

| Faculty of Chemistry  |  |         |                      |         |                 |
|---|--|---------|----------------------|---------|-----------------|
| SUBJECT CARD  |  |         |                      |         |                 |
| Name of subject in Polish   | <b>Zaawansowane programowanie i metody numeryczne</b>                                  |         |                      |         |                 |
| Name of subject in English  | <b>Advanced programming and numerical methods</b>                                      |         |                      |         |                 |
| Main field of study (if applicable):  | Biotechnology  |         |                      |         |                 |
| Specialization (if applicable):   | Bioinformatics   |         |                      |         |                 |
| Profile:  | academic   |         |                      |         |                 |
| Level and form of studies:  | 2nd level, full-time   |         |                      |         |                 |
| Kind of subject:  | obligatory   |         |                      |         |                 |
| Subject code  | INC024007  |         |                      |         |                 |
| Group of courses  | NO   |         |                      |         |                 |
|   | Lecture  | Classes | Laboratory           | Project | Seminar         |
| Number of hours of organized classes in University (ZZU)  |  |         | 45                   |         |                 |
| Number of hours of total student workload (CNPS)  |  |         | 90                   |         |                 |
| Form of crediting   |  |         | crediting with grade |         |                 |
| For group of courses mark (X) final course  |  |         |                      |         |                 |
| Number of ECTS points   |  |         | 3                    |         |                 |
| including number of ECTS points for practical (P) classes   |  |         | 3                    |         |                 |
| including number of ECTS points for direct teacher-student contact (BK) classes                     |  |         | 1,5                  |         |                 |
| PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES                                   |  |         |                      |         |                 |
| 1. Knowledge of basics of any programming language  |  |         |                      |         |                 |
| SUBJECT OBJECTIVES  |  |         |                      |         |                 |
| C1 Familiarizing students with good practices in programming  |  |         |                      |         |                 |
| C2 Teaching students the construction of algorithms   |  |         |                      |         |                 |
| C3 Familiarizing students with numerical recipes  |  |         |                      |         |                 |
| SUBJECT EDUCATIONAL EFFECTS   |  |         |                      |         |                 |
| relating to knowledge:  |  |         |                      |         |                 |
| PEK_W01 Student is familiar with efficient code development   |  |         |                      |         |                 |
| PEK_W02 Student knows the common sorting algorithms   |  |         |                      |         |                 |
| PEK_W03 Student knows the basics of code optimization   |  |         |                      |         |                 |
| PEK_W04   |  |         |                      |         |                 |
| relating to skills:   |  |         |                      |         |                 |
| PEK_U01 Student is able to use a random number generator in Monte Carlo algorithms                  |  |         |                      |         |                 |
| PEK_U02 Student is able to design and implement an algorithm for different sorting algorithms       |  |         |                      |         |                 |
| PEK_U03 Student is able to develop the code for numerical integration of Newton equations of motion |  |         |                      |         |                 |
| PROGRAMME CONTENT   |  |         |                      |         |                 |
| Laboratory  |  |         |                      |         | Number of hours |
| Lab 1   | Organization of course and conditions for passing the course. Programming environment. |         |                      |         | 3               |
| Lab 2   | Random number generators.  |         |                      |         | 3               |
| Lab 3   | Numerical integration of functions.  |         |                      |         | 3               |
| Lab 4   | Interpolation and extrapolation.   |         |                      |         | 9               |

|  |                                    |  |
|--|------------------------------------|--|
| Lab 5  | Numerical analysis of functions.   | 12   |
| Lab 6  | Monte Carlo methods.               | 12   |
| Lab 7  | End credit                         | 3  |
|  | Total hours                        | 45   |
| <b>TEACHING TOOLS USED</b>   |                                    |  |
| N1. Multimedia presentation<br>N2. Specialized computer software<br>N3. Gamification   |                                    |  |
| <b>EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT</b>   |                                    |  |
| Evaluation (F – forming<br>(during semester), P –<br>concluding (at semester end))   | Educational effect number          | Way of evaluating educational effect achievement |
| P1 (final assignment)  | PEK_W01-PEK_W03<br>PEK_U01-PEK_U03 | Final assignment (max 100 pts)                   |
| P (P1)<br>2,0, when (F1+F2) < 50% points<br>3,0, when (F1+F2) = 51-59% points<br>3,5, when (F1+F2) = 60-69% points<br>4,0, when (F1+F2) = 70-79% points<br>4,5, when (F1+F2) = 80-89% points<br>5,0, when (F1+F2) = 90-99% points<br>5,5, when (F1+F2) = 100% points |                                    |  |
| <b>PRIMARY AND SECONDARY LITERATURE</b>  |                                    |  |
| <b>PRIMARY LITERATURE:</b>   |                                    |  |
| [1] “Numerical Recipes in C: The art of scientific computing” W. Press, S. Teukolsky, W. Vetterling, B. Flannery, Cambridge University Press, 1988-1992, ISBN 0521 431085  |                                    |  |
| <b>SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)</b>   |                                    |  |
| Bartłomiej Szyja, PhD Eng, b.m.szyja@pwr.edu.pl  |                                    |  |