DE LA SALLE UNIVERSITY
College of Science
Department of Mathematics

NUMEANL– *Numerical Analysis*
Prerequisite: MATH115, LINEALG/MTRXTHE *Co-Requisite: DIFEQUA*

Instructor:_____ **Contact details:** _____
Consultation Hours:_____ **Class Schedule and Room:**_____

Course Description

NUMEANL is a course for mathematics and statistics majors. It introduces the students to numerical methods of approximating solutions to different classes of mathematics problems. It is designed to provide the students with real-life approaches to solving problems for which closed form solutions are not feasible.

Learning Outcomes

On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA)

ELGA	Learning Outcome
Critical and Creative Thinker Effective Communicator Lifelong Learner Service-Driven Citizen	At the end of the course, the student will be able to apply the appropriate mathematical concepts, well-known results, thinking processes, tools and technologies in solving various conceptual or real-life problems, whenever possible.

Final Course Output

As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.

Learning Outcome	Required Output	Due Date
At the end of the course, the student will be able to apply the appropriate mathematical concepts, well-known results, thinking processes, tools and technologies in solving various conceptual or real-life problems, whenever possible.	• A portfolio of the computer laboratory exercises performed during the course with an analysis and comparison of errors across various methods for a given class of problems • A group write-up on a specific real-life application of a numerical method including a description of the problem, the formulation of a solution and a discussion of the results. Students may form groups of 2-3 students.	Week 13

Rubric for assessment

Portfolio of Computer Laboratory Exercises

CRITERIA	Excellent	Very Good	Good	Fair
Completeness 40%	The submitted work includes all the prescribed exercises and the required parts of the solutions.	The submitted work has a few omissions but includes at least 85% of the prescribed exercises and the required components of the solutions.	The submitted work has some omissions but includes between 70%-84% of the prescribed exercises and the required components of the solutions. Certain aspects are either incomplete or incorrect.	The submitted work contains many omissions and satisfies less than 70% of the exercises and the required components of the solutions.
Accuracy 45%	The submitted work implemented the prescribed methods correctly and showed the correct results to all exercises.	The submitted work	The submitted work partially manifests the required qualities. Certain aspects are either incomplete or incorrect.	

Organization 15%	The write-ups for the laboratory exercises are all in order, and follow the prescribed format.	The write-ups for the laboratory exercises have minor errors and the prescribed format is followed in at least 85% of the items in the portfolio.	The write-ups for the laboratory exercises contain occasional errors and the prescribed format is followed in 70-84% of all write-ups.	The write-ups for the laboratory exercises contain occasional errors and the prescribed format is followed in less than 70% of the exercise write-ups.

Group Written Report

CRITERIA	EXCELLENT	VERY GOOD	SATISFACTORY	NEEDS IMPROVEMENT
Content and Accuracy (55%)	In-depth and insightful discussion was used throughout the report Supporting details were provided whenever necessary and appropriate Mathematical terms, concepts and results presented are correct throughout	Sufficient supporting details Mathematical terms, concepts and results presented are correct in most parts of the report.	Details are given but inadequate to support the topic Mathematical terms, concepts and results presented are correct in the majority of the report	Most of the details irrelevant Errors in the use of mathematical terms, concepts and results were noted in a major portion of the report.
Organization and Presentation (35%)	Logical sequencing of information throughout Excellent choice of examples and illustrations to enhance and clarify the discussion Clear and effective concluding paragraph	Logical sequencing of information most of the time Appropriate use of examples and illustrations Clear and effective concluding paragraph with very minor errors No grammatical error noted	Logical sequencing of information in some parts of the output. Some of the examples and illustrations used are appropriate. Clear concluding paragraph but lacks effectiveness Between one and three errors were noted	Improper sequencing of information in a substantial part of the report Majority of the illustrations and examples used are inappropriate Concluding paragraph not clear More than four errors were noted
Bibliography (15%)	All resources cited and up-to-date	Most of the resources were cited and up-to-date	Some of the resources were not cited and others are out-of-date	Majority of the resources not cited and some are out-of-date

Additional Requirements

- Skills Check (Seatwork/Quizzes/Assignment/Boardwork

Grading System

Final Course Output: 5 % Skills Check 65% Final Exam 30%. **TOTAL 100%** **Passing Grade: 60%**	**Scale:** 95-100% 4.0 89-94% 3.5 83-88% 3.0 78-82% 2.5 72-77% 2.0 66-71% 1.5 60-65% 1.0 <60% 0.0

Learning Plan

LEARNING OUTCOME	TOPIC	NO. OF HOURS/WEEK NO.	LEARNING ACTIVITIES
At the end of the course, the student will be able to apply the appropriate mathematical concepts, well-known results, thinking processes, tools and technologies in solving various conceptual or real-life problems, whenever possible.	**I.SOLUTIONS OF NONLINEAR EQUATIONS** 1. Bracketing Methods 2. Fixed Point Methods	4 Hours (Weeks 1-2)	Review of some results from Calculus Library Work Class Discussions Skills Exercises Introduction to Graphmatica Review of Excel Functions Computer Laboratory Activity
	II. SYSTEMS OF LINEAR EQUATIONS 1. Exact Methods a. Gaussian Elimination b. LU Decom-position 2. Iterative Methods a. Gauss-Seidel b. Gauss-Jacobi **QUIZ 1**	6 hours (Weeks 2-4)	Class Discussions Skills Exercises Computer Laboratory Activity
	III. INTERPOLATING POLYNOMIALS 1. The Lagrange Form of the interpolating polynomial 2. Undetermined Coefficients 3. Divided Differences 4. Newton's Formulas 5. Gauss' Formulas **QUIZ 2**	8 Hours (Weeks 6-8)	Introduction to Mathematica /Sage(optional) Class Discussions Skills Exercises Computer Laboratory Activity
	IV. NUMERICAL DIFFEREN-TIATION AND INTEGRATION 1. Numerical Differentiation 2. Newton-Cotes Formulas 3. Composite Integration: Trapezoidal and Simpson's Rules 4. Romberg Integration 5. Gaussian Integration	8 Hours (Weeks 9-11)	Class Discussions Skills Exercises Computer Laboratory Activity Review concept of initial value problems and their solutions Class Discussions Skills Exercises Computer Laboratory Activity

	QUIZ 3 **V. NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS** 1. One Step Methods a. Euler b. Taylor c. Runge-Kutta 2. Multistep Methods a. Adams' Method b. Milne's Method **QUIZ 4** **VI. EIGENVALUES AND EIGENVECTORS (Optional)** 1. Power Method 2. Inverse Power Method 3. Shifted Inverse Power Method	1.5 hours 6 hours (Weeks 12-13) 3 hours (Week 14)	Review of eigenvalues and eigenvector Class Discussions Skills Exercises Computer Laboratory Activity
	FINAL EXAMINATION	2 hours	

References

Atkinson, Kendall and Han, Weimin (2004). *Elementary Numerical Analysis (3rd ed.)*. John Wiley & Sons, Inc.

Chapra, Steven (2008). *Applied Numerical methods With MATLAB for Engineers and Scientists (2nd ed.)*. McGraw-Hill

Epperson, James F. (2007). *An Introduction to Numerical Methods and Analysis* (Revised edition). John Wiley & Sons, Inc.

Grasselli, Matheus and Pelinovsky, Dmitry. *Numerical Mathematics.* Jones and Bartlett Publishers Ltd.

Gerald, Curtis F.(2003). *Applied Numerical Analysis*. (7th Edition). Addison Wesley

Ruivivar, Leonor A. and Cureg, Edgardo S. (2000). *Introductory Numerical Analysis* (2nd edition.) Manila : De La Salle University Press.

Won Young Yang et.al.(2005). *Applied Numerical Methods Using MATLAB.* John Wiley & Sons, Inc.

Online Resources

Lecture Notes in Numerical Analysis. Accessed October 29, 2012 from: ocw.mit.edu/courses/mathematics/18-330/introduction-to-numerical-analysis-spring-2004/lecture-notes/

Teaching Numerical Analysis Using Elementary Numerical Analysis. Accessed October 29, 2012 from: www.math.iowa.edu/~atkinson/ena_master.html

Class Policies

1. The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit course. No part of the final exam may be considered as one quiz.
2. Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
3. As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
   A. approved absences (where the student concerned officially represented the University at some function or activity).
   B. absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.
4. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.
5. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.

6. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
7. Learning outputs are required and not optional to pass the course.
8. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
9. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
10. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
11. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
12. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
13. Only students who are officially enrolled in the course are allowed to attend the class meetings.

Approved by:

DR. ARTURO Y. PACIFICADOR, JR.
Chair, Department of Mathematics