

**List of sample problem subjects (questions) for the exam,  
the Joint Second-cycle (Master) Degree Programme of the  
Energy and Environmental Engineering**



## **Joint Second-cycle (Master) Degree Programme**



### **Abstract**

The proposed study program is developed based on the long-time experience of academic staff from the AGH University of Science and Technology and the Shibaura Institute of Technology. The study program is inspired by the best Polish, Japanese and international study programs, as well as Polish and European Qualification Frameworks.

This document presents a list of sample problem subjects (questions) for the oral exam the Joint Second-cycle (Master) Degree Programme of the Energy and Environmental Engineering. The oral exam in English will include 3 questions;

**1st question:** presentation by student his/her research conducted during undergraduate study and research plan for Master programme (student has to show during exam written by himself the document max 2 pages, i.e. max 400 words, (max.40 pts for 1st question).

**2nd and 3rd question:** with 2 randomly selected questions from the list of sample problem subjects shown below, (max. 30 pts for 2nd question + max. 30 pts for 3rd question).

Total maximum points for the exam are 100.

- Laws of thermodynamics
- Thermodynamic processes
- Thermodynamic cycles
- Mass conservation for fluids flow
- Energy conservation for fluids flow
- Linear momentum conservation for fluids flow
- Mechanisms of heat transfer processes
- Dimensional analysis and concepts of models and prototypes
- Basic numerical methods in heat transfer analysis
- Basic classification and principles of turbomachinery
- Classification and principles of power stations
- Fundamental physical units in energy engineering
- Efficiencies of common energy conversions
- Alternative fuels and methods their methods of productions
- Energy storage
- Equilibrium of chemical reaction
- Reaction stoichiometry
- RedOx reaction
- Kinetics of reaction
- Molecular theory of mater
- Elastic and plastic deformation of materials
- Higher and lower heating value
- The power density of common fuels
- Uncertainty and its propagation
- Fundaments of numerical methods (numerical errors, derivative, interpolation, integration, approximation, solving a linear and non-linear equation)
- The role and benefits of using catalysts
- The water cycle in nature
- Energy and its impact on the environment
- Poland's water resources - condition, threats, opportunities for improvement
- The role of water reservoirs
- Natural and anthropogenic sources of air pollution
- Classification and cleaning techniques of industrial and exhaust gases
- The most important problems of nature protection
- The effect of ionizing radiation on living organisms
- CO<sub>2</sub> sequestration
- The greenhouse effects

# EEE Research Proposal Template

**Name and surname of student**

University (of Bachelor Thesis Graduation)

Faculty (of Bachelor Thesis Graduation)

Department (of Bachelor Thesis Graduation)

**1.**

## **Title of Bachelor Thesis Graduation**

### **Abstract (of Bachelor Thesis):**

*In this thesis* .....Max 100 words.....

.....  
.....  
.....

**2.**

## **Title of research plan (for Joint Second-cycle (Master) Degree Programme of the Energy and Environmental Engineering)**

A student should write the Research Paper Proposal in the following format:

- 1) Paragraph of introduction to the research topic to be studied.
- 2) Research Hypothesis—expressed one of four ways:
  - as a one-sentence research hypothesis,
  - as a research question to be answered,
  - as a scientific paper title or,
  - as a device or a process to be optimized.
- 3) The third paragraph should cover the description of the methods that are planned to be used and the research to be conducted. This section might be seen as the “road map” to successful research and should outline the research that is going to be undertaken over four semesters.
- 4) In the last paragraph, a student discusses the predicted research outcomes. These conclusions must be responsive to the formulated research hypothesis.

The proposal might include illustrations and references to sources. It should be between one and two A4 pages written in Times New Roman 11 font.