Fundamentals of programming

Faculty of	**Mechanical and Power Engineering**
Name in English	**Fundamentals of programming**
Name in Polish	**Podstawy programowania**
Main field of study	**Power Engineering**
Specialization	**-**
Level of studies	**II level**
Form of studies	**full-time**
Kind of subject	**optional-specialization**
Subject code	**W09ENG-SM2344**
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		30		
Number of hours of total student workload (CNPS)	25		50		
Form of crediting	Zaliczenie		Zaliczenie		
For group of courses mark final course with (X)					
Number of ECTS points	1		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BU) classes	0,68		1,36		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	Knowledge of calculus
2.	Knowledge of algebra
3.	Knowledge of information technology

SUBJECT OBJECTIVES

C1	Presenting a selected programming environment and showing how to use it in order to obtain a numerical code implementing selected calculation algorithms.
C2	Presentation of sample algorithms implementing selected calculation goals met typically while using mathematical tools in engineer practice, especially during numerical modelling of physical phenomena, such as heat flow or fluid flow.
C3	Developing practical skills leading from identifying a computational problem through selection of algorithms and programming tools, creating code, running the program, up to verifying the correctness and accuracy of the numerical results obtained.

SUBJECT LEARNING OUTCOMES

relating to knowledge:	
PEU_W01	understands how the computer performs numerical calculations and knows principles of numerical programming
PEU_W02	knows the basic algorithms that solve typical computational tasks occurring when mathematical tools are applied to engineering problems
relating to skills:	

PEU_U01	knows how to use a selected developer environment
PEU_U02	can decide whether a given computational problem can be solved by computer
PEU_U03	is able to select the appropriate numerical algorithm as well as programming tools suitable for coding this algorithm
PEU_U04	subsequently, is able to run correctly and efficiently the code and obtain the desired numerical results

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction. Operating systems, programs, programming languages.	1
Lec2	Program flow control. Calculations using integer and real numbers.	2
Lec3	Loops and logical conditions applied to calculating series, derivatives and integrals.	2
Lec4	File operations. Output and graphic presentation of results.	2
Lec5	Functions and procedures.	2
Lec6	One-dimensional steady heat flow. Internal heat sources.	2
Lec7	Accurate solutions of linear equation systems.	2
Lec8	Written test.	2
Total hours		15

laboratory		Number of hours
La1	Installation of a programming environment. Compilation of a simple program.	2
La2	Calculations with integers and reals. Ranges of values, precision, text formats of real numbers.	2
La3	Calculating series, derivatives and integrals.	2
La4	Functions and procedures.	2
La5	Implementation of numerical algorithms for ordinary differential equations.	2
La6	File operations. Output of results. Graphical presentation of results.	2
La7	One-dimensional heat flow. Internal heat sources.	4
La8	Accurate solution of linear equation systems. Cramer patterns. Gauss elimination. Thomas' algorithm.	4
La9	Relaxation methods for solving systems of linear equations. Jacobi method. Gauss-Seidel method.	2
La10	Numerical solution for selected two-dimensional fluid flows.	8
Total hours		30

TEACHING TOOLS USED	
N1	Lecture using multimedia (presentation - slides), supported by numerical software.
N2	Computer laboratory using programmer's environment for creating numerical programs.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEU_U01- PEU_U02	Laboratory reports
P1	PEU_W01- PEU_W02	Written test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	T. Beu: Introduction to Numerical Programming, CRC Press, 2015.
2	D. Yevick: A Short Course in Computational Science and Engineering - C ++ , Java and Octave Numerical Programming with Free Software Tools.
3	W. Cheney, D. Kincaid: Numerical Mathematics and Computing, Thomson Brooks 2008.

4	G. Dahlquist, A. Bjorck: Numerical Methods in Scientific Computing, SIAM 2007.
Secondary literature	
1	D. Haskins: C Programming in Linux.
2	P. Wellin: Programming with Mathematica.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Imię i nazwisko:	Józef Rak
E-mail:	jozef.rak@pwr.edu.pl