



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Uses of gaseous fuels [S2EPiO1-TGiEO>UPG]

### Course

Field of study

Industrial and Renewable Energy Systems

Year/Semester

1/2

Area of study (specialization)

Gas Technology and Renewable Energy

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

15

### Number of credit points

4,00

### Coordinators

dr hab. inż. Rafał Ślefarski prof. PP  
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### Lecturers

### Prerequisites

Basic has knowledge in the field of mechanics, thermodynamics and fluid mechanics and knowledge about construction of energetic machines. Student should also have skills required to solve engineering problems with scientifically valid methodologies. Can effectively acquire the information from various sources including datasheets, literature and Internet.

### Course objective

To acquaint students with the basic theoretical and practical aspects related to the used of gaseous fuels in industry, household applications.

### Course-related learning outcomes

Knowledge:

has expanded knowledge necessary to understand of use of gaseous fuels in energetic devices in steel, glass, ceramic industry

knows the basic processes occurring in the life cycle of devices powered by natural gas such as: furnace, heaters, glass bath, gas flare

has expanded knowledge about the development directions of technologies based on renewable

gaseous fuels such as pyrolysis, gasification and their use in heat production.

**Skills:**

is able to notice systemic and non-technical aspects, including ethical ones when formulating and solving engineering tasks in the field of industrial energy

is able to use the experience gained in the environment of professionally engaged in engineering activities related to the aspects of increase of environmental quality in field of gaseous fuels use.

is able to communicate on topics related to industrial energy with diverse audiences

**Social competences:**

is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment is able to obtain information from the literature, internet, databases and other sources. can integrate the information to interpret and learn from them, create and justify opinions.

is ready to critically assess knowledge and received content

he is ready to fulfil social obligations, inspire and organize activities for the social environment -

is ready to perform responsible professional roles, taking into account changing social needs, including: developing the profession's achievements, maintaining the ethos of the profession, compliance with and development of the principles of professional ethics and actions to comply with these principles.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Knowledge acquired during the lecture is verified during the final test carried. Each test consists of 5 questions (open). Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.

Skills acquired as part of the laboratory classes will be verified basis on the final test, consisting of 10 tasks differently scored depending on their level of difficulty. Passing threshold: 50% of points.

Project: the skills acquired during the design class will be assessed on the basis of the solution to the engineering problem presented by the student during the last class presentation.

### Programme content

Lecture: Production of HC from crude oil, Gasification of residual crude oils, Numeric calculation of combustion process, Numerical code: Ansys, Chemkin, Cantera, GERG, Stanjan, Special equipments powered by natural gas, Fuel cells, ORC system, Natural gas in chemical industry, chemical fertilizers, glass industry, incineration process of toxic compounds, household application of natural gas, flameless combustion, oxy-fuel application, industrial furnace, heat tubes,

Laboratory: analysis of the process of combustion of gaseous fuels in a diffusion burner, performance of the energy balance of an industrial furnace, assessment of the operation of a gas boiler, determination of the efficiency of the condensing boiler, assessment of the impact of the plotting parameters on the emission of toxic compounds during the combustion of gaseous fuels, determination of the properties of gaseous fuels

Project: solution of an engineering task in the field of gaseous fuel use

### Course topics

none

### Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board

Laboratory: multimedia presentation and performance of tasks given by the teacher - practical exercises.

Project: multimedia presentation illustrated with examples given on a blackboard and performance of tasks given by the teacher - practical exercises

### Bibliography

Basic

Dobski, T.: Combustion Gases in Modern Technologies, 2scd Ed., Wydawnictwo Politechniki Poznańskiej  
 Jarosiński J.: Techniki czystego spalania, WNT,  
 Molenda J.: Gaz ziemny. Paliwo i surowiec, WNT, Warszawa  
 Additional  
 Hiroshi T., Gupta A.: High Temperature Air Combustion  
 Sloan E.D.; Koh C.A.: Clathrate Hydrates of Natural Gases, CRC Press, 2007  
 A. Lefebvre: Gas Turbine Combustion  
 R. Stone: introduction to Internal Combustion Engines, Third edition  
 Joachim G. Wunning: Handbook of Burner Technology for Industrial Furnaces

### Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00