

MATH470

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Course Summary

Course : MATH470 **Title :** Measurement Theory

Length of Course : 8

Prerequisites : MATH305 **Credit Hours :** 3

Description

Course Description: This course covers the study of basic topics in analysis with emphasis on methods and measurement. Sequences, series, functions, uniform convergence, continuity, partial differentiation, extreme value problems with constraints, Riemann integrals, line integrals, improper integrals, integrals with parameters, transformations. (Prerequisite: MATH305)

Course Scope:

MATH470, Measurement Theory covers the study of basic topics in numerical analysis with emphasis on methods and measurement. It will include sequences, series, functions, uniform convergence, continuity, partial differentiation, extreme value problems with constraints, Riemann integrals, line integrals, improper integrals, integrals with parameters, and transformations. Practical applications are provided throughout the course.

The main components of this course include:

- Mathematical preliminaries necessary to measure and analyze the effects of various errors associated with the computations.
- Interpolation and approximation methods and the measure of error involved in using these methods.
- Methods for differentiation and integration. Methods for solving initial-value problems for ordinary differential equations.
- Direct methods for solving systems of linear equations
- Singular value decomposition and the measure of error involved in using these methods.

Objectives

After successfully completing this course, you will be able to accomplish the following course objectives (CO):

- CO-1: Review mathematical preliminaries necessary to measure and analyze the effects of various errors associated with the computations.
- CO-2: Analyze the errors associated with the computations of solutions for equations in one variable and the convergence of sequences and series.

- CO-3: Differentiate between interpolation and approximation methods in order to measure the error involved in using these methods.
 - CO-4: Differentiate between methods for differentiation and integration on order to measure the error involved in using these methods.
 - CO-5: Differentiate between various methods for solving initial-value problems for ordinary differential equations in order to measure the error involved in using these methods.
 - CO-6: Differentiate between direct methods for solving systems of linear equations in order to measure the error involved in using these methods.
 - CO-7: Analyze singular value decompositions in order to measure the error involved.
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Outline

Week 1:

Learning Objectives

CO-1: Review mathematical preliminaries necessary to measure and analyze the effects of various errors associated with the computations.

Assessments / Assessment Plan

Week 1 Written Assignment

Chapter 1.1: 1b, 2b, 3b, 4b, 12

Chapter 1.2: 1e, 2a, 5h, 7h

Chapter 1.3: 3a, 6a

Chapter 1.4: none

Week 1 Forum topic: Introductions

Week 1 Forum topic: Selected discussion problems on mathematical preliminaries and measure of error.

Week 1 Learning Journal

Instructional Content

Chapter 1, sections 1.1 – 1.4

Week 1 Lesson

GETTING STARTED » Introduction Forum

WEEK 1: CH1: MATHEMATICAL PRELIMINARIES & ERROR ANALYSIS

Week 2:

Learning Objectives

CO-2: Analyze the errors associated with the computations of solutions for equations in one variable and the convergence of sequences and series

Assessments / Assessment Plan

Week 2 Written Assignment

Chapter 2.1: 6b, 10a, 16, 20

Chapter 2.2: 12a, 12d
Chapter 2.3: 12a, 20a, 28
Chapter 2.4: 6a, 10
Chapter 2.5: 2

Week 2 Forum topic: Selected discussion problems on equations of one variable, rates of convergence, and measure of error.

Week 2 Learning Journal

Instructional Content

Chapter 2, sections 2.1 – 2.5

Week 2 Lesson

WEEK 2: CH 2: SOLUTIONS OF EQUATIONS IN ONE VARIABLE

Week 3:

Learning Objectives

CO-3: Differentiate between interpolation and approximation methods in order to measure the error involved in using these methods.

Assessments / Assessment Plan

Week 3 Written Assignment

Chapter 3.1: 6b, 8b
Chapter 3.2: 2a, 6
Chapter 3.3: 4a, 5a
Chapter 3.4: 2b, 4b, 10

Week 3 Forum topic: Selected discussion problems on interpolation methods and measure of error.

Week 3 Learning Journal

Instructional Content

Chapter 3, sections 3.1 – 3.4

Week 3 Lesson

WEEK 3: CH 3: INTERPOLATION & POLYNOMIAL APPROXIMATION

Week 4:

Learning Objectives

CO-4: Differentiate between methods for differentiation and integration in order to measure the error involved in using these methods.

Assessments / Assessment Plan

Week 4 Written Assignment

Chapter 4.1: 2a, 4a, 6a, 8a
Chapter 4.2: 1c

Chapter 4.3: 2a, 4a, 6a

Weeks 4: No Forum

Week 5 Written Assignment

Chapter 4.3: 8a, 10a, 12a, 21a

Chapter 4.4: 8, 12

Chapter 4.5: 6a

Chapter 4.9: 2a, 4a

Instructional Content

Chapter 4, sections 4.1 – 4.5 & 4.9

Week 4 & 5 Lesson

WEEKS 4 & 5: CH 4: NUMERICAL DIFFERENTIATION & INTEGRATION

Week 5:

Learning Objectives

CO-4: Differentiate between methods for differentiation and integration on order to measure the error involved in using these methods.

Assessments / Assessment Plan

Week 5 Written Assignment

Chapter 4.3: 8a, 10a, 12a, 21a

Chapter 4.4: 8, 12

Chapter 4.5: 6a

Chapter 4.9: 2a, 4a

Week 5 Forum topic: Selected discussion problems on methods of differentiation, integration, and measure of error.

Week 5 Learning Journal

Instructional Content

WEEKS 4 & 5: CH 4: NUMERICAL DIFFERENTIATION & INTEGRATION

Week 6:

Learning Objectives

CO-5: Differentiate between various methods for solving initial-value problems for ordinary differential equations in order to measure the error involved in using these methods.

Assessments / Assessment Plan

Week 6 Written Assignment

Chapter 5.1: 4a, 4c

Chapter 5.2: 2c, 4c

Chapter 5.3: 10

Chapter 5.4: 4a, 8a, 12a, 16a, 26a
Chapter 5.5: 2b

Week 6 Forum topic: Selected discussion problems on methods for solving initial-value problems and measure of error.

Week 6: Learning Journal

Instructional Content

Chapter 5, sections 5.1 – 5.5

Week 6 Lesson

WEEK 6: CH 5: INITIAL-VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

Week 7:

Learning Objectives

CO-6: Differentiate between direct methods for solving systems of linear equations in order to measure the error involved in using these methods.

Assessments / Assessment Plan

Week 7 Written Assignment

Chapter 6.1: 6a, 6c, 14d
Chapter 6.2: 10b, 14b, 18b
Chapter 6.5: 2a, 6a
Chapter 6.6: 2, 4a, 6a, 12c

Week 7 Forum topic: Selected discussion problems on direct methods for solving systems of linear equations and measure of error.

Week 7: Learning Journal

Instructional Content

Chapter 6, sections 6.1 – 6.2, and 6.5 – 6.6

Week 7 Lesson

WEEK 7: CH 6: DIRECT METHODS FOR SOLVING LINEAR SYSTEMS

Week 8:

Learning Objectives

CO-7: Analyze singular value decompositions in order to measure the error involved.

Assessments / Assessment Plan

Week 8 Written Assignment

Chapter 9.6: 2a, 2d, 4a, 4d

Week 8 Forum topic: Selected discussion problems on singular value decomposition and measure of error.

Week 8: Learning Journal

Instructional Content

Chapter 9, sections 7.1 – 7.2 and 9.1 – 9.2 only as needed for review, section 9.6

Week 8 Lesson

WEEK 8: CH 9: APPROXIMATING EIGENVALUES

Week 8: Assignments, Tests & Quizzes

Evaluation

Forum Assignments: The University requires weekly contact from each student. This requirement can be met by submitting chapter Journals and by participating in the Forums. A total of 20% of the final grade will be based on participation in eight forum topics within seven Forums. It is expected that Forum posts are written in complete sentences using correct grammar and spelling. Any post that requires research must be accompanied by a proper APA style citation of the references used. There are many citation tutorials available on the web, but citefast.com works well and can be used quickly, efficiently, and gives the student the ability to save the resource.

Written Assignments: Written homework is assigned to provide you an opportunity to practice what you have read. It gives the professor a summative means by which to determine the level of understanding that a student has achieved. Your homework problems can be written up directly in the assignment text box using the equation editor to enter any mathematics. However, if you prefer, you could also choose to write up your solutions in a Word document using the Equation Editor to enter mathematics or scan your hand written solutions. Or work the problems in a spreadsheet. If you choose the latter two options, make sure that your hand written solutions are clearly numbered and readable. In either case, you would attach your files to the appropriate drop box.

There are 8 weekly written assignments for a total of 50% of the final course grade. If the student is having difficulty with a problem, he/she should check the companion website for additional resources and/ ask questions about a similar problem in the text in the appropriate Weekly Question forum.

Learning Journal: A very important component of your learning experience is to be able to reflect on what you have learned. The purpose of keeping a weekly journal is to enhance your learning through the process of writing and thinking about your experiences. During each week you will be responsible for keeping a written record (journal) of your lesson notes, observations, thoughts about your learning experience, and questions. At the end of the week you will be asked to submit the journal.

There are 8 weekly journals for a total of 30% of the final grade.

Your journal should be written as a 3-column table with the following headings: Definitions, Algorithms, and Questions. For each section covered in this chapter, provide the following information:

- Definition heading: list pertinent definitions and proof writing tools that you read about in this module;
- Algorithm heading: provide a brief summary of any algorithms presented in the chapter.
- Questions heading: list any questions regarding the material you had in this module.

Example:

Definition: list

pertinent definitions
and proof writing
tools that you read
about in this module

Algorithm: provide a
brief summary of any questions regarding
algorithms presented the material you had
in the chapter

Questions: list any
questions regarding
the material you had
in this module

Evaluation is based on homework assignments, journals, and discussion board participation. The student is assessed on the level of conceptual understanding and technical application of the various topics of Measurement Theory in Numerical Analysis.

Please see the [Student Handbook](#) to reference the University's [grading scale](#).

Final course evaluation will be based on the following breakdown of each time of Learning Activity.

Grading:

Name	Grade %
Forums	20.00 %
APUS Honor Code and Pledge	1.00 %
Week 1: Introductions	2.22 %
Week 1: Mathematical preliminaries and measure of error	2.22 %
Week 2: Equations of one variable, rates of convergence, and measure of error	2.22 %
Week 3: Interpolation Methods and Measure of Error	2.22 %
Week 5: Methods of differentiation, integration, and measure of error	2.22 %
Week 6: Methods for solving initial-value problems and measure of error	2.22 %
Week 7: Direct methods for solving systems of linear equations and measure of error	2.22 %
Week 8: Singular value decomposition and measure of error	2.22 %
Week 8: COURSE WRAP UP	2.22 %
Homework	50.00 %
Week 1: Written Homework Exercises	6.25 %
Week 2: Written Homework Exercises	6.25 %
Week 3: Written Homework Exercises	6.25 %
Week 4: Written Homework Exercises	6.25 %
Week 5: Written Homework Exercises	6.25 %
Week 6: Written Homework Exercises	6.25 %
Week 7: Written Homework Exercises	6.25 %
Week 8: Written Homework Exercises	6.25 %
Journal	30.00 %
Week 1: Learning Journal	4.29 %
Week 2: Learning Journal	4.29 %
Week 3: Learning Journal	4.29 %
Week 5: Learning Journal	4.29 %
Week 6: Learning Journal	4.29 %

Week 7: Learning Journal 4.29 %
Week 8: Learning Journal 4.29 %

Materials

Book Title: Numerical Analysis, 9th Ed - The VitalSource e-book is provided via the APUS Bookstore

Author: Burden

Publication Info: Cengage

ISBN: 9780538733519

Book Title: You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - <http://apus.libguides.com/bookstore/undergraduate>

Author: N/A

Publication Info: N/A

ISBN: N/A

Supplementary Resources

The Numerical Analysis Companion Website contains a plethora of supplementary resources including power points, video clips where available, algorithm program files written in MAPLE, MATLAB, C, JAVA, MATHEMATICA, FORTRAN, and PASCAL, sample tests, and the first two chapters of the Student Study Guide.

Web Sites

NUMERICAL ANALYSIS Companion Website: the link is listed in the table below.

In addition to the required course text, the following public domain web sites are useful. Please abide by the university's academic honesty policy when using Internet sources as well. Note web site addresses are subject to change.

DESCRIPTIONURL

NUMERICAL
ANALYSIS
Companion
Website

<https://sites.google.com/site/numericalanalysis1burden/>

Dr. R.L.
Burden's
Website

<http://people.yzu.edu/~rlburden/>

Dr. A.M.
Burden's
Website

<http://people.yzu.edu/~amburden/>

NPTEL: e-
Learning
Courses from <http://nptel.ac.in/courses/111101003/2>
the IITs and IISc

Holistic
Numerical <http://nm.mathforcollege.com/videos/>
Methods

Learners TV <http://www.learnerstv.com/Free-maths-Video-lectures-Itv687-Page1.htm>

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- [Tutor.com](http://www.tutor.com) offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not

copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

[Student Handbook](#)

- [Drop/Withdrawal policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)
- [Disability Accommodations](#)

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