involved in the problem solving process in order to realize the accuracy of complex solutions.
CO3	Apply the problem solving skill to implement the various numerical algorithms for linear and non-linear equations, data prediction using interpolation and approximation.
CO4	Solve the complicated numerical differentiation, integration and differential equations using numerical methods related to multi-disciplinary complex problems.
CO5	Design and solve the minor project related activities using the knowledge gained in this course.

S. NO	Contents	Contact Hours
UNIT 1	Errors in numerical calculations: Introduction, Number and their accuracy, Errors and their analysis, Absolute, Relative, Percentage and Maximum probable error, Physical significance of errors, General error formula, Error in series approximation.	6

UNIT 2	Solution of numerical algebraic and transcendental equation: Roots of equations, Direct method and iteration method, Bisection method, Regula Falsi Method or Method of False position, Secant or Chord method, Newton-Raphson method, Roots of polynomial, solution of nonlinear simultaneous equations using Newton Raphson Method, Condition of Rate of convergence, Convergence of Bisection, Regula-Falsi, Secant and Newton Raphson Method	10
UNIT 3	Interpolation: Introduction, Finite differences, Difference Operators and relation between them, Detection of errors by use of difference tables, Differences of a polynomial, Interpolation with equally spaced data points: Newton's forward and backward formulae for interpolation, Central difference: Gauss forward, Gauss Backward, Stirling, Bessels, Everett's formula for interpolation, Interpolation with unequally data points: Lagrange's interpolation formula, Divided differences and their property, Newton Divided differences formula, Curve fitting: Introduction, Least square curve fitting procedures, fitting a straight line, nonlinear curve fitting, curve fitting by a sum of exponentials, Data fitting with cubic splines	12
UNIT 4	Numerical Differentiation and Integration: Numerical differentiation, formulae for derivatives: Derivative using Newton forward difference and backward formula, derivative using central difference formula, maximum and minimum values of a tabulated data, Numerical integration, Newton-cotes integration formulae, trapezoidal method, Simpson's 1/3-rule, Simpson's 3/8-rule, Boole's and Weddle's Rule, Error in quadrature formulae, Romberg integration, Euler-Maclaurin formula, Numerical double integration	8
UNIT 5	Numerical solution of ordinary differential equations: Introduction, solution by Taylor's series, Picard's method of successive approximation methods, Euler's method, modified Euler's method, Runge-Kutta method, predictor-corrector method, solution of second order and simultaneous differential equations	6
TOTAL		42

REFERENCES		
S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Numerical Methods for Engineers; S. C. Chapra, R. P. Canale, McGraw-Hill International Editions.	1998
2	An Introduction to Computational Physics; T. Pang, Cambridge University Press.	2010

3	Numerical Methods for Engineers and Scientists; A. Gilat, John Wiley & Sons .	2008
4	Applied Numerical Analysis; Gerald, Wheatley, Pearson.	2003
5	Numerical methods for Scientific and Engineering Computation; J. Iyengar, Jain, New Age.	2009

B. Tech. Information Technology