SYLLABUS: ALGORITM, PROGRAMMING 2

Date / Revision	23 May 2015 / 02 May 2017 / PP
Faculty	Engineering and Lifesciences
Study Programs	All Engineering – and Lifesciences Study Programs

SUBJECT: Algorithm, Programming 2

1 Basic Information

1.01	**Subject Name**	**Algorithm, Programming 2**
1.02	**Semester**	2
1.03	**Level**	2
1.04	**SKS**	3
1.05	**Mandatory / Curriculum**	F-06
1.06	**Subject Code**	PROG
1.07	**Subject Code**	ENG-F-PROG-2203
1.08	**Year**	2017 (7)
1.09	**Quality Control**	Final Test, see evaluation
1.10	**Limitations**	Min 12 and Max 32 students in one class
1.11	**Combined with**	all Engineering- and Lifesciences Study Programs
1.12	**Perquisite**	Algorithm, Programming 1
1.13	**Responsible**	Dean of Engineering- and Lifesciences Faculty
1.14	**Revision**	15-08-2017/MaS

2 Description of Subject

Algorithm Programming & Data Structure 2 course is designed to give students a solid foundation in understanding the method of programming to solve engineering problems. The theory and practice of using programming language C++ is given. C++ use as a tool and method to solve engineering problems. Tools for algorithm drawing and simulation of OOP (Object Oriented Programming) using UML (Unified Modeling Language) are explored. Accessing hardware using communication port and protocol will be explored within programming of hardware interfacing

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3 Objectives

- to learn the Object Oriented Programming (OOP) and methodology.
- to learn Unified Modeling Language
- to use the C++ program language to solve engineering problem.
- Impart relevant skills and knowledge for independent learning of other subjects that require such skills and knowledge.

4 Competency

After having the course, students are expected to:

- Understand the concept of Object Oriented Programming and Methodology
- Able to describe the problem to be solved involving C++ programming skill
- Able to analyse and describe algorithm using flow-chart and draw object using Unified Modeling Language
- Understand string, array, vector, list, and other containers and iterators
- Understand how to work with searching, sorting, etc.
- Understand how to work with file/data streaming
- Understand how to program communication interface for hardware control.

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Circuit simulation using Electronic Workbench Software;
- Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	**Absence maximum**	25%
5.2	**Participation in Discussion**	05 Points
5.3	**Homework / Classwork**	05 Points
5.4	**Presentation /Simulation**	10 Poins
5.5	**Daily Quiz**	20 Points
5.6	**Final Examination**	60 Points
	Total	100 Points

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7 Text Book and Reference

1	**Main Text Book:** "C++ How To Program, 9th Edition, 2014", **Authors**: Harvey M. Dietel & Paul J. Dietel, Publisher: Pearson.
2	**Supplement Textbooks:** • "Interfacing with C++", Author: Jayantha Katupitiya & Kim Bentley, Publisher: Springer Verlag • web / internet

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	**Introduction and overview.**		
2	**Functions and introduction to recursion:** Program components in C++, math library functions, function definition with multiple parameters, function prototypes and argument coercion, C++ std lib, random number generator, game of chance, C++ 11 random numbers, storage classes and storage duration, scope rules, function call stack and activation records, functions with empty parameter lists, inline functions, references and references parameters, default arguments, unary scope resolution operator, function overloading, function template, recursion, iteration	Ch6[1]	
3	**Class Templates array and vector : catching exceptions.** Using c++ standard library class template array, use arrays to store, sort and search lists and tables of values, declare arrays, initialize arrays and refer to the elements of arrays, use range based for statement, pass arrays as functions, declare and manipulate multidimensional arrays, using c++standard library class template vector – a variable related data items	Ch7[1]	
4	**Pointers :** what is pointers, learn the similarities between pointers and references, using pointers to pass arguments to functions by reference, understand the close relationship between pointers and built-in arrays, using c++11 capabilities, including nullptr and standard library functions begin and end	Ch8[1]	
5	**Throwing Exceptions:** Use an include guard, access class member via an object's name, a reference or a pointer, use destructors to perform "termination housekeeping", learn the order of constructor and destructor calls, learn about the dangers of returning a reference to private data, assign the data members of one object to those of another object, create objects composed of other objects, using friend function and friend class, use the this pointer in a member function to access a non-static class member, use static data members and member functions	Ch9[1]	

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6	**Operator Overloading:** operator overloading craft valuable classes, overload unary and binary operator, convert objects from one class to another class, use overloaded operators and additional features of the string class, perform dynamic memory allocation with new and delete, using keyword explicit to constructor	Ch 10 [1]	
7	**Object-Oriented Programming: inheritance** inheritance promotes software reuse, the notion of base classes and derived classes and the relationship between them, the protected member access specifier, the use of constructor and desctructors in inheritance hierarchies, the order in which constructors and destructors are called in inheritance hierarchies, the difference between public, protected and private inheritance	Ch 11[1]	
8	**MIDTERM SEMESTER BREAK**		
9	**Object-Oriented Programming: polymorphism** polymorphism makes programming more convenient and system more extensible, the distinction between abstract and concrete classes and how to create abstract classes, to use runtime type information (RTTI), implementation of virtual function and dynamic binding, using virtual desctructors run on an object	Ch 12[1]	
10	**Stream Input/Output:** C++ stream input/output, formatting input/output, the stream I/O class hierarchy, to use stream manipulators, control justification and padding, determine the success/failure of input/output operations, to tie the output stream to input streams	Ch 13[1]	
11	**File Processing :** create, write and update files, sequential file processing, random-access file processing, to use high-performance unformatted I/O operations, the differences between formatted-data and raw-data file processing, to build a transaction-processing program using random-access file processing, object serialization	Ch 14[1]	
12	**Standard Library Containers and Iterators:** standard library containers, iterators, and algorithms, using vector, lists and deque sequence containers, using set, multiset, map and multimap associative containers, using the stack, queue and priority_queue container adapters, use iterators to access container elements, use the copy algorithm and ostream_iterators to output a container, use the bitset “near container” to implement the sieve of eratoshtenes for determining prime numbers	Ch 15[1]	
13	**Searching and Sorting:** linear search and binary search, Use Big O notation to express the efficiency of searching and sorting algorithms and to compare their performance, sort an array using insertion sort, selection sort and the recursive merge sort algorithms		

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14	**Class String and String Stream Processing:** string assignment and concatenation, comparing strings, substrings, swapping strings, string charcteristics, finding substrings and characters in a string, replacing characters in a string, inserting characters into a string, conversion to pointer-based char* strings, iterators, string stream processing		
15	**Hardware Interfacing :**		
16	**FINAL EXAMINATION**		

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