**Course code:** ……. **Plan position:** ……

## A. INFORMATION ABOUT THE COURSE

### B. Basic information

| | |
|---|---|
| Name of course | ***Separation Operations*** |
| Field of studies | Chemical Technology |
| Level of studies | First degree |
| Profile of studies | General academic |
| Form of studies | Stationary |
| Specialty | 1.Chemical process technology<br>2. Bioengineering<br>3. Chemistry and technology of cosmetics |
| Unit responsible for the field of studies | Faculty of Chemical Technology and Engineering/<br>Division of Chemical and Biochemical Engineering |
| Name and academic degree of teacher(s) | Ireneusz Grubecki Professor, Ilona Trawczyńska PhD |
| Introductory courses | Chemical engineering |
| Introductory requirements | No requirements |

### C. Semester/week schedule of classes

| Semester | Lectures (W) | Auditorium classes (Ć) | Laboratory classes (L) | Project classes (P) | Seminar (S) | Field classes (T) | Number of ECTS points |
|---|---|---|---|---|---|---|---|
| Summer | 30 | | | 15 | | | 5 |

## 2. LEARNING OUTCOME

| No. | Learning outcomes description | The reference to the learning outcomes of specific field of study | The reference to the learning outcomes for the area |
|---|---|---|---|
| KNOWLEDGE | | | |
| W1 | The student has knowledge in the field of chemical engineering. | K_W13 | P6S_WG |
| W2 | The student knows the basic methods, techniques, tools and materials used in solving simple engineering tasks related to technology and chemical engineering. | K_W15 | P6S_WG |
| SKILLS | | | |
| U1 | The student uses knowledge to design and implement simple chemical processes and unit operations. He can explain the basic phenomena related to important processes in chemical technology and engineering. | K_U07 | P6S_UW |
| U2 | The student uses the principles of saving raw materials and energy. | K_U16 | P6S_UW |

| | | | |
|---|---|---|---|
| U3 | The student solves simple engineering tasks related to the implementation of processes and unit operations. | K_U18 | P6S_UW |

## 3. TEACHING METHODS

### A. Traditional methods used

Standard lecture with PowerPoint presentation.

### B. Distance learning methods used

**Synchronous method** (classes conducted in a way that ensures direct interaction between the student and the teacher in real time, enabling immediate flow of information, the method can be used only if it is provided for in the study plan for a given cycle of education):
e.g. remote lecture in the form of videoconference, remote discussion, etc.

**Asynchronous method** used as an auxiliary (a method that does not ensure direct interaction between the student and the teacher in real time, used only as an auxiliary / complementary method):

e.g. online educational videos, online multimedia presentations, etc.

## 4. METHODS OF EXAMINATION

Written exam from lectures during summer examination session.

## 5. SCOPE

| | |
|---|---|
| Lectures | Introduction to separation processes. The evaporators types and equipment (single-effect and multiple-effect evaporators, vapor recompression evaporator). Equilibrium diagrams. Flash, simple batch and continuous distillation. Steam distillation. Total reflux, minimum reflux and tray efficiency. McCabe-Thiele method. Extractive distillation, azeotropic distillation. Calculation of boiling point and dew point. Liquid-liquid extraction and solid-liquid extraction. Absorption. Membrane processes. |
| Project | Project of the plate rectifying column. |

## 6. METHODS OF VERIFICATION OF LEARNING OUTCOMES

| LEARNING OUTCOME | Form of assessment | | | | | |
|---|---|---|---|---|---|---|
| | Oral examination | Written exam | Colloquium | Project | Presentation | Reports |
| W1 | | x | | | | |
| W2 | | x | | | | |
| U1 | | x | | x | | |
| U2 | | | | x | | |
| U3 | | | | x | | |

## 7. LITERATURE

| | |
|---|---|
| Basic literature | 1. McCabe W.L., Smith J.L.: Unit operations of chemical engineering. McGraw-Hill's, New York, 1985.<br>2. Chpey N. P.: Handbook of Chemical Engineering Calculations. McGraw – Hill's, New York, 2004.<br>3. Himmelblau D.M.: Basic Principles and Calculations in Chemical. Prentice Hall, London, 1982. |

| | |
|---|---|
| | 4. Wankat P. C.: Separation Process Engineering: Includes Mass Transfer Analysis, Prentice Hall, 2016.<br>5. Pabby A.K., Rizvi S.H., Sastre A.M.: Handbook of membrane separations chemical, pharmaceutical, food, and biotechnological applications. CRC Press. cop. 2015. |
| Supplementary literature | 1. http://en.wikibooks.org/wiki/Introduction_to_Chemical_Engineering_Processes<br>2. Perry R.H. Green D.W. Perry's Chemical Engineers' Handbook. Mc Graw – Hill, New York. 1997. |

## 8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

| Student's activity | | Student workload– number of hours |
|---|---|---|
| Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes | Participation in classes indicated in point 1C | 45 |
| | Supervision hours | 20 |
| Student's own work | Preparation for classes | 20 |
| | Reading assignments | 20 |
| | Other (preparation for exams, tests, carrying out a project etc) | 20 |
| Total student workload | | 125 |
| | Number of ECTS points | **5** |