



ACADEMIC – GRADUATE STUDIES AND RESEARCH DIVISION
BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI-HYDERABAD CAMPUS

SECOND SEMESTER 2021-22

Course Handout (Part II)

15-01-2022

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CE G513
Course Title : Advanced Computational Techniques
Instructor-in-Charge : Dr. Raghu Piska

Description: Interpolation, Polynomial Interpolation, Lagrange, Newton's Interpolation, Numerical integration, Wilson Method, Newmark's Method, Gauss and Hermitian Quadrature, Quadrature rules for multiple integrals, Large system of linear simultaneous equations, Direct and iterative algorithms based on Gauss elimination, Gauss Seidel method and symmetric banded equations, storage schemes – skyline, band solver, frontal solver, Cholesky decomposition, Non-linear system of equations, Eigen value problems, Forward iteration, Inverse iteration, Jacobi, Given's method, Transformation of generalized Eigen value problem to standard form, Vector iteration method, Initial and boundary value problems, Solution of first and second order differential equations using Euler, modified Euler, and Runge-Kutta methods, Finite difference operators.

Scope and Objective of the Course:

Analytical and exact solutions are possible only for the simple and very standard problems in Engineering. Most of the real-world problems require numerical methods to determine the solution. Numerical methods involve tedious iterative operations which cannot be solved manually. To implement the problem using a computer, one has to supply the detailed algorithm via the computer programs in any of the available tools. The objective of the course is to introduce the students to existing numerical methods to solve linear and nonlinear equations, Eigen value problems, partial and differential equations etc. Parallelly students will be introduced to writing pseudo codes to implement these numerical methods in MATLAB.

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

- CO1. Solve different Engineering problems using the existing numerical methods
- CO2. Implement these numerical methods by writing programs in MATLAB

Student Learning Outcomes (SLOs) assessed in this course – (a), (b),

Student Learning Outcomes (SLOs):

SLOs are outcomes (a) through (b) plus any additional outcomes that may be articulated by the program.

- (a) An ability to think logically and write the pseudo codes and develop codes in MATLAB
- (b) an ability to apply knowledge of numerical methods for solving real world problems

Textbook:

1. Curtis F Gerald and Patrick O Wheatley “*Applied Numerical Analysis, (2006)*” Pearson

Reference books:

1. Richard L Burden, J. Douglas Faires, (2011). “*Numerical Analysis*”, CENGAGE learning.
2. Rajasekaran(1999). “*Numerical Methods in Science and Engineering*”, S.Chand

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book	S L O
1-2	Introduction	Introduction to errors, numerical methods	Ch-0	a, b
3-6	Interpolation techniques	Polynomial, Lagrange, Newton's interpolation	Ch-3	a, b
7-12	Solution to linear equations	Gauss elimination, Gauss sieedel, symmetric banded equations, Cholesky decomposition	Ch-2	a,b
13-16	Solution to nonlinear equations	Newton Raphson method	Ch-1	a, b
17-20	Solution to Eigen value problems	Forward and inverse iteration, Jacobi and Given's method, transformation, Vector iteration method	Ch-6	a, b
21-25	Solution to boundary value problems	Finite difference method etc...	Ch-5	a, b
26-30	Numerical integration	Wilson θ method, Gauss and Hermitian quadrature, Newmarks's method	Ch-5	a, b
31-38	Solution to first and second order differential equations	Euler, modified Euler, Runge Kutta method	Ch-6	a, b
39-42	Miscellaneous problems			a, b

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	90 min (theoretical)	25	As per Timetable	Closed book
Comprehensive Exam	120 min (Theoretical + Programming)	35	As per Timetable	OPEN BOOK
Assignments (Theoretical + MATLAB Programming)		20 (Theoretical - 5% and programming - 15%)	-	OPEN BOOK
Mini Project		15		OPEN BOOK
Teaching presentation		5		

Chamber Consultation Hour: 4:30PM (office no: 040 – 66303773, mobile no: 9494728796)

Notices: Concerning this course will be displayed on CMS

Make-up Policy: Make-up would be granted only for genuine cases with prior permission.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE

CE G513