

City University
Department of Computer Science and Engineering
Faculty of Science and Engineering

Course Outline

Course Code and Title, CSE – 232: Numerical Analysis Laboratory

Credit Hours: 1.5

Prerequisites:

Program: B. Sc. in Computer Science & Engineering (CSE),

Semester: Fall 2018

Total Weeks: 13

Hours/Week: 3

Total Hours: 39⁺

Instructor: Supta Richard Philip

Designation: Senior Lecturer

Office: Room 404

Phone: 01914818982

Email: supta.philip@gmail.com

Office Hrs: By appointment

Course Details

Rationale:

Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science. Such methods include techniques for simple optimization, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under random influences. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer and familiar with the ways of solving complicated mathematical problems numerically. The secondary objective is to gain practical programming experience with Matlab, including algorithm design and the proper understanding and use of available numerical algorithms.

Course Objectives:

1. Derive appropriate numerical methods to solve algebraic and transcendental equations.
2. Develop appropriate numerical methods to approximate a function.
3. Develop appropriate numerical methods to solve a differential equation.
4. Derive appropriate numerical methods to evaluate a derivative at a value.
5. Derive appropriate numerical methods to solve a linear system of equations.
6. Perform an error analysis for various numerical methods.
7. Prove results for various numerical root finding methods.
8. Derive appropriate numerical methods to calculate a definite integral.
9. Code various numerical methods in a modern computer language.

Intended learning outcomes (ILOs) of the Course:

Knowledge	LO1: Will be able to solve an algebraic or transcendental equation using an appropriate numerical method
	LO2: Will be able to approximate a function and root findings methods using an appropriate numerical method
	LO3: Will be able to solve a differential equation and definite integral using an appropriate numerical method
	LO4: Will be able to evaluate a derivative at a value and an error analysis for a given numerical method using an appropriate numerical method
Skills	Will develop skills on understanding the problems
	Will gain skills on analysis the problem and selecting the solutions for the problem.
	Will help in achieving communication, demonstrate and presentation skill.
Attitude	Will develop attitude to group dynamics and team work.
	Will create attitude to tackle challenges related to computer and basic software.
	Will create positive attitude to listen ideas of classmates.

Mapping of Course ILO and PLO:

Learning Outcome (LO) of the Course	Program Learning Outcome (PLO)											
	1	2	3	4	5	6	7	8	9	10	11	12
LO1	MJ	MJ	MJ	MJ	MJ			MN		MJ	MN	
LO2	MJ	MJ	MJ	MJ						MJ	MN	
LO3	MJ	MJ	MJ	MN	MN					MJ	MN	
LO4	MJ	MJ	MN		MN					MJ	MN	

Course Contents:

Sl. No.	ILO	Topic	Teaching Strategy	Assessment Strategy	Number of Sessions
1	1,4	Introduction of MATLAB	Lecture, Implementation in MATLAB	Q/A, Problem Solving	2
2	1	Solution of Algebraic and Transcendental Equations: To find the roots of non-linear equation using Bisection method, False Position method, Newton Raphson Method	Lecture, Implementation in MATLAB	Q/A, Problem Solving, Lab Assessment	3
3	2	Interpolation with Equal Interval: To solve the system of Newton's Forward interpolation formula for equal interval, To solve the system of Newton's Backward interpolation formula for equal interval.	Lecture, Implementation in MATLAB	Q/A, Problem Solving Assignment	4
4	3	Interpolation with Unequal Interval: To solve the system of Lagrange's formula for unequal interval, To solve the system of Newton's general divided difference formula for unequal interval.	Lecture, Implementation in MATLAB	Q/A, Problem Solving Assignment	3
5	3	Numerical Integration: To Integrate numerically using Trapezoidal rule, To Integrate numerically using Simpson's rules.	Lecture, Implementation in MATLAB	Q/A, Problem Solving, Lab Assessment	3
6	3	Numerical Solution of Ordinary Diff. Equation: To find numerical solution of ordinary differential equations by Euler's method, To find numerical solution of ordinary differential equations by Runge-Kutta method, To find numerical solution of ordinary differential equations by Taylor's Series method.	Lecture, Implementation in MATLAB	Q/A, Group work	4
7	1,4	Solution of Linear Algebraic Equation: To find numerical solution of Linear Algebraic equation	Lecture, Implementation in MATLAB	Q/A, Assignment, Quiz	3
8	2,4	Eigen Value and Eigen Vectors: Find the eigen value and eigen vectors from a equation.	Lecture, Implementation in MATLAB	Q/A, Presentation	1
				Total	23

Teaching Learning Methods:

Analyze and solve knowledge-based problems for practical situation , Group discussion.
Lecture slides, presentations, audio and video
Analytical and critical thinking approach to understand real life system and models

Assessment Schedule:

Assessment 1	Quizzes	Week 4, Week 10
Assessment 2	Assignments	Week 5, Week 11
Assessment 3	Presentation	Week 5, Week 11
Assessment 4	Mid-Term Exam	Week 6
Assessment 5	Final Exam	Week 12

Weights of Assessments:

Assessments	%
Mid-Term Exam	30
Final Exam	40
Quizzes	10
Assignments	10
Presentation	10
Total	100

Grading Policy:

Policy	Letter Grade	Grade Point	Assessments
80% and above	A+	4.00	Outstanding
75% to below 80%	A	3.75	Superlative
70% to below 75%	A-	3.50	Excellent
65% to below 70%	B+	3.25	Very Good
60% to below 65%	B	3.00	Good
55% to below 60%	B-	2.75	Average
50% to below 55%	C+	2.50	Below Average
45% to below 50%	C	2.25	Passing
40% to below 45%	D	2.00	Probationary
Below 40%	F	-----	Fail

List of References:

Course Notes: Follow Lecture notes.

Essential Books (Text Books): G. Shankar Rao : Numerical Analysis.

Recommended Reference Books:

1. E. Balagurusamy: Numerical Methods,
2. Gerald and C.F.: Applied Numerical Analysis

Online Recourses: Use Internet to get documents on specific topics.

Facilities Required for Teaching and Learning:

Projector, Whiteboard, Internet access from classroom computer, Audio/Visual equipment.

Course Policies and Procedures:

1. **Class attendance:** Regular attendances of classes are mandatory and students will be assigned F automatically if he/she misses 6 consecutive classes.
2. **Late submission of work:** Late submission will be followed by penalty, please maintain deadlines.
3. **Unfair means /plagiarism:** Plagiarism will be dealt with severe penalty. Original work is encouraged as they will carry value marks.

Appendix-1: Program Learning Outcome (PLO)

PLO No.	PLO
1.	Engineering Knowledge
2.	Problem Analysis
3.	Design/Development of Solutions
4.	Investigation
5.	Modern Tool Usage
6.	The Engineer and Society
7.	Environment and Sustainability
8.	Ethics
9.	Communication
10.	Individual and Team Work
11.	Life Long Learning
12.	Project Management and Finance

Professional/Generic Skills (Detailed):

- 1. Engineering Knowledge (T)** -Apply knowledge of mathematics, sciences, engineering fundamentals and manufacturing engineering to the solution of complex engineering problems;
- 2. Problem Analysis (T)** – Identify, formulate, research relevant literature and analyze complex engineering problems, and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
- 3. Design/Development of Solutions (A)** –Design solutions, exhibiting innovativeness, for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, economical, ethical, environmental and sustainability issues.
- 4. Investigation (D)** Conduct investigation into complex problems, displaying creativeness, using research-based knowledge, and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
- 5. Modern Tool Usage (A & D)** -Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations;
- 6. The Engineer and Society (ESSE)** -Apply reasoning based on contextual knowledge to assess societal, health, safety, legal, cultural, contemporary issues, and the consequent responsibilities relevant to professional engineering practices.
- 7. Environment and Sustainability (ESSE)** -Understand the impact of professional engineering solutions in societal, global, and environmental contexts and demonstrate knowledge of and need for sustainable development.
- 8. Ethics (ESSE)** –Apply professional ethics with moral values and commit to responsibilities and norms of professional engineering code of practices.
- 9. Communication (S)** -Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 10. Individual and Team Work (S)** -Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
- 11. Life Long Learning (S)** -Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- 12. Project Management and Finance (S)** -Demonstrate knowledge and understanding of engineering management and financial principles and apply these to one's own work, as a member and/or leader in a team, to manage projects in multidisciplinary settings, and identify opportunities of entrepreneurship.

.....
Course Coordinator/ Teacher

Date:

.....
Head of the Department

Date: