This syllabus serves to establish the rules of the course and provides a rough course outline. Note that some aspects may evolve as the quarter progresses.

**Course Description:** The purpose of this course is to first finish our discussion of tree-level physics by working out the quantum theory of spin-1 particles. This will require us to confront the notion of gauge invariance. We will introduce non-Abelian gauge theories and spinor helicity methods. We will then reformulate QFT using the language of the path integral. Finally, we will turn to a discussion of Effective Field Theory before getting into loop calculations and renormalization. This course is designed to be the second third of a full year sequence.

**Course Objectives:** students will develop knowledge of the following topics:

1. Massive spin-1 particles
2. Massless spin-1 particles and gauge invariance, QED
3. Non-Abelian gauge theory, QCD
4. Spinor-helicity methods
5. The path integral
6. Effective Field Theory

**Prerequisite:** PHYS 664.

**Credit Hours:** 4
Required Text: *Fundamentals of Quantum Field Theory*
Authors: Timothy Cohen and Markus A. Luty

Supplementary Text: *QFT and the Standard Model, 1st Edition*

Supplementary Text: *QFT, 1st Edition*

Supplementary Text: *An Introduction to QFT, 1st Edition*


Grade Distribution:

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Questions on readings</td>
<td>20%</td>
</tr>
<tr>
<td>Homework assignments</td>
<td>60%</td>
</tr>
<tr>
<td>Presentations (at the end of the quarter)</td>
<td>20%</td>
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Letter Grade Interpretation:

- **Mastery:** $\geq$ A-
  - All (or virtually all) assignments done correctly and turned in on-time. Presentation is clear, organized, and questions are adequately addressed.

- **Pass:** $\geq$ B-
  - Solid attempt on virtually all assignments and turned in on-time. Presentation is clear, organized, although questions posed some challenges.

- **Fail:** $\leq$ C+
  - Habitually late HW (one or more missed HW set) and/or several incorrect problems on several HW sets. Presentation is unclear, not organized, and questions cannot be addressed.

General Course Policies

- This is an advanced graduate course (arguably the most advanced), so you are responsible for your own learning. If you want to *learn* QFT, expect to spend between 10-20 hours per week on this course. That includes reading, doing HW, chatting with me and your classmates.

- Do not be discouraged if you feel overwhelmed and confused. If you think you are really “getting it,” you are not working hard enough.

- You are expected to read the relevant material *before* lecture.

- Working on homework together is strongly encouraged.

- Communication by Slack and email. I will disseminate course material using Dropbox.

Statement of Inclusion

- Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities.
Graded Assignments

- Although many solutions can be found online, but as with any subject in physics, you will not learn the material if you do not put some sweat into the course.
- HW will be assigned periodically. The due date will be clearly stated. It should be turned in at the beginning of class. Please be sure your work is legible and organized (no need to write on the back of paper, start a problem on a new page, etc.).
- 24 hour late policy: Late assignments will be accepted up to 24 hours late. You get one free late waver. Each additional late assignment results in a grade level reduction (A+ → A, etc.).
- I reserve the right to assign homework during dead week.
- Detailed instructions for the presentation assignment will be provided later.

COVID-19 Policies and Good Classroom Citizenship

- We will follow the UO COVID Containment Plan for classes: https://provost.uoregon.edu/covid-containment-plan-classes
- Wear your mask and make sure it fits you well
- Stay home if you’re sick (and please let me know)
- Get to know your neighbors in class, and let them know if you test positive
- Get tested regularly
- Watch for signs and symptoms with the daily symptom self-check
- Wash your hands frequently or use hand sanitizer
- Complete the UO COVID-19 case and contact reporting form if you test positive or are a close contact of someone who tests positive: https://oregon.qualtrics.com/jfe/form/SV_6lfKVJrE0jAGPvn