Term Information

Effective Term	Spring 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 6602 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 6601 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	6602
Course Title	Numerical Methods in Scientific Computing II
Transcript Abbreviation	Num Meth Sc Comp 2
Course Description	Approximation theory: interpolation, projection, integration; Initial value problems: one- and multi-step methods, Runge-Kutta methods, stability analysis; PDEs: advection equation, diffusion equation, stability analysis.
Previous Value	*Interpolation and approximation theory; numerical differentiation and integration; time evolution ODEs; boundary value ODEs; eigenvalues, including Krylov subspace methods; solving linear systems using iterative methods.*
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	Math 6601
Previous Value	*Prereq: 6601 (708)*
Exclusions	
Previous Value	Not open to students with credit for 709
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

- Approximation theory: Polynomial interpolation, orthogonal polynomials, orthogonal projection, best approximation.
- Numerical integration, Gauss quadrature, bounded and unbounded domains
- Initial value problem (IVP): basic methods, Euler forward, mid-point rule, truncation errors.
  Analysis of one-step methods: consistency, convergence, stability.
  Multi-step methods. Adams methods, BDF methods.
- Runge-Kutta methods
- Zero-stability for IVP, absolute stability for ODEs.
- PDE: boundary value problems, steady-state diffusion equation. Parabolic problems. Von Neuman analysis. Method of lines.
- Linear advection equations: Euler forward, Leapfrog, Lax-Friedrichs, Lax-Wendroff.
- Stability analysis. Upwinding methods, CFL condition. Multi-dimensions. Boundary conditions.

Previous Value

- *Interpolation and approximation theory*
- *Numerical differentiation and integration*
- *Time evolution ODEs*
- *Boundary value ODEs*
- *Eigenvalues, including Krylov subspace methods*
- *Solving linear systems using iterative methods*

Sought Concurrence No

Attachments

- MATH6602_Syllabus_ed_2019_03_04.pdf: Math 6602 Syllabus

  (Syllabus. Owner: Kerler,Thomas)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	03/19/2019 08:48 PM	Submitted for Approval
Approved	Husen,William J	03/20/2019 09:30 AM	Unit Approval
Approved	Haddad,Deborah Moore	03/20/2019 10:04 AM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	03/20/2019 10:04 AM	ASCCAO Approval

Math 6602 Syllabus **Spring 2019**

Numerical Methods for Scientific Computing II

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. The major topics include: basic approximation theory, methods for initial value problems and ordinary differential equations, and finite difference methods for partial differential equations.

PREREQUISITES

Math 6601, or instructor's permission

Textbook

MAIN REFERENCES

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

R. LeVeque: *"Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems"*, SIAM 2007. ISBN: 0-898-71629-2.

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 and via 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.

Weekly Schedule

Week 1	Approximation theory: Polynomial interpolation, orthogonal polynomials.
Week 2	Approximation theory: Orthogonal projection, best approximation
Week 3	Gaussian integration, Gauss quadrature, bounded and unbounded domains
Week 4	Initial value problem (IVP): basic methods, Euler forward, mid-point rule, truncation errors
Week 5	IVP: analysis of one-step methods: consistency, convergence, stability
Week 6	IVP: multi-step methods. Adams methods, BDF methods.
Week 7	Runge-Kutta methods
Week 8	Zero-stability for IVP
Week 9	Absolute stability for ODEs
Week 10	PDE: boundary value problems, steady-state diffusion equation.
Week 11	PDE: Parabolic problems. Von Neuman analysis. Method of lines
Week 12	Linear advection equations: Euler forward, Leapfrog, Lax-Friedrichs, Lax-Wendroff
Week 13	Stability analysis. Upwinding methods, CFL condition
Week 14	Multi-dimensions. Boundary conditions.

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/.