



**DEPARTMENT OF COMPUTER ENGINEERING**  
**College of Electrical and Mechanical Engineering (CEM)**  
**National University of Sciences and Technology (NUS)**



<b>1. Course Information</b>	
Course Number and Title:	CS-114 Fundamentals of Programming
Credits:	3 (2-1)
Instructor(s)-in-charge:	Dr Muhammad Usman Akram + Ms Shanza
Course type:	Lecture + Lab
Required or Elective:	Required
Course pre-requisites	Nil
Degree and Semester	DE-42 (ME), Semester 1
Month and Year	Fall 2020
Course Web-Page	<a href="https://biomisa.org/usman/fundamentals-programming-fall-2020.html">https://biomisa.org/usman/fundamentals-programming-fall-2020.html</a>

<b>2. Course Schedule</b>	
Lecture:	2 hrs/week, Meets once weekly
Lab:	3 hrs/week, Meets once in a week
Discussion:	1 hr/discussion, multiple discussion sections offered per quarter
Outside study:	7 hrs/week
Office Hours :	3 hrs/week by instructor, 3 hrs/week by teaching assistant/lab engineer

<b>3. Course Assessment</b>				
Exam:	1 Mid and 1 Final			
Home work:	4 graded Assignments			
Lab reports:	12 reports, 01 open Lab, 01 Lab final			
Design reports:	1 Design report			
Quizzes:	N/A			
Grading:	Theory (67%)		Lab (33%)	
	Mid term	30%	Lab Work/Tasks (Every week)	50%
	Quizzes:	N/A	Open Lab + Lab Final	15%
	Assignments	20%	Home Tasks	5%
	Final Exam	50%	Final Project	30%

#### 4. Course book and Related Course Material

Textbooks:	1. Deitel and Deitel: C++ How to Program, 7 <sup>th</sup> Edition, Prentice Hall Publications
Reference Books:	1. Robert Lafore: Object-Oriented Programming in C++, Fourth Edition, December 2001, Sams Publishing . 2. A Structured Programming Approach Using C++ by Behrouz A. Forouzan 3. <a href="http://www.cplusplus.com">www.cplusplus.com</a>

#### 5. Catalog Descriptions

The purpose of this course is to teach fundamentals of programming to the students starting from the basic. The course is software-oriented as students will be trained to create piece of code that are capable of performing one of more tasks. The course includes comprehensive laboratory exercises.

#### 6. Course Objectives

- a) The students will have a thorough understanding of the basic concepts of programming.
- b) The students will gain an in-depth knowledge of a modern IDE such as Microsoft Visual Studio.
- c) The students will have good knowledge of C++ including its advantages and disadvantages.
- d) Thus, having acquired a knowledge of Visual Studio and C++, the students will be able to design and implement an algorithm from scratch.

#### 7. Topics covered in the Course and Level of Coverage

1. Overview a. What is programming? b. Computer configuration c. Algorithms and flowcharts d. Computer languages; generations and levels of programming languages e. data and results f. Introduction to a typical IDE (Microsoft Visual C++ 6.0).	3hrs
2. Input and Output a. Stream I/O b. Cin and Cout c. Assignment Statement d. Implicit and explicit type casting	3hrs
3. Operators a. Arithmetic Operators b. Operator precedence c. Associativity	2hrs
4. Selection (Decisions) a. Relational and logical operators b. AND, OR, and NOT operators c. Truth Tables for conditional operators d. Single, double and multiway selection structure e. If, if/else, nested ifs f. Conditional operator g. Conditional expressions h. Switch statement	8hrs

<p>5. Repetition (Loops)</p> <ul style="list-style-type: none"> <li>a. Entrance closed and exit controlled loops</li> <li>b. While, do/while, for(; :), break and continue statements</li> </ul>	3hrs
<p>6. Functions</p> <ul style="list-style-type: none"> <li>a. Programmer defined functions</li> <li>b. Library functions</li> <li>c. Storage classes</li> <li>d. Scope and lifetime of variables</li> <li>e. Parameter pass</li> <li>f. Call by copy and call by reference</li> <li>g. Recursion</li> <li>h. Comparison of iteration and recursion</li> </ul>	3hrs
<p>7. Arrays</p> <ul style="list-style-type: none"> <li>a. Declaring arrays</li> <li>b. Input and output of data in arrays</li> <li>c. Accessing individual elements</li> <li>d. Passing arrays to functions</li> <li>e. Searching and sorting</li> <li>f. Sequential search and binary search</li> <li>g. Bubble sort, selection sort, insertion sort</li> <li>h. Array of characters</li> <li>i. String library functions</li> </ul>	6hrs
<p>8. Structures</p> <ul style="list-style-type: none"> <li>a. Structure declaration</li> <li>b. Accessing structure members</li> <li>c. Arrays of structures</li> <li>d. Passing structures as function arguments</li> <li>e. Structure with structured elements</li> </ul>	3hrs
<p>9. Files</p> <ul style="list-style-type: none"> <li>a. Opening and closing files</li> <li>b. Files pointer</li> <li>c. Binary and text files</li> <li>d. Sequential and random access files</li> <li>e. Reading and writing text files</li> <li>f. Library functions for file manipulation</li> </ul>	3hrs

8. Lab Experiments	
Lab 01	Introduction to Computers and its components
Lab 02	Introduction to programming
Lab 03	Variables, constants and data types
Lab 04	Expressions, Coercion and casting
Lab 05	Selection structures
Lab 06	Repetition structures (for)
Lab 07	Repetition structures (while, do while)
Lab 08	Open Lab-1
Lab 09	Functions
Lab 10	Arrays
Lab 11	Arrays
Lab 12	Pointers
Lab 13	Structures
Lab 14	Strings
Lab 15	Recursion, files
Lab 16	Lab Final

9. Course Outcomes and their Relation to Program Outcomes (Mapping CLO to PLO)			
Course Learning Outcome (CLOs)		PLOs	Learning Level
CLO 1	<b>Understanding</b> fundamental concepts of computer programming to solve a problem	1	C2
CLO 2	<b>Implementing</b> and <b>applying</b> the concepts of functions and Structures in C++	1	C3
CLO 3	<b>Analyse</b> real life problems and <b>relate</b> their knowledge of programming and algorithms to solve those complex problems using arrays, functions and pointers	3	C4
CLO 4	To code, document, test and <b>implement</b> a well-structured, robust computer program in Visual Studio using C++ programming language	5	P2

<b>10. Program Learning Outcomes</b>	
<b>PLO 1</b>	<b>Engineering Knowledge</b>
	An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
<b>PLO 2</b>	<b>Problem Analysis</b>
	An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
<b>PLO 3</b>	<b>Design/Development of Solutions</b>
	An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
<b>PLO 4</b>	<b>Investigation</b>
	An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
<b>PLO 5</b>	<b>Modern Tool Usage</b>
	An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
<b>PLO 6</b>	<b>The Engineer and Society</b>
	An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
<b>PLO 7</b>	<b>Environment and Sustainability</b>
	An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
<b>PLO 8</b>	<b>Professional Ethics</b>
	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
<b>PLO 9</b>	<b>Individual and Teamwork</b>
	An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.
<b>PLO 10</b>	<b>Communication</b>
	An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PLO 11</b>	<b>Project Management</b>
	An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
<b>PLO 12</b>	<b>Lifelong Learning</b>
	An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments