COURSE DESCRIPTION: EE-2003 Computer Organization & Assembly Language (COAL)

COURSE DESCRIPTION FORM

INSTITUTION National University of Computerand Emerging Sciences, FAST

PROGRAM TO BE EVALUATED BS-School of Computing– FALL 2024

Course Description

Course Code	EE-2003
Course Title	Computer Organization & Assembly Language
Credit Hours	3
Prerequisites by Course(s) and Topics	PF, DLD
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam re-take/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the **whole assignments** category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	***50% Theory 50% Practical*** Assessment Items

Assessment Item	Number	Weight (%)
Assignment	3	10%
Quiz	3	10%
Midterm Exam	2	30%
Final Exam	1	50%

Course Instructors	Muhammad Usman
Lab Instructors (if any)	Waseem Rauf
Course Coordinator	Shoaib Rauf
URL (if any)	

Current Catalog Description	- Programming Methodology of low-level languages - How to access computer hardware directly - Overview of a user-visible architecture (of Intel 80x86 processors) - Intel 80x86 instruction set, assembler directives, macro, etc. - How programs interact with the operating system for various services including memory management and input/output services - How is it possible to interface high-level language and low-level language modules
Textbook (or **Laboratory Manual** for Laboratory Courses)	Assembly Language for Intel Based Computers K.Irvine 7th Edition MIPS Assembly Language Programming by Ed Jorgensen, Version 1.1.35 April 2018
Reference Material	Computer organization and design: the hardware/software interface by David A. Patterson and John L. Hennessy Computer Organization & Embedded Systems Hamacher et al. 6th Ed.

Course Learning Outcomes

A. Course Learning Outcomes (CLOs)

On successful completion of this course students will have to know how of:

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Illustrate micro-architectures of x86 and RISC processors	Cognitive	3	02	A1, Q1, M1, F
02	Create basic assembly code using different type of addressing modes in x86 & RISC ISAs to solve simple-moderate problems	Cognitive	4	02	A2, Q1, M1, F
03	Apply translation of machine instructions into binary code and visa versa.	Cognitive	5	03	A2, A3, Q2, M1, M2, F
04	Illustrate use of stack during a parametrized function/procedure call that uses local variables.	Cognitive	5	03	Q3, A3, M2, F
05	Justify need to use assembly code along with a high-level language code	Cognitive	5	03	Q3,A3, M2, F

Tool: A = Assignment, Q = Quiz, M = Midterm, F=Final

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✓
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✓
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	

8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1					✓							
	2		✓	✓									
	3					✓							

Topics covered in the course with number of lectures on each topic (Assume 15 weeks of instruction and 1 hour lecture duration)	**Topics to be covered**				
	List of Topics	**Week**	**No. of Weeks**	**Contact Hours**	**CLO(s)**
	Introduction: Introduction to Computer Architecture & Organization & Assembly Language ***(1 Lecture)*** --- Applications of Assembly Language, Assemble-Link-Execute Cycle ***(1 Lecture)*** --- Assembly Relativity, Portability, Virtual Machine Concept and Machine Levels ***(1 Lecture)***	**1**	**1**	**3**	**1**
	Microcomputer Concepts, Components of Microcomputer (***1 Lecture)*** --- Intel 80x86 Processor Architecture, Mode of Operations ***(1 Lecture)*** --- Basic Execution Environment ***(1 Lecture)***	**2**	**1**	**3**	**1**
	Assembly Language Fundamentals: *Integer, Character & String Literals, Identifier, Directive Vs Instruction* ***(1 Lecture)*** --- *Instruction, Defining Data* ***(1 Lecture)*** --- Symbolic Constants ***(1 Lecture)*** **Assignment no 1 Release (Start of Week 3)**	**3**	**1**	**3**	**2**
	Data Transfer **(1 Lecture)** --- Addressing **(1 Lecture)** --- Arithmetic Operations **(1 Lecture)** **Assignment no 1 Submission**	**4**	**1**	**3**	**2**

	(End of Week 4)				
	Operators and Directive **(1 Lecture)** --- Instruction to control transfer Instructions **(1 Lecture)** --- Arrays and Loops **(1 Lecture)**	**5**	**1**	**3**	**2**
	WEEK 6	***MID -1 Exam***			
	Procedures and Stack Operations **(1 Lecture)** --- Runtime Stack **(1 Lecture)** --- PUSH and POP Instructions **(1 Lecture)** **Assignment no 2 Release (Start of Week 7)**	**7**	**1**	**3**	**4**
	Conditional Processing: Boolean and comparison instruction, conditional jumps ***(3 Lectures)***	**8**	**1**	**3**	**2**
	conditional loop structures, high-level language constructs ***(3 Lectures)*** **Assignment no 2 Submission (End of Week 9)**	**9**	**1**	**3**	**2**
	Shift & Rotate *Instructions* ***(1 Lectures)*** --- Multiplication & Division instructions ***(1 Lecture)*** --- Extended Addition & Subtraction ***(1 Lecture)***	**10**	**1**	**3**	**2**

	Week 11	***MID -2 Exam***			
	Advanced Procedures – Introduction and Examples: Stack Frames --- *Recursion* **(1 Lecture)** --- *INVOKE, ADDR, PROC, PROTO Directives* **(1 Lecture)** **Assignment no 3 Release (Start of Week 12)**	**12**	**1**	**3**	**1,2,4**
	String and Arrays String primitive Instructions ***(3 Lectures)*** --- *Two dimensional array* **(1 Lecture)** **Assignment no 3 Submission (End of Week 13)**	**13**	**1**	**3**	**2**
	Machine Language Translation Instruction Formats, encoding an Instruction Set and Modes of Addressing, Translation and Working of an Assembler, Map File and Memory Map ***(3 Lectures)***	**14**	**1**	**3**	**3**
	CISC vs RISC, Introduction to MIPS Assembly ***(3 Lectures)***	**15**	**1**	**3**	
	Week 16	***Final Exam***			
	Review		**1**	**3**	
	Total		**16**	**48**	

Laboratory Projects/Experiments Done in the Course	**Mentioned in Lab Course Description**			
Programming Assignments Done in the Course	3 Assignments are given which are attached in the assignments section			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**

	50	25	20	5
Oral and Written Communications	Every student is required to submit at least 1 written report of typically 10 pages in IEEE research report format. Students will also be called for viva/presentation of the project and any assignment where necessary in Lab Section			

Instructor Name: Muhammad Usman

Instructor Signature: USMAN

Date: 19th August 2024