

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Code: J-319 Module name: Programming Advanced Techniques

Academic year: 2018/2019 Semester: Fall ECTS credits: 6

Programme: Physics and Applied Computer Science

Course homepage: http://taurus.fis.agh.edu.pl/~mindur/adv_eng Lecture language: Polski i AngielskiResponsible teacher: dr hab. inż. Mindur
Bartosz (mindur@agh.edu.pl)Academic teachers: dr hab. inż. Mindur
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Module summary

Programming Advanced Techniques addresses modern programming concepts, shows how to efficiently use meta-programming, design patterns and unusual programming techniques and aspects.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K004	Student potrafi samodzielnie i w zespole pracować i zdobyć odpowiednią wiedzę i umiejętności niezbędne do realizacji postawionego przed nim zadania	Activity during classes, Execution of a project, Execution of laboratory classes
M_K005	Student ma świadomość odpowiedzialności za własną pracę.	Activity during classes, Execution of a project, Execution of laboratory classes
Skills		
M_U004	Student potrafi napisać program z wykorzystaniem paradygmatów programowania obiektowego połączonych z paradygmatami programowania uogólnionego.	Activity during classes, Scientific paper, Execution of a project, Execution of laboratory classes
M_U005	Student potrafi napisać program działający i komunikujący się bez udziału użytkownika	Activity during classes, Execution of a project, Execution of laboratory classes
M_U006	Student potrafi przygotować dokumentację oraz prezentację poświęconą zaawansowanym zagadnieniom programistycznym	Activity during classes, Execution of a project, Execution of laboratory classes

Knowledge		
M_W008	Student zna zaawansowane cechy i elementy charakterystyczne dla obiektowych i uogólnionych języków programowania.	Activity during classes, Scientific paper, Execution of a project, Execution of laboratory classes
M_W009	Student zna i potrafi wyjaśnić działanie zaawansowanych konstrukcji używanych w językach wysokiego poziomu	Activity during classes, Scientific paper, Execution of laboratory classes

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Others	E-learning
Social competence												
M_K004	Student potrafi samodzielnie i w zespole pracować i zdobyć odpowiednią wiedzę i umiejętności niezbędne do realizacji postawionego przed nim zadania	-	-	+	+	-	-	-	-	-	-	-
M_K005	Student ma świadomość odpowiedzialności za własną pracę.	-	-	+	+	-	-	-	-	-	-	-
Skills												
M_U004	Student potrafi napisać program z wykorzystaniem paradygmatów programowania obiektowego połączonych z paradygmatami programowania uogólnionego.	-	-	+	+	-	-	-	-	-	-	-
M_U005	Student potrafi napisać program działający i komunikujący się bez udziału użytkownika	-	-	+	-	-	-	-	-	-	-	-
M_U006	Student potrafi przygotować dokumentację oraz prezentację poświęconą zaawansowanym zagadnieniom programistycznym	-	-	-	+	-	+	-	-	-	-	-
Knowledge												

M_W008	Student zna zaawansowane cechy i elementy charakterystyczne dla obiektowych i uogólnionych języków programowania.	-	-	+	+	-	+	-	-	-	-	-
M_W009	Student zna i potrafi wyjaśnić działanie zaawansowanych konstrukcji używanych w językach wysokiego poziomu	-	-	+	+	-	+	-	-	-	-	-

Module content

Laboratory classes

Main topics

Students will design, develop and verify short programs which show main aspects of the topics given during the seminars.

Skills:

- student is able to present characteristic traits of the object oriented and generic programming languages
- student is able to design and implement programs using features of the above mentioned programming languages
- student is able to use complex library components (belonging to variety of libraries) in the design and implementation of the programs

Project classes

Main topics

Students will accomplish the projects, which corresponds to the topic presented during their seminar. Starting point for the project is the goals and hints mainly from the customer point of view. The project has to utilize the object oriented, generic programming design patterns and library resources in a way which as optimal as possible carries out the assigned tasks. The project must be formed in as the problem to be solved and the solution, presented separately.

Seminar classes

Main topics

1. Templates: functions and classes
2. Standard Template Library (STL)
3. Containers adaptors
4. C++11, C++14, C++17, C++20
5. Design patterns
6. Efficient memory management
7. Threads and their synchronization and communication
8. Serialization
9. Interprocess communication
10. Low level network programming
11. Designing of the Win/Linux services
12. Static and dynamic libraries design, implementation and usage
13. Interfacing different programming languages (e.g. Python \leftrightarrow C, C++)
14. Program optimization techniques (manual and by compiler)

Method of calculating the final grade

Final grade (OK) is calculated using weighted average of the grades from seminar (S) of the lab (L), the project (P) and exam (E), with a given percentage for each one.

$$OK = 0.3 \cdot S + 0.2 \cdot L + 0.2 \cdot P + 0.3 \cdot E$$

It is mandatory to get positive grade from all forms of classes.

Prerequisites and additional requirements

Good knowledge of C, C++, Python, Java programming languages.

Recommended literature and teaching resources

- Seminars
- Josuttis N., "C++. Programowanie zorientowane obiektowo", Helion 2003 / Object- Oriented Programming in C++, Wiley 2002
- Vandevoorde D., Josuttis N., "C++. Szablony", Helion 2003 / "C++ Templates The Complete Guide", Addison- Wesley 2002
- <http://en.cppreference.com/w/cpp>
- <http://www.boost.org/>

Scientific publications of module course instructors related to the topic of the module

1. B. Mindur and Ł. Jachymczyk, The Ethernet based protocol interface for compact data acquisition systems, Jour. Instr. 7, T10004 (2012).

Additional information

- No all of the topic proposed for the seminar must be accomplished. On the other hand, interesting topics not included in the list could be presented.
- Detailed information about the course is available on my website: http://taurus.ftj.agh.edu.pl/~mindur/adv_eng

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in laboratory classes	20 h
Participation in project classes	20 h
Participation in seminar classes	20 h
Completion of a project	30 h
Preparation for classes	40 h
Realization of independently performed tasks	30 h
Summary student workload	160 h
Module ECTS credits	6 ECTS