

## Course description

<b>Course abbreviation:</b>	KKE/NPPA	<b>Page:</b>	1 / 4
<b>Course name:</b>	Nuclear Power Plants		
<b>Academic Year:</b>	2023/2024	<b>Printed:</b>	03.06.2024 08:12

<b>Department/Unit /</b>	KKE / NPPA			<b>Academic Year</b>	2023/2024
<b>Title</b>	Nuclear Power Plants			<b>Type of completion</b>	Pre-Exam Credit
<b>Accredited/Credits</b>	No, 3 Cred.			<b>Type of completion</b>	Combined
<b>Number of hours</b>	Lecture 1 [Hours/Week] Tutorial 2 [Hours/Week]				
<b>Occ/max</b>	Status A	Status B	Status C	<b>Course credit prior to</b>	NO
<b>Summer semester</b>	0 / -	0 / -	0 / -	<b>Counted into average</b>	YES
<b>Winter semester</b>	0 / -	0 / -	0 / -	<b>Min. (B+C) students</b>	10
<b>Timetable</b>	Yes			<b>Repeated registration</b>	NO
<b>Language of instruction</b>	English			<b>Semester taught</b>	Winter semester
<b>Optional course</b>	Yes			<b>Internship duration</b>	0
<b>Evaluation scale</b>	1 2 3 4				
<b>No. of hours of on-premise</b>					
<b>Auto acc. of credit</b>	Yes in the case of a previous evaluation 4 nebo nic.				
<b>Periodicity</b>	K				
<b>Substituted course</b>	KKE/CHPA				
<b>Preclusive courses</b>	N/A				
<b>Prerequisite courses</b>	N/A				
<b>Informally recommended courses</b>	N/A				
<b>Courses depending on this Course</b>	N/A				

### Course objectives:

The course is intended to give students of technical fields a good insight into the following areas of nuclear systems: History and evolution of nuclear systems, machinery and equipment for nuclear systems, materials for nuclear systems, application of nuclear chemistry and physics, fission chain reaction and equipment for its utilization, shielding theory, basics of nuclear physics, introduction to nuclear reactor thermodynamics, nuclear reactors of generation III and IV, nuclear fusion and fusion systems, other nuclear applications (healthcare, agriculture, transportation, material testing), nuclear safety - introduction, Probabilistic Safety Assessment, human factor, external events, decommissioning of nuclear power plants.

### Requirements on student

Self-study of the given topic and presentation.

### Content

Contents of the lectures:

1. History and evolution of nuclear systems
2. Machinery and equipment for nuclear systems
3. Materials for nuclear systems
4. Application of nuclear chemistry and physics
5. Fission chain reaction and equipment for its utilization
6. Shielding theory
7. Basics of nuclear physics
8. Introduction to nuclear reactor thermodynamics
9. Nuclear reactors of generation III and IV
10. Nuclear fusion and fusion systems
11. Other nuclear applications (healthcare, agriculture, transportation, material testing)
12. Nuclear safety - introduction, Probabilistic Safety Assessment, human factor, external events
13. Decommissioning of nuclear power plants

## Fields of study

1. Reuss, P. : Reactor Physics, EDP Sciences, 2008.
2. Lamarsh, J. R.: Introduction to Nuclear Engineering, Prentice Hall, 2001.
3. Stacey, M. Weston : Nuclear Reactor Physics, Second Edition. Wiley-VCH Verlag, 2007.
4. E. E. Lewis, Fundamentals of Nuclear Reactor Physics, Academic Press, 2008.
5. Crossland, I.G. : Nuclear fuel cycle science and engineering, Woodhead Publishing, 2012.
6. Prince, R.: Radiation protection at light water reactors, Springer, 2012.
7. McCormick, N. J.: Risk and safety analysis of nuclear systems, John Wiley & Sons, 2011.

## Guarantors and lecturers

- **Guarantors:** Ing. Kateřina Bílá, Ph.D. (100%)
- **Lecturer:** Ing. Kateřina Bílá, Ph.D. (80%)
- **Tutorial lecturer:** Ing. Kateřina Bílá, Ph.D. (20%)

## Literature

- **Basic:** Reuss, P. *Reactor Physics*. France, 2008. ISBN 978-2-7598-0041-4.
- **Extending:** IAEA. *Industrial Applications of Nuclear Energy*. Vienna, 2017.
- **Extending:** IAEA. *Nuclear or radiological facility decommissioning*. Vienna, 2011.
- **Recommended:** Introduction to Nuclear Engineering (Lamarsh, J. R.)
- **Recommended:** Nuclear fuel cycle science and engineering (Crossland, I.G)
- **Recommended:** Nuclear Reactor Physics (Stacey, M. Weston)
- **Recommended:** Radiation protection at light water reactors (Prince, R.)
- **Recommended:** McCormick, N. J. *Risk and safety analysis of nuclear systems*. John Wiley & Sons, 2011.

## Time requirements

### Part-time form of study

Activities	Time requirements for activity [h]
Presentation preparation (report in a foreign language) (10-15)	25
<b>Total:</b>	<b>25</b>

### Full-time form of study

Activities	Time requirements for activity [h]
Contact hours	50
<b>Total:</b>	<b>50</b>

## assessment methods

**Knowledge - knowledge achieved by taking this course are verified by the following means:**

Kolokvium

Group presentation at a seminar

**Skills - skills achieved by taking this course are verified by the following means:**

Group presentation at a seminar

**Competences - competence achieved by taking this course are verified by the following means:**

Group presentation at a seminar

### prerequisite

#### Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

- be able to explain basic principles of chemistry - atom structure, particles etc.
- understand the basis of mathematics and physics (university knowledge level)
- use independently theoretical knowledge in the field of mechanics, thermomechanics, elasticity and strength, material science and machine parts
- be able of individual work and collaboration in group
- Very good knowledge of English.

#### Skills - students are expected to possess the following skills before the course commences to finish it successfully:

- Ability to work with PC and basic SW (Word, Excel, PowerPoint), ability to search for information using available information sources, the ability to put the obtained information into context and ability to interpret the information.
- ability to synthesize analytical knowledge acquired in the previous subjects

#### Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

N/A

- používá s porozuměním odborný jazyk a symbolická a grafická vyjádření informací různého typu
- své učení a pracovní činnost si sám plánuje a organizuje

### teaching methods

#### Knowledge - the following training methods are used to achieve the required knowledge:

- Lecture
- Self-study of literature
- Practicum

#### Skills - the following training methods are used to achieve the required skills:

- Lecture
- Lecture supplemented with a discussion
- Practicum

#### Competences - the following training methods are used to achieve the required competences:

- Individual study
- Students' portfolio
- Discussion

### learning outcomes

#### Knowledge - knowledge resulting from the course:

- Knowledge of basic principles of nuclear energetics - neutron characteristics, principle of fission chain reaction, neutrons diffusion and four factor formula.
- Is able to describe different nuclear systems and ways of nuclear energy use.
- Knowledge of thermodynamics basis.
- Knowledge of nuclear reactor kinetics.

#### Skills - skills resulting from the course:

- Ability to describe different systems that use nuclear energy.
- Ability to calculate energy gain from nuclear reactions
- Apply basic approaches of probabilistic safety assessment.

#### Competences - competences resulting from the course:

N/A

Course is included in study programmes:

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