PH2814 Science-Fiction and Physics

Professor : Pascal BERNAUD

Language of instruction : ANGLAIS – **Number of hours** : 36 – **ECTS** : 3,0 - **Quota** : 30

Prerequisites : This teaching activity is related to physics but also energy, mechanical engineering, and so on, depending on the chosen text and on the speciality devoted inside the team in charge of the study of the text.

Period : S8 elective 13 may

Course Objectives

The main objective of this course is not to "learn" physics but to "do" physics, using the knowledge students have of physics to understand and model specific problems. The work is done in teams. However, the instructors will provide training on subjects not usually taught at Ecole Centrale: relativity, introduction to astrophysics, allometry etc.

This teaching activity takes place in one single but full week and, beside the scientific challenge to solve all the questions "given" by the Sci-Fi story, the team organisation plays some important rule for the result.

On completion of the course, students should be able to

- acquire a critical sense vis a vis readings or other type of information
- learn how to use order-of-magnitude analysis, out-of-the-box thinking, common sense
- show team working ability

Course Contents

Sci-Fi stories are used as raw material for this teaching activity. The goal is to determine if what is described in the texts is compatible with the laws of physics. To this end, the problem must be modeled and then solved as realistically as possible. Additional material (for instance elements on star evolution, neutron stars, black holes, similitude, allometry, etc) may be introduced by the professor as needed.

The week is organized as written below:

- On Monday introduction to the methodology through examples by the teaching staff

- election of the stories and team building

- analytical reading of the texts

- first analysis of different topics to study and problems to solve

- sharing time between teams, possibility of creation of super-teams devoted to solve some problems out of the school basic curriculum

- analysis and problem solving

- writing of a detailed report

- preparation of a defense

- defense of every team, facing all the other students

Professors are advisers during the first day and methodology demonstration, but also all week long when listing the problems to be solved and methods to be used for these problem solving.

This course is typically a good opportunity to delve into the following topics:

- statistical physics
- quantum physics
- heat transfer: steady and unsteady conduction, convection, radiation
- fluid mechanics
- strength of materials
- celestial mechanics
- astrophysics, stellar evolution…

Course Organization

Combined lectures and tutorials: one full week

Exam: oral defense of a teamwork during the final day + written report

Bibliography / Teaching Material and Textbooks

All necessary documents are provided by the instructors for topics including relativity, stellar evolution, neutron stars, black holes, ...

Resources

Lecturers: Pascal Bernaud (Centrale Paris), Ann-Lenaig Hamon (Centrale Paris), Peter Schattschneider (TU Wien)

Evaluation

- final written report
- oral presentation in teams, during the final day of the week