

- Instructor:** Prof. Dr. Ismail Turan
Room 413, **Extension:** x5083
Email: ituran@metu.edu.tr
- Textbook:** *Introduction to Elementary Particles*, Second Revised Edition, by David Griffiths. Chapters 6, 7, 9 and 10 will at least be covered. More might be covered as time permits.
- Web Page:** Follow course webpage in ODTUClass site, <http://www.odtuclass.metu.edu.tr/>
- Prerequisite:** Consent of the Department (Phys 407 or Phys 481 or Equivalent)
- Schedule:** **Thursday 12:40-15:30 via ZOOM meeting**
Link: <https://zoom.us/j/7580320731?pwd=akJjc1FqYUdhcEZsQ0RwW11tdVp0dz09>
- Recitations:** TBA
- TA Info:** Kerim Demirel, **Room** 209, **Extension:** x3270, **Email:** demirelk@metu.edu.tr
- Lectures:** I will upload weekly videos to the ODTUClass web page. This part of the class will be asynchronously but in these videos I will deliver the lectures in real time (no slides) so that I will make sure that you will get just one week's material, not more.
Online sessions: Since the course material will be covered through video recordings, we may not need three lecture-hour long online meetings. However, a weekly meeting would still be useful to have a chance for further discussion on the material presented on videos, answer your questions, discussing homework problems etc.
- Exams:** All the exams are going to be online and the details of the format will be available.
- Grading:** There will be one midterm and a final as well as a term project. Homeworks will also be given on an irregular basis (about four homeworks in total). For your final grade, homeworks count 20%, term project counts 20%, midterm counts 20%, and the final counts 40%.
- Topics:**
- **Chapter 6: The Feynman Calculus (already covered in 407):** Decay rates, cross sections, the golden rule for decays and scattering, Feynman rules for a toy model, $1 \rightarrow 2$ decay, $2 \rightarrow 2$ scattering.
 - **Chapter 7: Quantum Electrodynamics (QED):** Dirac equation and its solutions for free particle, Bilinear covariants, Feynman rules for QED, Casimir's trick.
 - **Chapter 9: Weak Interactions:** Charged leptonic currents; muon, neutron and pion decays. Charged hadronic currents, neutral currents, electroweak unification, weak isospin and hypercharge, electroweak mixing
 - **Chapter 10: Gauge Theories:** Lagrangian formulation, gauge invariance, Yang-Mills theory, Feynman rules, Higgs mechanism.
- HEP Tools:** Using computational tools for calculations in particle physics is indispensable nowadays. That's why, as we continue to our theory lectures, students are expected to get accustomed to tools like CalcHEP and MadGraph, both of which are used to do tree level scattering and decay process analyses. There are also package programs like FeynArts, FormCalc, FeynCalc, LoopTools, specialized to do especially one-loop calculations in an automatized way. There is another program called PackageX which is used to calculate one-loop Feynman integrals. The basics of the programs will be introduced and some relevant material will be provided. A Linux tutorial session will be given as a working environment. The ultimate purpose is to calculate various processes both by hand and by computer and then compare.
- Exam Dates:** Midterm Exam: **Thursday, May 6, 2021 at 12:00**
Final Exam: TBA

Code of Integrity: All students are expected to have academic integrity principle in all academic works. That is, a student must submit work only the student's own. Students shall comply with academic integrity codes and shall avoid situations likely to violate this code since academic dishonesty diminishes credit to the academic community.