**PHIL 192S – TOPICS IN THE PHILOSOPHY OF SCIENCE**

***SCIENCE, MATHEMATICS AND PHILOSOPHY***

Spring 2024

**Instructor:**  Manuel Barrantes ([barrantes@csus.edu](mailto:barrantes@csus.edu); 540.246.8822)

**Class meetings:** Mondays & Wednesdays 12:00-1:15pm

**In-Person Office Hours:** Thursdays 11am-1pm (Mendocino Hall 3022)

**Online Office Hours:** Mondays & Fridays 1:15-1:45pm; Thursdays 11am-1pm; and by appointment.

(<https://csus.zoom.us/j/5268471798>)

**Credit hours:**  3WTU

**I. Course Description**

CATALOG DESCRIPTION: *Issues in the epistemology and ontology of science; special problems in the philosophy of mathematics, physics, chemistry, cognitive science, and biology; naturalistic and non-naturalistic approaches to understanding scientific inquiry.*

The course will cover three related questions at the intersection between science, mathematics and the philosophy of scientific explanation: what is the role of mathematics in scientific explanation? Does the usefulness of mathematics in science justify mathematical realism? And, how do structural explanations of physical phenomena work? All the readings will be posted on canvas. The assigned textbook will be the manuscript of my forthcoming book: *Structural Explanations in Science: Understanding So-Called Mathematical Explanations of Physical Phenomena* (referred as SES in the schedule below), to be published in the Synthese Library Book Series (Springer).

**II. Methodology**

The semester is divided in three units of five weeks each. Every week (except the first) you must participate in an online discussion with your classmates. When the discussion is about an article, it will be held on canvas. When it is about my chapters, it will be held on a Google doc, since you will be asked to annotate the document containing my manuscript. In addition, at the end of each unit you will take an in-class test. Finally, at the end of the semester you must submit a term paper. Each class you will be asked to elaborate on your online posts and comment on the readings. Classes will be discussion-based, with very little lecturing. Office hours will be held during the times outlined above. You do not need an appointment to come to regular office hours, but you may have to wait if I am with another student. If you can’t make it to office hours, contact me and we will set up an appointment. Communication will be via canvas announcements and canvas email.

**III. Learning OUTCOMES**

* You will learn about the contemporary philosophical discussions revolving around the applicability of mathematics in science, specifically in scientific explanations.
* You will learn to write philosophy papers and evaluate philosophical arguments.

**IV. Course Requirements**

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| **%** | **Assignments\*** | **Modality** |
| 20% | 14 discussions | Every week you must post a question about the reading, and react to one of your classmates’ questions. Some discussions will be held on Canvas and others over a shared Google document. Full credit is not automatic, and depends on the quality of the contributions. Specific guidelines will be posted on canvas. You may be required to elaborate on your question during class. Discussions are due right before Wednesday class (see schedule below). **Absolutely no makeups for discussions under any circumstance.** The lowest 4 grades will be dropped. |
| 60% | 3 in-class tests | The last Wednesday of each unit you will take an in-class test, consisting of several reading questions, and one essay question. More details, including a question poll, will be posted on Canvas. Make ups should be requested in person after class at your earliest convenience, **not by email**, and will receive a 1/3 letter-grade penalty, unless you have a documented justification. |
| 20% | Final paper | You must write a 2000-word paper. Guidelines will be posted on canvas. You are welcome to discuss paper drafts in my office. Paper feedback will not be given by email. Papers must be submitted through canvas. Late papers will receive a 1/3 letter-grade penalty and **will only be accepted within 72 hours after the deadline**, unless you have a documented justification. |

**V. COURSE GRADING SCALE**

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| **Letter** | **Range** | | **Letter** | **Range** | | **Letter** | **Range** | | **Letter** | **Range** | |
| A | 100% | to 94% | B | < 87% | to 84% | C | < 77% | to 74% | D | < 67% | to 64% |
| A- | < 94% | to 90% | B- | < 84% | to 80% | C- | < 74% | to 70% | D- | < 64% | to 61% |
| B+ | < 90% | to 87% | C+ | < 80% | to 77% | D+ | < 70% | to 67% | F | < 61% | to 0% |

**VI. SCHEDULE**

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| **Date** | **Readings** | **Assignments\*** |
| **Unit 1. The role of mathematics in scientific explanation** | | |
| Week 1  1.22-1.24 | SES: Chapter 1. Introduction | *No assignments* |
| Week 2  1.29-1.31 | Wesley Salmon, Scientific Explanation | Discussion (Canvas) |
| Week 3  2.5-2.7 | SES: Chapter 2. Two problems in scientific explanation  James Woodward, Flagpoles Anyone? | Discussion (Google Docs) |
| Week 4  2.12-2.14 | Mary Leng, Models, Structures and the explanatory role of mathematics in empirical science. | Discussion (Canvas) |
| Week 5  2.19-2.21 | SES: Chapter 3. A theoretical juice extractor. The role of mathematics in science  Otavio Bueno & Steven French, Applying Mathematics, Chapter 9. | Discussion (Google Docs)  **Test 1** |
| **Unit 2. Mathematical realism and the applicability of mathematics** | | |
| Week 6  2.26-2.28 | SES: Chapter 4. Mathematical realism and the applicability of mathematics in science  Stewart Shapiro, Thinking About Mathematics, chapter 1 | Discussion (Google Docs) |
| Week 7  3.4-3.6 | Alan Baker, Are there genuine mathematical explanations of physical phenomena? | Discussion (Canvas) |
| Week 8  3.11-3.13 | SES: Chapter 5. Indispensability Arguments  Mary Leng, Taking it Easy | Discussion (Google Docs) |
| Week 9  3.25-3.27 | Lauren Ross, The Explanatory Nature of Constraints: Law-Based, Mathematical, and Causal. | Discussion (Canvas) |
| Week 10  4.3 | SES: Chapter 6. Mathematical vs Logical Constraints  Marc Lange, Because Without Cause, Chapter 1 | Discussion (Google Docs)  **Test 2** |
| **Unit 3. Mathematical explanations as Non-causal Explanations** | | |
| Week 11  4.8-4.10 | Mark Colyvan, The Ins and Outs of Mathematical Explanation | Discussion (Canvas) |
| Week 12  4.15-4.17 | SES: Chapter 7. Do mathematical explanations require explanatory proofs?  Alan Baker, Science-Driven Mathematical Explanation | Discussion (Google Docs) |
| Week 13  4.22-4.24 | Alexander Reutlinger, Extending the counterfactual theory of explanation | Discussion (Canvas) |
| Week 14  4.29-5.1 | Alisa Bokulich, Searching for Non-Causal explanations in a sea of causes | Discussion (Canvas) |
| Week 15  5.6-5.8 | SES: Chapter 8. Structural Explanations: Impossibilities vs Failures  Marc Lange, Because Without Cause, Chapter 3 | Discussion (Google Docs)  **Test 3**  **Final paper** (Due 5.10 at 11:59pm.) |

\* All discussions are due Wednesday right before class. Tests will be taken in the classroom on the Wednesday of the week specified in the schedule.

**VII. course Policies and STUDENT RESOURCES**

* All work done in this course is subject to the CSUS academic honesty policy, which you may read at: [Academic Honesty Policy & Procedures.](https://sacramentostate.policystat.com/policy/11300038/latest) You can also check the [Library’s guide on Plagiarism](https://csus.libguides.com/plagiarism) and *my note on Canvas*.
* If you are experiencing serious distress, you can contact either [Student Health and Counseling Services](https://www.csus.edu/shcs/) or [Peer and Academic Resource Center](https://www.csus.edu/parc/).
* You can check out a laptop at the [CSUS University Library](https://www.csus.edu/information-resources-technology/teaching-learning/laptop-checkout.html).
* If you are experiencing any COVID- like symptoms (fever, cough, sore throat, muscle aches, loss of smell or taste, nausea, diarrhea, or headache) or have had exposure to someone who has tested positive for COVID, contact [Student Health & Counseling Services (SHCS)](https://www.csus.edu/student-life/health-counseling/) and notify me. More information can be found [here](https://www.csus.edu/return-to-campus/).
* If you believe that you require disability-related academic adjustments (including pregnancy-related disabilities), please contact [Services for Students with Disabilities (SSWD](https://www.csus.edu/student-affairs/centers-programs/services-students-disabilities/)) to discuss eligibility. A current accommodation letter from SSWD is required before any modifications. These adjustments are not retroactive.
* Sac State is committed to supporting students and fostering a campus environment free of sexual misconduct and gender-based discrimination. If a student chooses to disclose to a faculty or staff member an experience related to sexual misconduct which includes, but is not limited to rape, relationship violence, or stalking, all faculty and staff members are obligated to report this disclosure to the university’s Title IX Coordinator. Contact Sac State’s Title IX Coordinator, Skip Bishop, at 916.278.5770 or email at william.bishop@csus.edu. Upon receipt of the report, the Title IX Coordinator will contact you to inform you of your rights and options as a survivor and connect you with support resources, including resolution options for holding accountable the person who harmed you. Students who elect not to discuss their experience with the Title IX Coordinator can speak confidentially to the following confidential resources: Student Health & Counseling Services at The WELL 916.278.6461; [www.csus.edu/shcs](http://www.csus.edu/shcs). Campus Confidential Advocate – Laura Swartzen ([weave@csus.edu](mailto:weave@csus.edu)). On Campus Phone Number: 916.278.5850 (during business hours) WEAVE 24/7 Hotline: 916.920.2952.