Ahsanullah University of Science and Technology
Bangladesh

COURSE OUTLINE

Part A

1. Course No./Course Code: ***CSE 2213 (BNQF 061)***

2. Course Title: ***Computer Architecture***

3. **Course Type (GEd/Core Course/Elective):** ***Core Course***

4. Year/Level/Semester/Term: ***Year 2 Semester 2***

5. Academic Session: ***FALL 2022***

6. Course Teacher/Instructor: ***Prof. Dr. Shamim Akhter***

7. Pre-requisite(s) (if any): ***Nil***

8. Credit Value: ***3***

9. Credit Hours: ***3***

10. Total Marks: ***100***

11. Rationale of the Course: ***SDG 4 (Ensure Technical Level Education) and SDG 8 (Reduce Unemployment Rate).***

12. Faculty: Engineering

13. Department: Computer Science and Engineering (CSE)

14. Program: Bachelor of Science in Computer Science and Engineering (B.Sc. in CSE)

15: Course Objectives:

Basic structures and concepts of computer systems: Functional units, Basic operational concepts, Bus structures, Software and Performance; Information representation and transfer; Instructions and data access methods: Registers and Addressing, Program flow control, Logic instructions, Program-controlled I/O, Stacks and subroutines; Control Unit: Hardwired control and Micro programmed control; Memory organization;

I/O systems and Interrupts; Introduction to Pipelining, Parallel processing and multiprocessor systems.

16. Mapping of Course Outcomes with Bloom's Taxonomy and Program Outcomes

Sl. No.	COs	POs	Bloom's Taxonomy		
			C	A	P
1	Recognize the basics of organizational and architectural issues of a digital computer	1	2		
2	Compare the elements of modern instructions sets and their impact on processor design	2	3		
3	Assess performance issues in processor and memory design of a digital computer	4	4		

17. Mapping of COs with Knowledge Profiles, Complex Engineering Problem Solving and Complex Engineering Activities

Course Outcome	Knowledge Profile	Complex Problem Solving	Complex Engineering Activities
CO1	K2-K4	P1	
CO2	K2-K4	P1	
CO3	K8	P1	

Part B

18. Week-wise Course Plan

Week	Topics	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
1	Basic Structure of Computers: Types of a computer, Basic functional units of a computer system, Basic operational concepts, Bus structures, Performance evaluation: Basic performance equation, Pipelining, and superscalar operation, Quantitative	- Lecture - Brainstorming Session	- *Class Performance*	1

Week	Topics	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
	measurement of performance; Instruction set architecture: CISC and RISC; Multiprocessor and multicomputer.			
2	Machine Instructions and Programs: Representation of numbers, characters, and instructions, Signed integer operations and overflow detection, Addressing modes of instructions, Assembly language notations.	- Lecture - Think – Pair -Share (TPS)	- *Class Performance*	2
3	Basic input/output operations. Instruction formats, Program sequencing, and branching, Subroutines: Nesting, parameter passing and stack frame; Stack processor organization, Example programs and instructions, Encoding of machine instructions.	- Lecture - Think – Pair -Share (TPS)	- *Class Performance*	2
4	Floating-point numbers: IEEE standard representation, Arithmetic operations, Guard bits and truncation	- Lecture	- *Class Performance* - Quiz 1	1
5-6	Basic Processing Unit: Single bus CPU datapath architecture, Control Unit architecture and organization. Arithmetic and logical operations, Fetching and storing instructions from/to memory, Execution of a complete instruction, Branch instructions, Control sequence of common instructions.	- Lecture - Brainstorming Session	- *Class Performance*	1, 2,3

Week	Topics	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
7	Pipelining: Role of Cache memory, Pipeline performance, Hazards: Examples of data, instruction and structural hazards, Operand forwarding, Handling data hazard in software.	- Lecture - Brainstorming Session	- *Class Performance* - *Assignment1*	2, 3
	MID BREAK			
8	Pipelining: Conditional and unconditional branches, Delayed branching, Branch prediction, Data path and control considerations, Superscalar operation, Performance considerations.	- Lecture	- *Class Performance* *- Quiz 2*	1,2, 3
9	The Memory System: Internal organization of semiconductor RAM memory, Static memory, Synchronous and Asynchronous DRAM, read-only memories, Principles of locality, and Memory hierarchy.	- Lecture - Brainstorming Session	- *Class Performance*	1, 3
10	The Memory System: Cache memory: Direct mapped, set-associative and fully associative cache, Multi-level cache, Measuring and improving cache performance; Virtual memory.	- Lecture - Think – Pair -Share (TPS)	- *Class Performance*	1, 3
11	Magnetic Disk Read and Write Mechanism with Physical Characteristics. RAID Architecture.	- Lecture	- *Class Performance*	1,3
12	Input/output Organization: Accessing I/O devices, Program controlled I/O, Interrupt based I/O: Handling multiple devices,	- Lecture - Brainstorming Session	- *Class Performance*	1, 3

Week	Topics	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
	Processor examples; Direct memory access.			
13	Input/output Organization: Bus arbitration algorithms, Synchronous and Asynchronous Bus, Interface circuits: Serial and parallel ports for input, output and combined I/O operations, Standard I/O interfaces: PCI, SCSI, and USB bus standards.	- Lecture	- *Class Performance* - Quiz 3	1, 3
14	Review classes.			

Part C

19. Assessment and Evaluation

1) Assessment Strategy: ***Class Performance, Quizzes/Assignments, and Final Examination***

2) Marks distribution:

a) Continuous Assessment: ***Class Performance (10), Quizzes/Assignments (20)***

b) Summative: ***Final Examination (70)***

3) Make-up Procedures: ***Carryover/Clearance/Improvement Examination***

Part D

20. Learning Materials

1. ***Course Website – https://classroom.google.com/c/NTc0OTYxNDM1ODE5?cjc=jnbzvs4***
   CSE2213 Computer Architecture
   Class Code: jnbzvs4

20.1. Required (if any)

- ***"Computer Organization and Design – The Hardware / Software Interface", David A. Patterson and John L. Hennessy, 5th.Edition, Morgan Kaufmann, Elsevier, 2013.***
- ***"Computer Organization and Architecture", William Stallings, 9th Edition, Pearson Education Inc,2015-2016***

20.2. Recommended (if any)

- ***"Computer Organization" (5th Edition) by Carl Hamacher, Zvonko Vranesic,***
    a. ***Safwat Zaky. Publisher: McGraw-Hill Education.***
- ***"Computer Architecture: A Quantitative Approach" (5th Edition) by John L. Hennessy and David A. Patterson. Publisher: Morgan Kaufmann Publishers Inc.***

20.1. Others (if any)

Prepared by:	**Checked by:**	**Approved by:**
Signature: _____	Signature: _____	Signature: _____
Name: Prof. Dr. Md. Shamim Akhter **Department: CSE** **Date:**	**Name: Mr. Md. Aminur Rahman** **OBE Program Coordinator, CSE** **Date:**	**Name: Prof. Dr. Md. Shahriar Mahbub** **HOD, CSE** **Date:**

Annex-1: PEO of CSE

PEO1 - Professionalism
Graduates will demonstrate sound professionalism in computer science and engineering or related fields.

PEO2 – Continuous Personal Development
Graduates will engage in life-long learning in multi-disciplinary fields for industrial and academic careers.

PEO3 – Sustainable Development
Graduates will promote sustainable development at local and international levels.

Annex-2: Mapping of PEO-PO

	PEO1	PEO2	PEO3
PO1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	√		
PO2 - Problem analysis: Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.	√		
PO3 - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.	√		
PO4 – Investigation: Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	√		
PO5 - Modern tool usage: 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.	√		
PO6 - The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	√		√
PO7 - Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.	√		√
PO8 – Ethics: Apply ethical principles and commit to professional ethics, responsibilities and the norms of engineering practice.	√		

PO9 - Individual work and teamwork: Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.	√	√	
PO10 – Communication: Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.	√		
PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.	√		
PO12 - Life-long learning: Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.		√	

Annex-3: Blooms Taxonomy *

Level	Cognitive Domain – Revised Version	Affective Domain	Psychomotor Domain
1	Remember (1)	Receiving Phenomena (1)	Perception (1)
2	Comprehend (2)	Responding to Phenomena (2)	Set (2)
3	Apply (3)	Valuing (3)	Guided Response (3)
4	Analyse (4)	Organizing Values (4)	Mechanism (4)
5	Evaluate (5)	Internalising Values (5)	Complex Overt Response (5)
6	Create (6)		Adaption (6)
			Origination (7)

* Based on "REVISED BLOOM'S TAXONOMY INDICATOR v3.31" , available athttp://adept.mmu.edu.my/wp-content/uploads/2018/09/Blooms-Taxonomy-Indicator-v3.31.xls