

## Mathematical Basis

### ECH 6847 Section 11997, Section CAMP, 12018 Section 1FE2

**Class Periods:** Monday, Period 7 Wednesday Period 6, 7

Please note that additional lectures will take place on occasion and these will also be recorded

**Location:** NEB 201 unless otherwise noted on CANVAS

**Academic Term:** Fall 2022

#### **Instructor:**

Name: R. Narayanan

Email Address: [ranga@ufl.edu](mailto:ranga@ufl.edu) (Please write ECH 6847 on your subject line to get an answer quickly)

Office Phone Number: 352 392 9103 Room 419 Chemical Engineering

Office Hours: Mondays and Wednesday, Period 8, We will meet via ZOOM unless otherwise indicated on CANVAS

More office hours will be announced as needed.

**ZOOM Room ID: 966 8488 6539. This link will be active during class hours and during office hours. So please join during those hours only if you need to be remote. Otherwise you are strongly encouraged to come to class in person.**

**Supervised Teaching Graduate Students:** Marisa Pacheco

Email Address: [marisa.pacheco@ufl.edu](mailto:marisa.pacheco@ufl.edu) (Please write ECH 6847 on your subject line to get an answer quickly)

Office Hours: Thursdays 8:30 am-9:30 am and Friday 3-4 pm in person in WERTH 475. Any changes in office hours will be indicated on CANVAS.

#### **Course Description**

Methods of linear systems, chemical engineering applications in finite and infinite dimensional spaces, concepts of stability, application to transport phenomena: 3 Hours

#### **Course Pre-Requisites / Co-Requisites**

Course on ordinary differential equations, linear algebra principles, separation of variables

#### **Course Objectives**

Clearly state the learning objectives of the course, and how those objectives will be accomplished (give a list of specific actions or course elements).

#### **Materials and Supply Fees**

NONE

**Required Textbooks and Software :** NONE

**Recommended Materials but NOT REQUIRED:** (I will NOT follow these books neither in style nor chapter sequence. The chapters are generally written as stand-alone and in that regard as well as others, the books are very nice. While the books are not required, I might occasionally refer to problems in the books- in any case such problems will be re-typed and put on CANVAS where needed).

a) 20 Lectures on eigenvectors, eigenvalues, and their applications: *Problems in Chemical Engineering*

Author: L.E. Johns

Publisher : Orange Grove Press, 2015

ISBN: 9781616101657

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b) *Mathematical Methods in Chemical Engineering*

A. Varma and M. Morbidelli

Publisher: Oxford Univ. Press

ISBN # ISBN-13 978-0-1 9-509821-1

**Tentative Course Schedule**

Week 1:	August 24. First order ODE, the basis for the course. Linear operators, homogenous and inhomogeneous equations.
Week 2:	August 29 and August 31 Matrix multiplication, inner products, adjoints, eigenvalues, solvability.
Week 3:	Sept. 7: More on adjoints, eigenvalues and solvability. Example problems on matrices, Det. and Trace
Week 4:	Sept 12 -Sept 14: Applications in Chemical Engineering: Eigenvalues extended to the Chemostat and Reactor stability.
Week 5	Sept 19 -Sept 21: Eigenfunction expansion applications to diffusion problem in rectangular coordinates
Week 6	Sept. 26:-Sept 28 . Unsteady heat diffusion problems in one dimension.
Week 7	Oct.3- Oct. 5: Applications to Cylindrical coordinates. Review of Bessel's equation.
Week 8	Oct 10: Review of Homework and <b>EXAM 1 on October 12 (location to be announced)</b>
Week 9	Oct 17- Oct 19: The Laplacian operator and Unsteady diffusion problems in multiple dimensions
Week 10	Oct 24- Oct. 26: More on unsteady problems in multiple dimensions- applications to heat transfer in cylindrical and spherical coordinates.
Week 11	Oct 31- - Nov. 2: Approximate methods: The Galerkin method and its use in inhomogenous as well as eigenvalue problems.
Week 12	Nov 7- Nov 9: Approximate methods: Regular perturbations- applications from Fluid mechanics, heat transfer. - Nov 11 is a Holiday
Week 13	Nov. 14- Nov. 16: Some nonlinear problems and regular perturbations. Brief expose on singular perturbations.
Week 14	Nov. 21: Domain perturbations and applications Nov 24-26 are Holidays
Week 15	Nov. 28- Nov. 30: More applications of domain perturbations and reviews.
Week 16	<b>Dec 5 EXAM 2</b> (location to be announced) <b>No class on Dec 7.</b>

**Attendance Policy, Class Expectations, and Make-Up Policy**

Class attendance will not be noted. Exams are announced on this syllabus. The EXAMS will take place in the evenings – the timings and locations will be announced on CANVAS. E-learning. However ,quizzes will ONLY be announced ONE week in advance on CANVAS E learning. **NO make ups will be allowed for any quiz because quiz points are bonus points. Absence from EXAMS must be due to medical reasons and will require certification. All exams and quizzes will be in person and in a classroom.**

**Evaluation of Grades**

You will be assigned Homework problems. These will be posted on CANVAS e-learning and will NOT be evaluated. **These problems will typically NOT involve number crunching.** They will usually involve derivations of expressions. **The instructor will provide hints and often solutions to these problems during the lectures so please pay attention to the lectures..** However, in general we will not provide solutions. If you have difficulty working out these problems please see the instructor and/or the ST. These problems or problems very close to them will certainly appear in the exams and quizzes which will be closed book/notes.

There will be TWO exams and TWO quizzes. There will be NO Final exam. The exams and quizzes will be CLOSED Book unless otherwise announced. No communication devices, smart phones or computers will be permitted. EXAM POINTS WILL AMOUNT TO 600 POINTS. QUIZ POINTS AMOUNT TO 100 POINTS AND ARE BONUS. SO IF YOU MISS A QUIZ YOU JUST MISS THE BONUS FROM THAT QUIZ. MAXIMUM POINTS ARE 600 BUT THEORETICALLY A PERSON COULD SCORE 700 POINTS (IF HE/SHE GETS ALL EXAMS AND ALL QUIZZES CORRECT).

### ***Grading Policy***

Grades percentage (based on points earned out of 600) (Grades are NOT determined by a curve).

Percent of total points	Grade
0-10	E
11-15	D (no D minus grade will be given)
16-20	D+
20-30	C (no C minus grade will be given)
31-40	C+
41-50	B-
51-65	B
66-80	B+
81-90	A-
91-100	A

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)  
[Grades and Grading Policies](#)

### ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

### ***In-Class Recording***

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Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

## ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

## ***Campus Resources:***

### ***Health and Wellness***

#### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### ***Academic Resources***

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints:** <https://distance.ufl.edu/state-authorization-status/#student-complaint>.