Term Information

Effective Term	Autumn 2020
Previous Value	*Summer 2012*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Revision of the 6601-6602 syllabi:

Topics have been rearranged and more advanced topics added.

The catalog description and prerequisites have been updated accordingly.

References to quarter courses have been removed.

One of the four credits has been identified as am individually scheduled lab requirement.

What is the rationale for the proposed change(s)?

The course sequence is intended serve as a required (also elective) for a newly proposed applied mathematics track in the mathematics PhD program. The rigor and sophistication of the content, the level of training, as well as the required preparations of the sequence thus needed to be adjusted to match that of our traditional track as well as the expected strength of incoming students.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

As noted above, Math 6601 will constitute a core gateway course requirement for the applied mathematics track. The 6601-2 sequence also serves as an elective in the traditional track but has historically very rarely been used by students as an elective. The impact on the traditional track is thus expected to be minimal.

Is approval of the requrest contingent upon the approval of other course or curricular program request? Yes

Please identify the pending request and explain its relationship to the proposed changes(s) for this course (e.g. cross listed courses, new or revised program)

This course approval request is submitted in conjunction with the change request for Math 6602 as well as the approval of the proposal for an applied math track/subplan.

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Mathematics
Fiscal Unit/Academic Org	Mathematics - D0671
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	6601
Course Title	Numerical Methods in Scientific Computing I
Transcript Abbreviation	Num Meth Sc Comp 1
Course Description	Numerical linear algebra: matrix operations, direct and iterative methods for systems of linear equations, eigenvalue problems; Nonlinear equations and systems; Numerical Integration.
Previous Value	*What is scientific computing; the evaluation of functions; solving linear systems using Gaussian elimination; finding zeroes and minima of nonlinear equations; bifurcation studies.*
Semester Credit Hours/Units	Fixed: 4

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Laboratory, Lecture
Previous Value	*Lecture*
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Graduate standing or Math 5603
Previous Value	*Prereq: 2415.xx and 2568; or 255 or 415, and 568 or 572.*
Exclusions	
Previous Value	Not open to students with credit for 707
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	27.0301
Subsidy Level	Doctoral Course
Intended Rank	Doctoral

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors
The course is an elective (for this or other units) or is a service course for other units

Previous Value

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Acquire a strong knowledge and skill set in doctoral level numerical methods in scientific computing.

Previous Value

Content Topic List

- Matrix operations, Singular value decomposition.

  Projection, QR factorization, Gram-Schmidt orthogonalization.
- Householder triangularization, least squares.

  Conditioning, stability, back substitution.
- Direct methods: Gauss elimination, LU factorization, Cholesky decomposition.

  Banded linear systems. Block systems.
- Iterative methods: Gauss-Siedel, Jacobi, SOR, Convergence.

  Gradient method, conjugate gradient, Krylov, GMRES.
- Eigenvalues. Power method, Rayleigh quotient, QR with shift
- Nonlinear equations: root finding, fixed point, bisection, convergence.
- Nonlinear systems: Newton, quasi-Newton, Secant, fixed-point.
- Numerical integration: mid-point, trapezoidal, Newton-Cotes, composite rules, Richardson extrapolation.

Previous Value

- *What is scientific computing*
- *The evaluation of functions*
- *Solving linear systems using Gaussian elimination*
- *Finding zeroes and minima of nonlinear equations*
- *Bifurcation studies*

Sought Concurrence

No

Attachments

- MATH6601_Syllabus_ed_2019_03_04.pdf: Math 6601 Syllabus

  (Syllabus. Owner: Kerler,Thomas)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	03/19/2019 08:47 PM	Submitted for Approval
Approved	Husen,William J	03/20/2019 09:29 AM	Unit Approval
Approved	Haddad,Deborah Moore	03/20/2019 10:05 AM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	03/20/2019 10:05 AM	ASCCAO Approval

Math 6601 Syllabus **Autumn 2018**

Numerical Methods in Scientific Computing I

Instructor and Class Information

Lecturer:	**Course Num.:**
Office:	**Lecture Room:**
Phone:	**Lecture Times:**
Email:	**Office Hours:**

About Course Goals

FORMAT

The course includes three 55-minute meetings a week and a one-hour, individually scheduled lab. Instruction will be mainly lectures delivered by the instructor. It may also include occasional in-class discussion as well as short student presentations, particularly by post-candidacy students.

DESCRIPTION & GOALS

This course covers the core numerical methods for scientific computing. Major topics include: numerical linear algebra, direct and iterative methods for linear system of equations, nonlinear equation and systems, and numerical integration.

PREREQUISITES

Math 5603 or graduate standing or permission of instructor.

Textbook

MAIN REFERENCE

L.N. Trefethen and D. Bau, III*: "Numerical Linear Algebra",* SIAM, 1997. ISBN: 978-0-898713-61-9.

A. Quarteroni, R. Sacco, and F. Saleri: *"Numerical Mathematics",* Springer, 2000. ISBN: 0-387-98959-5.

Assessments

HOMEWORK ASSIGNMENTS

There will be approximately 10 homework assignment sheets, which will typically contain several fully described problems as well as a list of numbers of textbook problems. Due dates of assignments will be announced and set typically a week after the assignments are published

FINAL PROJECT

The final project is a more extensive written assignment that will draw on techniques acquired throughout the semester through lectures and the weekly lab. It will be published about two weeks before the end of classes and will be due at the beginning of finals week.

CLASS PARTICIPATION AND ATTENDANCE

Although attendance is not regularly monitored frequent absences are likely to be noted and may factor into the grade in borderline cases.

Grading

COURSE SCORE

A course score will be computed from the above assessments. Homework assignments will count 70% towards the grade and the final project 30%.

LETTER GRADES

Letter grades will be determined based on the course score. The major topics include: numerical linear algebra, direct and iterative methods for linear system of equations, methods for nonlinear equation and systems, numerical integration.

Weekly Schedule

Week 1	Matrix operations, Singular value decomposition
Week 2	Projection, QR factorization, Gram-Schmidt orthogonalization
Week 3	Householder triangularization, least squares
Week 4	Conditioning, stability, back substitution
Week 5	Direct methods: Gauss elimination, LU factorization, Cholesky decomposition
Week 6	Banded linear systems. Block systems
Week 7	Iterative methods: Gauss-Siedel, Jacobi, SOR, Convergence
Week 8	Iterative methods: gradient method, conjugate gradient, Krylov, GMRES
Week 9	Eigenvalues. Power method, Rayleigh quotient, QR with shift
Week 10	Nonlinear equations: root finding, fixed point, bisection, convergence.
Week 11	Nonlinear systems: Newton, quasi-Newton
Week 12	Nonlinear systems: Secant, fixed-point
Week 13	Numerical integration: mid-point, trapezoidal
Week 14	Numerical integration: Newton-Cotes, composite rules, Richardson extrapolation

General Policies

ACADEMIC MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to

the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (https://trustees.osu.edu/index.php?q=rules/code-of-student-conduct/)."

DISABILITY SERVICES

Students with disabilities that have been certified by Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Ave; telephone 614-292-3307, VRS 614-500-4445; https://slds.osu.edu/.