General Studies Gold Request Form

Consult the General Studies Request FAQ for more information and quick answers.

New permanent numbered courses must be submitted to the workflow in Kuali CM before a General Studies request is submitted here. The General Studies Council will not review requests ahead of a new course proposal being sent to the Senate.

Submission Information

College/School	Department/School
Ira A. Fulton Schools of Engineering (CES)	Mechanical and Aerospace Engineering Program (CMECHAERO)

Submission Type

Mandatory Review

New Request: A request for a new designation, a change in designation, or to reinstate a designation that has been lost.

Mandatory Review: Only select if this course (or topic on a *permanent* course) is undergoing mandatory review in the current academic year. Not for omnibus topic use.

Modification: A request to modify the expected learning outcomes of the course, but not change any other aspect of the originally approved proposal. Only for courses that have a previously approved General Studies Gold request.

ASU Request

Is this request for a permanent course or a topic?

Permanent Course

Subject Code	Course Number	Units/Credit Hours
MAE	384	3

Course Information

Enter the course catalog information, found in the web course catalog or Kuali CM.

Course Title

Advanced Mathematical Methods for Engineers

Course Catalog Description

Methods for numerical solutions to engineering problems. Nonlinear equations, quadrature, ordinary differential equations. Analytical and numerical solutions to partial differential equations.

Enrollment Requirements (Prerequisites, Corequisites, and/or Antirequisites)

Prerequisite(s): Engineering major; CSE 100, CSE 110, or MAE 215 with C or better; MAT 242, 342, or 343 with C or better; MAT 274 or 275 with C or better; Pre- or corequisite(s): MAT 267 or 272 with C or better if completed OR Visiting University Student

Is this a crosslisted course?

No

Is this course offered by (shared with) another academic unit?

No

If you are requesting to change the existing GS Gold (not Maroon) designation, please check this box.

General Studies Gold Designation Request

General Studies Designation

Quantitative Reasoning (QTRS)

Attach a representative syllabus for the course, including course learning outcomes and descriptions of assignments and assessments.

Syllabus_MAE384_S25-v1.pdf

Quantitative Reasoning (QTRS)
Quantitative and computational reasoning is essential for success in 21st-century careers, for critically evaluating information in the age of "big data," for assessing the quality of arguments conveyed through digital media, for informed participation in community and social life, and for contributing to the formulation of effective solutions for achieving a sustainable and just future. Quantitative reasoning enables students to apply relevant mathematical, statistical, computational, and visualization methods in academic, social and personal settings.

In a quantitative reasoning course, students learn about data, data management, data summaries, data visualization, and the use of computational tools with data. Data can take many forms, including numerical data, textual data, images, and others. Students also learn about how quantitative reasoning can be used to make arguments clear, precise and verifiable. Finally, they learn to build quantitative models, make predictions, and communicate their findings based on available data. This may include some combination of mathematical, statistical, computational or network models, or visualizations.

Most of the course content should align with the Gold category learning outcomes.

Instructions: In the fields below, state the assignment, project, or assessment that will measure each learning outcome, and provide a description. The description should provide enough detail to show how it measures the learning outcome. If needed, more than one can be identified.

The proposal does not need to include all course assessments that measure a given learning outcome. The provided assessment should include sufficient detail to allow the subcommittee to make their evaluation. When appropriate, the same assessment can be listed for more than one learning outcome (e.g., a culminating project).

You may provide links to a document (Google Drive or Dropbox) that includes the relevant details for the assessment. **Do not provide links to Canvas shells.**

QTRS Learning Outcome 1: Understand variables, measurement and data, including how they can be used to pose and answer questions about society and nature, and to manipulate, organize, classify and visualize quantitative data.

Final Project

The final project engages students in modeling the relationship among important variables such as force of gravity, fluid flow rates, and dimensions of transport piping, in a realistic fluid dynamics context. For example, to determine the impact of changing the rate at which an elevator oscillates up and down, on the mass flow rate of fluid being injected into a container. By modeling such systems, students learn how to determine, computationally, appropriate solutions to critical problems of fluid transport such as what the optimal size of piping would be to obtain a steady flow of fluid for an oscillating system.

QTRS Learning Outcome 2: Evaluate arguments from everyday life or academic fields of study that are represented mathematically, statistically, computationally, or in visualizations.

Exam 3

This Exam assesses students' learning of how to find roots of systems of equations of n variables (n ranging from 1 to thousands) using the Secant and Gauss-Jordan methods. The systems of equations are derived from fluid dynamics contexts such as mass flow through pipes, or pressure changes over an airfoil. The methods learned are widely applicable across applications in engineering and the sciences.

QTRS Learning Outcome 3: Formulate hypotheses, mathematical models or narratives that are consistent with quantitative data.

Exam 6

This exam assesses students' ability to apply computational modeling to the dynamics of a cantilevered beam. The behavior of cantilevered beams of different dimensions, under different load specifications are modeled. Students must describe the loading of beams under different parameters and discuss the potential error in their models based on chosen intervals for estimating the behavior.

QTRS Learning Outcome 4: Communicate how quantitative data, interpretations, or models are connected to outcomes, predictions, decisions, explanations, or future states.

Exam 7
This exam assesses students ability to analyze data acquisition, filtering using various techniques, to isolate particular frequency bands of a signal. Students develop and apply a computational model that can be applied across data acquisition situations across frequencies bands.

QTRS Learning Outcome 5: Effectively employ one or more digital tools to demonstrate quantitative reasoning, interpretations of calculations, or the creation and evaluation of visualizations.

Exam 8
Students develop Matlab programs to solve ordinary differential equations that describe dynamics contexts using the Runge-Kutta method. They create and interpret visualizations of power spectra.

List all course-specific learning outcomes. Where appropriate, identify the associated QTRS learning outcome(s) in brackets (see below for example). Note: It is expected that a majority of course-specific learning outcomes will be associated with a QTRS learning outcome.

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1 Identify and estimate errors in numerical solutions. Comprehension Level [QTRS LO4]
2 Solve linear system of equations using direct methods. Application Level [QTRS LO1]
3 Solve nonlinear single variable functions and multivariate systems of functions using basic root finding techniques. Application Level [QTRS LO1, LO2, LO3,LO4, LO5]
4 Perform curve fitting and interpolation using given or generated data sets. Application Level [QTRS LO 5]
5 Calculate derivatives of given or generated data sets of one or more inde-pendent variables using finite differences. Application Level [QTRS LO3]
6 Calculate integrals of given or generated data sets using numerical inte-gration techniques. Application Level [QTRS LO2, LO3]
7 Analyze periodic data using discrete Fourier transforms. Application Level [QTRS LO4, LO5]
8 Solve ordinary differential equations (single ODEs and systems of ODEs) using numerical methods. Application Level [QTRS LO1, LO2, LO4]
9 Solve linear partial differential equations analytically. Comprehension Level [QTRS LO1, LO2, LO4]
10 Solve a partial differential equation using numerical methods. Comprehension Level [QTRS LO1, LO2, LO4]
11 Present numerical results in appropriate fashion. Application Level [QTRS LO4, LO5]
12 Solve engineering problems using a combination of appropriate numeri-cal methods. Analysis Level [QTRS LO1, LO2, LO3,LO4, LO5]

Form Submission - Proposer

Submitted for Approval | Proposer

James Middleton - January 28, 2026 at 1:52 PM (America/Phoenix)

Department Approval

Approved

Tiffany Wingerson - January 28, 2026 at 2:31 PM (America/Phoenix)

GSC Coordinator Review

Approved

Kimberly Singleton - January 29, 2026 at 7:50 AM (America/Phoenix)

April Randall

Assistant Vice Provost Review

Approved

Tamiko Azuma - January 29, 2026 at 1:30 PM (America/Phoenix)

All required components confirmed.

Pre-GSC Meeting

Approved

Kimberly Singleton

April Randall - February 5, 2026 at 3:18 PM (America/Phoenix)

Quantitative Reasoning (QTRS) Subcommittee

Acknowledgement Requested

Samantha Anderson

Jason Nichols

Terri Kurz - February 24, 2026 at 12:24 PM (America/Phoenix)

Revise and Resubmit; While it is likely this course fits the QTRS LOs, there is not enough details provided in the documentation. Please provide sample assignments and exams that align with the descriptions. The syllabus and course activities need to better show how course LOs line up with QTRS LOs. Clarity about how assignments meet the QTRS LOs is required for all LOs.

Elizabeth Kizer

General Studies Council Meeting

Waiting for Approval

Kimberly Singleton

April Randall

Proposer Notification

Notification

James Middleton

College Notification

Notification

Teresa Wu

Shawn Jordan

Amy Riggs

Cindy Boglin

Mike Sever

Tiffany Wingerson

Bob Monahan

Allison Curran

Elizabeth Tripodi

Jeremy Helm

Sergio Quiros