Course guide
240IEN41 - 240IEN41 - Particle Accelerator Engineering

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2023 **ECTS Credits:** 18.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Koubychine Merkulov, Youri Alexandrovich

Others: Escaler Puigoriol, Francesc Xavier

Llorca Pique, Jordi

PRIOR SKILLS

Knowledge of basics of general physics, electromagnetism, mathematical analysis, differential equations

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

Learn the main principles of operation of modern particle accelerators,
Learn the basics of the physics of the electron beam physics of an accelerator,
Familiarize with accelerator systems and used technologies,
Learn methods of accelerator systems design and techniques of measurement and adjustment of their characteristics,
Familiarize with main applications of particle accelerators, in particular applications using the synchrotron radiation.

CONTENTS

Particle Accelerators Engineering

Description:
I. Particle accelerators and their applications (theory and exercises)
1. General introduction
2. Methods of acceleration. Linear accelerators
3. Circular accelerators
4. Magnetic lattice design
5. Magnetic systems
6. Accelerating structures and RF systems
7. Accelerator systems
8. Generation and applications of synchrotron radiation
9. Applications of particle accelerators

II. Laboratory practices (at Alba)
1. Magnetic measurements
2. RF measurements
2. Linac emittance measurements
4. Vacuum system

III. Project under supervision of Alba and ETSEIB researchers
? Design of a booster or a storage ring (work in groups)
? Design of accelerator systems

Full-or-part-time: 69h
Practical classes: 48h
Laboratory classes: 16h
Guided activities: 5h

GRADING SYSTEM

BIBLIOGRAPHY

Basic:
- Hamm, Robert W. ; Marianne E. Hamm. Industrial accelerators and their applications. Singapore: World Scientific, 2012. ISBN 9789814307048.
- Wiedemann, H. Particle accelerator physics [on line]. 4th ed. Cham: Springer, 2015 [Consultation: 03/04/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3062807. ISBN 9783319183169.
- Kubyshin, Yury. Acceleradors de partícules : Problemes [on line]. Barcelona: Edicions UPC, 2007 [Consultation: 01/02/2018]. Available on: http://hdl.handle.net/2099.3/36795. ISBN 9788498809999.
- Humphries, Stanley. Principles of charged particle acceleration. Los Alamos: R Books, 1997. ISBN 0471878782.
- Wu Chao, Alexander, [i 3 més]. Handbook of accelerator physics and engineering [on line]. 2nd ed. Singapore: World Scientific, 2013 [Consultation: 03/02/2022]. Available on: https://www-worldscientific-com/worldscibooks/10.1142/8543#t=toc. ISBN 9789814417174.

RESOURCES

Audiovisual material:
- Particle Accelerators Engineering. Resource

Computer material:
- Simulation codes. Codes for simulation with manuals

Other resources:
Class presentations prepared by the course professors