

# Physical Systems and Applied Mathematics, 2018-19

## Program Syllabus – Fall Quarter

sites.evergreen.edu/psam1819

This intermediate-to-advanced program builds on previous introductory work in calculus and calculus-based physics to deepen students' understanding of nature, how it can be represented via physical models, and the powerful connections between mathematics and physical theories. Each of us will bring unique backgrounds and goals to our studies, and it is our collective goal to build on those strengths at the same time as we stretch our learning in new directions. In fall, we will study applied math content: differential equations (DE), linear algebra (LA), and multivariable and vector calculus (MVVC), both for their intrinsic mathematical interest and to set the necessary mathematical foundation for our studies in winter and spring; we will also learn some related computational tools. In winter and spring, we will focus on physics, studying classical mechanics, electricity & magnetism, quantum mechanics, and completing advanced lab projects. Several partial credit options will exist in each quarter. We will devote time in each quarter to looking at our studies in a broader historical, philosophical, and cultural context. These goals and the activities we undertake to reach them will support students' work towards meeting the Six Expectations of an Evergreen graduate.

### **Expected credit distribution, fall quarter:**

Differential Equations (DE) – 4 credits

Linear Algebra (LA) – 4 credits

Multivariable and Vector Calculus (MVVC) – 4 credits

Integrated Math Lab – 4 credits

### **Program Faculty and Contact Information:**

Krishna Chowdary (fall, winter, spring)

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Sem2 C3110

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**Texts:** Used versions of textbooks are fine, and we encourage you to seek out the most economical versions you can appropriately obtain (in particular, you should be able to find copies of Boas that are much reduced from the cover price), with the caveat that students are responsible for adjusting to discrepancies between editions, especially in exercise and problem numbering. The books are also available via the Evergreen Bookstore and on reserve in the Evergreen Library. We expect that you will bring copies of the texts with you to class regularly. Electronic versions are fine as long as you can access them on devices that won't distract you or your classmates.

- *Mathematical Methods in the Physical Sciences*, 3rd Edition. Mary L. Boas. ISBN 9780471198260.
- *Introduction to Linear Algebra*, 5th Edition. Gilbert Strang. ISBN 9780980232776.
- *Div, Grad, Curl, and All That (An Informal Text of Vector Calculus)*, 4th Edition. H.M. Schey. ISBN 9780393925166.

NOT REQUIRED: students with their own computer may wish to purchase access to the student version of the computer program *Mathematica*, which we'll be using in the Integrated Math Lab, for their own convenience. However, *Mathematica* is available in campus computer labs, so no purchase is required.

**Special Needs:** Students who require accommodations for academic work should contact Access Services (<http://evergreen.edu/access/>, ph. 360-867-6348/TTY: 360-867-6834). Information about such accommodations is confidential and protected by legal and ethical considerations.

**Inclusive Practices Policy:** Generous response to others' requests for inclusive practices counts people in. Requests that someone speak more loudly or slowly, read aloud, follow inclusivity guidelines for presentations, write in large letters on the board, or enable captioning when available are requests to be included.

We've done our best to plan a program that is accessible to everyone, but we may not be aware of all the issues that affect you. You are always invited to speak with us privately if you have any questions or concerns.

**Fall Schedule:**

Monday (CAL)	Tuesday (CAL)	Wednesday (Cave)	Thursday
		Multivariable & Vector Calculus 9:00 – 10:30	
Quiz & Quiz Workshop 10:00 – 12:00	Differential Equations 10:00 – 12:00	Differential Equations 10:30 – 12:00	Linear Algebra 10:00 – 11:30 (Cave)
Break 12:00 – 1:00	Break 12:00 – 1:30	All-Program Meeting 12:00 – 1:00	Break 11:30 – 12:30
Multivariable & Vector Calculus 1:00 – 3:00	Linear Algebra 1:30 – 3:30	<i>CAL: Lab 2 1223</i> <i>Computer Applications Lab</i>	Math Lab 12:30 – 4:00 (CAL)
	Open Hours w/ Brian 3:30 – 4:30		

**Open Hour with Brian:** On Tuesday afternoons, Brian will be available for consultation in our regular classroom from 3:30pm to 4:30pm. (Some people would call this an “office hour” – but we won’t be in anyone’s office! Anyway, the open hour is time when Brian is available to answer your questions, etc., and we’ll already be in the classroom.) This is time when you can talk with Brian in groups or 1-on-1 about whatever you need to, including homework questions. Note that you can also make an appointment to talk with Brian and/or Krishna at another time.

**Awarding of credit:** Students who complete all of the work (including Problem Sets, Collaborative Solutions Sets, Math Labs, Quizzes, Exams, and Quiz and Exam Revisions when required) will earn full credit. Students who demonstrate understanding of the material at a suitable level of competency will earn upper-division credit. All work will be evaluated with the program learning goals (see below) in mind. Partial credit in individual subject areas will not be awarded. Students must also complete a self-evaluation prior to evaluation conferences each quarter, and faculty evaluations on exiting the program, in order to earn credit.

**Evaluations:** At the end of the quarter, faculty will prepare a narrative evaluation of each student’s work in the program, discussing the quality of the student’s work, the student’s demonstrated understanding of the relevant material, and the student’s engagement in the program learning community. Students are expected to come to class prepared and to participate actively and positively in class activities; poor attendance or poor participation in program activities will be mentioned in the evaluation.

You must be prepared to stay until the end of evaluation week, Friday, December 14, 2018. If you miss your evaluation conference, you agree to accept your evaluation as written. Your self-evaluation must be completed prior to the evaluation conference. If exiting the program, your evaluations of faculty must also be posted prior to the evaluation conference. Students must write evaluations for all program faculty.

### **Program Learning Goals (Fall Quarter):**

- By attending to issues of power, identity, privilege, and equity in the practice of math and science, create an intentionally inclusive and anti-bias learning environment that is attentive to and respectful of the unique gifts and background of each student.
- Improve your ability to articulate and assume responsibility for your own work.
- Strengthen your collaborative skills and the ability to respond in useful ways to the work of colleagues.
- Improve your skills in clear communication of mathematical and scientific ideas, both orally and in writing.
- Improve your reading of technical texts to develop both conceptual understanding and procedural skills.
- Develop and utilize increasingly sophisticated mathematical models that describe and explain physical systems.
- Use multiple representations to gain a firm understanding of the concepts and procedures of differential equations, linear algebra, and multivariable and vector calculus.
- Use a computer-based algebra system to visualize and solve complex problems and gain insight into the related mathematics.

Our work will take place in a learning community, and we will be responsible for our interactions within the group as well as our individual learning. It is important to keep in mind the institution-level expectations and approaches that form the backdrop of our work, as described in the “Six Expectations” and “Five Foci”:

### **Six Expectations of an Evergreen Graduate:**

- Articulate and assume responsibility for your own work.
- Participate collaboratively and responsibly in our diverse society.
- Communicate creatively and effectively.
- Demonstrate integrative, independent, critical thinking.
- Apply qualitative, quantitative and creative modes of inquiry appropriately to practical and theoretical problems across disciplines.
- As a culmination of your education, demonstrate depth, breadth and synthesis of learning and the ability to reflect on the personal and social significance of that learning.

### **Five Foci of Learning:**

- Interdisciplinary Study
- Collaborative Learning
- Learning Across Significant Differences
- Personal Engagement
- Linking Theory with Practical Applications

## **HOMEWORK, ASSIGNMENTS, AND ASSESSMENTS**

**No late homework, assignments, or assessments will be accepted.** Late homework, assignments, or assessments will not be reviewed by faculty during the quarter, but should be completed and included in your portfolio.

**Reading Assignments:** It is absolutely essential that you come to each class prepared, having already read and wrestled with the material before the in-class discussion. The first class meeting in each subject in each week will begin with small group discussion of the questions that emerged for you as you did the reading, so you will need to come in with a clear sense of which topics it is most important to do additional work on to develop your understanding; bring a list of questions and topics, and be prepared to discuss the material with your classmates. The rest of our work in class will focus on material that you and others identify as giving you difficulty, and also on applications of the relevant concepts.

**Problem Sets:** Each week, substantial homework assignments will be assigned in DE, LA, and MVVC. Problem Sets should be completed in Problem Set Notebooks (PSNs) dedicated to each subject (so, a separate PSN for each of DE, LA, and MVVC – three PSNs in all). You should strive to complete Problem Sets and review the Collaborative Solution Sets (see next paragraph) by Monday morning quiz time, and you are responsible for keeping a complete PSN that demonstrates your own personal understanding of the subject material. The work in your PSN should be done consistently in two colors: choose one color (standard choices: pencil, or blue or black ink) to use for the work you do before looking at the solutions, and a second color (standard choices: red or green or purple, pencil or ink) to use for corrections you make to your work with the help of the Collaborative Solution Sets. Bring your PSNs to weekly quizzes

for spot checks and to earn the opportunity to complete Quiz Revisions; students who produce electronic PSNs should consult with faculty about options for spot checks.

Each week, you will be assigned to contribute one or more problems from each of the week's three Problem Sets to online Collaborative Solution Sets (CSS). You are strongly encouraged (but not required) to produce these contributions collaboratively with classmates. Your contributed solution(s) to the CSS can be either a good quality image of the solution(s) from your own PSNs or typeset solutions. These contributions should be made as early as possible after the assignment is posted and no later than 6pm Friday. Feedback and corrections to the CSS will be provided by noon Saturday (and in the rare case of a missing problem, a brief solution will be provided). Student feedback within the CSS is also encouraged! The goal is to have a complete CSS, with feedback, available in each subject by Saturday noon to help you with checking over/completing the Problem Set and studying for the weekly Quizzes.

Collaboration is allowed and encouraged, as is appropriate and responsible use of resources, including program tutors. Attempt every problem and get as far as you can on your own first. It is expected that you may struggle with problems before collaboration; it is vital that after collaboration, you are personally able to display understanding of the concepts and mathematics associated with such problems. The first draft of each weekly Quiz and each Exam will be individual efforts, so consider your learning associated with Problem Sets in light of your individual progress.

**Math Labs:** Math Labs will give you the opportunity to learn to use the computer algebra system *Mathematica* to visualize and solve problems related to the mathematics being studied in other parts of the program. At the same time you use this tool to help you solve math problems, you will also use *Mathematica* to explore, discover, and learn math concepts. You'll save your Math Lab work electronically to your Cubby in the program file share, and some parts of Math Labs will be submitted for faculty to review.

**Quizzes:** The first class meeting each week in weeks 3 through 8 will be devoted to individual Quizzes that cover (some of) the material since the previous Quiz in two subjects, and will be based on the Problem Sets since the last Quiz in that subject. Calculators and personally prepared 3 inch by 5 inch note cards will be allowed. You will submit Quizzes for faculty to assess. Immediately following the Quiz, we will have a Quiz Revision Workshop in which you will work collaboratively to review and revise the Quiz. Faculty may go over particular areas of difficulty with the whole class, as needed. The quizzes will cover two subjects per week in weeks 3 through 8, rotating through DE, LA, and MVVC. (Hence each of those subjects will appear on four quizzes in all.) You can see which subjects appear on which weeks' quizzes in the pacing guide below.

If you are unsatisfied with your performance on a Quiz, you may submit a Quiz Revision. For faculty to review a Quiz Revision, the corresponding Problem Set(s) must be complete in your PSN, as determined by the weekly spot checks. Quiz Revisions are due in class the Monday after the original Quiz is administered.

**Exams:** There will be final exams for DE, LA, and MVVC in the last two weeks of fall quarter. Calculators and a 3 inch by 5 inch card of personally prepared notes will be allowed. Exam Revision opportunities will be available.

**Seminar and Academic Statement:** All-Program Meeting times on Wednesdays will be used for **Seminars** and **Academic Statement** writing. Each student is required to write and submit to faculty an updated draft of their Academic Statement by the end of fall quarter. We will devote six hours of class time in fall quarter to support students in developing their Academic Statements. (Not all of this time will be on Wednesdays.) This work will also support **Self-Evaluation** writing; each student is required to write and submit to faculty an evaluation of their own work and achievements in the program at the end of each quarter. Graduating students will have individual meetings with faculty to support their final transcript Academic Statement; these meetings will take place close to the student's graduation date. Students will complete brief pre-seminar writing assignments, which faculty will review for thoughtful completion.

**Portfolio:** Throughout the program, you will maintain a portfolio of your work consisting of all the above assignments and assessments as well as any notes or other material that reflect your work. The portfolio will be submitted at the end of week 10 and will inform faculty evaluations of your work. It will also provide a lasting record and resource for your own future reference.

## MORE ABOUT INCLUSIVE PRACTICES AND POLICIES

**Disability and Chronic Illness Access:** As program faculty, we are committed to creating an environment in which meaningful learning is accessible to every member of our learning community. Please tell us very early in the quarter if you have particular learning needs. If the needs are related to a disabling condition, we will keep the condition confidential unless you give us permission to speak to others (with the understanding that Brian and Krishna will speak freely to each other about such matters).

If you are Deaf, or a person living with a disabling condition and with needs that require arrangements, technology or expense to meet, please talk to staff in the TESC Access Services Office (<http://www.evergreen.edu/access/>) to request support; contact them at (360) 867-6348 or find them in Library 2129 (in the SASS area). The accommodations that faculty can make in the classroom without support from Access Services is limited.

Evergreen's Assistive Technology (AT) lab is available to everyone on campus, regardless of disability status. Staff provide help with specific software, hardware, and strategies for learning. You can find the AT lab in its own room toward the back of the main floor of the Evergreen Library proper. Go to the website for hours and contact information: <https://evergreen.edu/access/assistive-technology>.

**Scents and Smoke:** By minimizing the presence of allergens and sensitivity-triggering fragrances on campus, Evergreen students, staff, and faculty make shared spaces available to people who live with otherwise-disabling conditions. To that end, please don't wear strongly-scented products and smoke-saturated clothing in classrooms and offices. The indoor air quality policy may be found at <http://collab.evergreen.edu/policies/policy/airquality>.

College-wide policies allow smoking (including e-cigarettes) only in designated campus areas. The smoking policy may be found at <https://evergreen.edu/facilities/smokers-information-center>. Note that the designated smoking area closest to Lab I and Lab II is next to the Carving Studio, behind Seminar I and next to the Longhouse. Please be thoughtful about and interested in where your smoke might be going!

**Electronic Device Policy:** Please do not check or use your cell phone in the classroom during class time; if you need to attend to pressing business, please step outside to check or use your phone. The standard exception will be that if you need a calculator and the calculator you use is on your phone, you are allowed to use it. But we want you to consider deeply the potential negative impact on collaborative work that comes from diverting your attention away from your classmates. Refraining from using electronic devices will help us all keep our attention in the room, on the work at hand, and on each other.

## ACADEMIC AND STUDENT SUPPORT RESOURCES

Your tuition and fees pay for many resources on campus. Here are a few:

**QuaSR Center:** The [Quantitative and Symbolic Reasoning \(QuaSR\) Center](#) is the campus Math and Science student support center. Located in the Library and open M-Th 11am-8pm and Friday and Sunday noon-5pm, the QuaSR Center offers support in all the subjects covered in our program. See <http://www.evergreen.edu/mathcenter>.

**Writing Center:** The [Writing Center](#) offers support for the different kinds of writing students will encounter at Evergreen. Located in the Library right next to the QuaSR, the Writing Center is open M-Th 11am-8pm and Friday and Sunday noon-5pm. See <http://www.evergreen.edu/writingcenter>.

**Academic & Career Advising:** [Academic & Career Advising](#) can help you understand your educational options, plan your academic path, and succeed as a learner. They are located in the Library, and schedule appointments M-F 9am-noon and have drop-in hours M-W 1pm-5pm and Th-F 1pm-4pm. See <http://www.evergreen.edu/advising>.

**Access Services:** [Access Services for Students with Disabilities](#) is responsible for providing support services for

students with documented disabilities. Access Services is located in Academic Advising in the Library, with hours from 9am-5pm M-F. See <http://evergreen.edu/access>.

**TRiO:** The [TRiO Student Success](http://www.evergreen.edu/trio) programs are federally funded grants designed to improve college access and graduation rates for individuals from disadvantaged backgrounds, specifically low-income students, first-generation college students, and students with disabilities. TRiO is located in Academic Advising in the Library. See <http://www.evergreen.edu/trio>.

**First Peoples Multicultural, Trans, and Queer Support Services and the Student Equity and Arts Lounge:** [First Peoples Multicultural, Trans, and Queer Support Services](http://www.evergreen.edu/multicultural) offers support for students of color and LGBTQ+ students on campus so that students can bring their whole selves to Evergreen, and supports academic and personal success by providing comprehensive academic, career, cultural, social, and personal advising. The Student Equity and Arts Lounge is a welcoming and inclusive space for studying, meeting up with friends, attending a workshop, or just taking a minute to recharge. See <http://www.evergreen.edu/multicultural>.

**Veterans Resource Center:** The [Veterans Resource Center](http://www.evergreen.edu/veterans) serves all military, dependents, and veterans with respect, compassion, and confidentiality, and helps them receive all the benefits they have earned through their or their loved one's service to our country. Located in LIB 1103 and open M-F 8am-5pm and by appointment. See <http://www.evergreen.edu/veterans>.

**Evergreen Wellness Resources:** Your quarterly student health fee covers office visits for medical and counseling services at Student Wellness Services, Seminar 1 2110. Services include screening and treatments for cold, flu, reproductive & sexual health, depression, anxiety, and drug and alcohol use. If you or someone you know needs assistance, please contact Student Wellness Services at (360) 867-6200. If faculty are concerned about your well-being, we will express our concern to you and offer to help you connect with Student Wellness Services. We welcome students asking for assistance with medical and counseling concerns. Please consider asking for assistance at the earliest possible point. See <http://www.evergreen.edu/health>.

## HEALTH AND SAFETY POLICIES

**Alcohol and Drugs:** Faculty want you to thrive academically in this program and in your time at The Evergreen State College. The use of alcohol and other drugs often has a negative effect on students' academic success. If we are concerned that you are under the influence of drugs or alcohol during class meetings or activities, we will express our concerns to you. Use of alcohol, marijuana, and illegal drugs are prohibited on field trips. Behavior that may be a violation of the [Student Conduct Code](#) will be reported to the Senior Conduct Administrator in the office of the Vice President for Student Affairs. A special note on marijuana: because The Evergreen State College receives federal funding (e.g., students receiving federal financial aid), the possession and use of marijuana on campus remains illegal and may impact your ability to work for certain companies or agencies after graduation.

**Sexual Violence:** The Evergreen State College is committed to an educational environment free from sexual harassment and sexual misconduct. In order to connect students with the best possible services and all available options, members of the faculty are required to report disclosures of sexual harassment and sexual misconduct made by students to Evergreen's Title IX Coordinator. Students may contact the Title IX Coordinator directly, at [titleixcoordinator@evergreen.edu](mailto:titleixcoordinator@evergreen.edu) or (360) 867-5224, for information about their rights and options at Evergreen, to access support services, or begin a formal complaint. Members of the faculty are also required to report abuse of minors. Confidential support is available to students affected by sexual misconduct in the Student Wellness Services Office of Sexual Violence Prevention and Response, Seminar 1 2110, (360) 867-6200. Find out how you can help stop sexual assault, relationship violence, and stalking by joining [Green Dot](http://blogs.evergreen.edu/evergreendot); see <http://blogs.evergreen.edu/evergreendot>. Evergreen has an affirmative consent policy with regard to sexual violence.



## TENTATIVE PACING GUIDE / READING SCHEDULE (SUBJECT TO CHANGE)

	DE (Boas)	LA (Strang)	MVVC (Boas)	Seminar & Academic Stmt.	Quizzes
<b>Week 1</b> 9/24-9/28	8.1, 8.2	1.1, 1.2, 1.3	4.1, 4.3-4.4	Cronon's "Only Connect" (for Thurs pm)	None
<b>Week 2</b> 10/1-10/5	8.3, 8.4	2.1, 2.2, 2.3	4.5, 4.7-4.8	TBD	None (Class still meets)
<b>Week 3</b> 10/8-10/12	8.5, 8.6	2.4, 2.5, 2.7	4.9, 4.11	TBD	MVVC & DE
<b>Week 4</b> 10/15-10/19	8.7, 8.8, 8.9	3.1, 3.2, 3.3	5.1-5.3	TBD	LA & MVVC
<b>Week 5</b> 10/22-10/26	7.1, 7.2, 7.3, 7.4	3.4, 3.5	5.4, 6.1-6.4	TBD	DE & LA
<b>Week 6</b> 10/29-11/2	7.5, 7.6	4.1, 4.2, 4.4	6.5-6.7 DGC Ch. 1	TBD	MVVC & DE
<b>Week 7</b> 11/5-11/9	7.9, 7.12	6.1, 6.2, 6.3	6.8-6.10 DGC Ch. 2	TBD	LA & MVVC
<b>Week 8</b> 11/12-11/16 (Mon holiday)	13.1, 13.2, 13.3	6.4, 6.5, 5.1, 5.3	6.10 DGC Ch. 2	TBD	DE & LA (Quizzes on Tues morning this week)
<b>Thanksgiving Break</b> 11/19-11/23					
<b>Week 9</b> 11/26-11/30	13.4, 12.1, 12.2, 12.6, 12.7; Exam review: Thurs pm	8.1, 8.2, 8.3	6.10-6.11 DGC Ch. 3	TBD	None (Class still meets)
<b>Week 10</b> 12/3-12/7	<b>EXAM</b> <b>Mon 10-12</b>	Exam Review: Tues 1-3; <b>EXAM</b> <b>Wed 10-12</b>	Exam Review: Mon 1-3; <b>EXAM</b> <b>Tues 10-12</b>		
<b>Evaluation Week</b> 12/10-12/14	Evaluation Conferences happen this week; don't plan to leave town before Friday, 12/14.				

*The Evergreen State College sits on the traditional lands of the Medicine Creek Treaty Tribes, which include Squaxin Island Tribe, Nisqually Indian Tribe, and the Puyallup Tribe of Indians. The 1854 treaty ceding these lands is still in dispute. All who are not Salish peoples are visitors here. With this awareness, we pay respect to elders past and present of the Medicine Creek Treaty Tribes and all Native peoples.*