Green University of Bangladesh

Department of Computer Science and Engineering

Course Outline

1 General Information

Faculty	Faculty of Science and Engineering (FSE)
Department	Department of Computer Science and Engineering (CSE)
Programme	Bachelor of Science in Computer Science and Engineering
Semester	**Spring 2024**
Course Title	*Computer Architecture*
Course Code	CSE 211
Course Credit	3.0 units
Contact Hours	2.5/week
Course Status	Core Course
Prerequisite Course	CSE 203

2 Course Instructors

Section	Name	Office	Email
222 D1	Syed Ahsanul Kabir	F - 129	kabir@cse.green.ac.bd
222 D2	Md. Sabbir Hosen Mamun	A-510	mamun@cse.green.edu.bd
222 D4	Mahbubur Rahman	A-510	mahbubur@cse.green.edu.bd
223 D1	Syed Ahsanul Kabir	F - 129	kabir@cse.green.ac.bd
223 D2	Syed Ahsanul Kabir	F - 129	kabir@cse.green.ac.bd
223 D3	Jarin Tasnim Tonvi	A-608	jarin@cse.green
223 D4	Jarin Tasnim Tonvi	A-608	jarin@cse.green
223 D5	Maisha Muntaha	A-608	maisha@cse.green.edu.bd
213_E1	Mahbubur Rahman	A-510	mahbubur@cse.green.edu.bd

3 Class Hours

Section	Room	Weekday	Time	Weekday	Time
222 D1	J - 106	Wednesday	11:00 - 12:15 PM	Thursday	11:00 - 12:15 PM
222 D2	J-107	Tuesday	12.15 - 01.30 PM	Thursday	12.15 - 01.30 PM
222 D4	K-103	Tuesday	03:15 - 04:30 PM	Wednesday	03:15 - 04:30 PM
223 D1	K - 106	Monday	09:45 - 11:00 AM	Wednesday	09:45 - 11:00 AM
223 D2	K - 105	Tuesday	09:45 - 11:00 AM	Thursday	09:45 - 11:00 AM
223 D3	K - 108	Wednesday	2:00 - 03:15 PM	Friday	2:15 - 03:30 PM
223 D4	A - 606	Thursday	11:00 - 12:15 PM	Friday	09:15 - 10:30 AM
223 D5	K - 105	Tuesday	8:30 - 9.45 AM	Thursday	8:30 - 9.45 AM
213_E1	Online	Saturday	06:30 - 07:45 PM	Saturday	07:45 - 09:00 PM

4 Counseling Hours

Section	Weekday	Time	Weekday	Time
222 D1	Wednesday	12:15 - 1:30 PM	Thursday	12:15 - 1:30 PM
222 D2				
222 D4	Tuesday	10:00 - 11:00 AM	Wednesday	10:00 - 11:00 AM
223 D1	Monday	08:30 - 09:45 AM	Wednesday	08:30 - 09:45 AM
223 D2	Tuesday	08:30 - 09:45 AM	Thursday	08:30 - 09:45 AM
223 D3	Tuesday	2:00 - 03:15 PM	Thursday	08:30 - 09:45 AM
223 D4	Wednesday	03:15 - 4:30 PM	Thursday	09:45 - 11:00 AM
223 D5	Wednesday	12:15 - 1:30 PM	Thursday	12:15 - 1:30 PM
213_E1	Tuesday	10:00 - 11:00 AM	Wednesday	10:00 - 11:00 AM

5 Course Rationale

Computer Architecture is one of the fundamental courses for CSE students. It is concerned with all aspects of the design and organization of the CPU and integration of the CPU into the computer system itself. It aims to give students a theoretical idea about Computer Architecture and Design and familiarize them with digital logic and functional design of arithmetic and logic unit that is capable of performing arithmetic operations.

6 Course Description

Information representation; measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) operations: floating point operations, designing ALU; Processor design: data paths single cycle and multicycle implementations, control unit design - hardwired and micro-programmed, hazards, exceptions; Pipeline: pipelined data path and control, superscalar and dynamic pipelining; Memory organization: cache, virtual memory, channels; DMA and interrupts; Buses; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

7 Teaching Methods

Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, assignments, presentations and small group works.

8 Course Outcomes

CO	CO Description	PO	Domain (LoBT)	Weight	WK	WP	EA	Assessment Methods
CO1	Apply the core concepts of computer architecture to understand the design, organization and mechanism of modern processors, registers and memories.	PO1	Cognitive(C3)	50%	WK3	WP1		

CO2	Analyze various architectural concepts, including implementing different computational operations, parallel processing, pipelining and interprocessor communication.	PO2	Cognitive(C4)	30%	WK3	WP1		Please refer to Section 9.
CO3	Compare various appropriate paradigms for selecting robust, secure, efficient and sustainable computer architectures.	PO5	Psycomotor (P6)	20%	WK6	WP3, WP4	EA1	

Legend:

CO: *Course Outcome*
PO: *Program Outcome* (Appendix: A)
WK: *Knowledge Profile* (Appendix: B)
WP: *Complex Problem Solving* (Appendix: C)
EA: *Complex Engineering Activities* (Appendix: D)
LoBT: *Level of Bloom's Taxonomy* (Appendix: E)

9 Assessment Methods of COs

Assessment Method	CO1	CO2	CO3	Total
Class Tests	10%			10%
Midterm Exam	20%	10%		30%
Final Exam	20%	20%		40%
KSA Test 1			10%	10%
KSA Test 2			10%	10%
Total	50%	30%	20%	100%

10 Topic Outline

Lecture	Selected Topic	Article	Problems
(1)	Computer Abstractions and Technology.Basic structure of Computers: Functional Units, Operational Concepts	1.1 – 1.6 (Ref.)	1.1 – 1.10 (Ref.)
(2-3)	Registers, Shift Registers, Binary Counters, Memory Unit	2.4 – 2.7	2.6, 2.7, 2.12, 2.19 – 2.21
(4-5)	Register Transfer and Micro-operations, Arithmetic Logic Unit (ALU)	4.2 – 4.7	4.1, 4.2,4.5 – 4.21
(6-7)	Instruction Codes, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output Interrupt	5.1 – 5.7	5.1 – 5.8
(8-11)	Computer Arithmetic: Addition and Subtraction of Signed Numbers	10.1, 10.2	10.3 – 10.8, 10.11
(12-15)	Multiplication: Unsigned and Signed (Booth's) multiplication, Array Multiplier,Division: Restoring and non-restoring division	10.3 - 10.4,3.2-3.5(R)	10.12 – 10.15
(16-18)	Micro-programmed Control: Micro-program Example, Design of Control Unit	7.3, 7.4	7.22 – 7.24

(19-21)	Memory organization: Memory Hierarchy, Main Memory, Cache Memory, Virtual Memory.	12.1, 12.2, 12.5, 12.6	12.1 – 12.3, 12.21
(22-24)	Pipeline: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline.	9.1 – 9.4	9.1 – 9.5, 9.7
(25-27)	Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).	11.2 - 11.6 (T)8.4, 8.5 (R)	11.2, 11.9, 11.10, 11.12, 11.14, 11.22
(28-29)	Multiprocessors: Characteristics, Interconnection Structures, Multiprocessors connected by a Single Bus, Multiprocessors connected by a Network, Clusters.	13.1 - 13.29.3 - 9.5(R)	13.1, 13.3, 13.4, 13.5, 13.6, 13.8.
(30)	Recap.		

For the definitions of **T** and **R** , Please refer to Section 11.

11 Text and Reference Materials

T Textbook:

- *M. Morris Mano*, **Computer System Architecture**, 3rd Edition, Prentice Hall, 1993.

R References:

- *David A. Patterson & John L. Hennessy*, **Computer organization and design : the hardware / software interface**, 3rd Edition, Morgan Kaufmann, 2010.
- *John P. Hayes*, **Computer Architecture and Organization**, 3rd Edition, Tata McGraw-Hill, 2012.
- *William Stallings*, **Computer Organization and Architecture**, 6th Edition, Prentice Hall, 2002.

12 Grading Policy

Marks Obtained	Letter Grade	Numerical Evaluation	Definition
80% and above	A+	4.00	Excellent
75% <80%	A	3.75	Excellent
70% <75%	A-	3.50	Very Good
65% <70%	B+	3.25	Good
60% <65%	B	3.00	Good
55% <60%	B-	2.75	Good
50% <55%	C+	2.50	Average
45% <50%	C	2.25	Average
40% <45%	D	2.00	Below Average
below 40%	F	0.00	Failing

13 Additional Course Policies

1. **Equipment and Aids**: Bring your own materials such as a calculator, notebook, and pen to participate effectively in classroom activities. You are NOT allowed to borrow from others inside the classroom which may potentially create distractions for your classmates.

2. **Assignments**: There will be a number of assignments for formative assessment purposes. The average of the assignment marks will be used for computing the final grade. Late submission of homework will carry a zero mark.

3. **Class Tests**: There will be at least three Class Tests taken during the semester and the best two will be counted for final grading. A class test can be taken with/without prior announcement.

4. **Examinations**: The midterm and final examinations will be a closed book, closed notes. Mobile phones are strictly prohibited in the exam hall. Please bring your own watch (non-smart) and synchronize at the beginning of the examination.
5. **Test Policy**: In case of missing a test without prior notice to the respected faculty member, a zero mark will be given. No makeup tests will be taken as the best two test scores will be considered for grading out of three tests.
6. **Mobile Devices Policy**: Empirical evidence of using multitasking devices such as laptops and smartphones in the classroom hinders the learning experience. Thus, the use of multitasking devices is strictly discouraged. Switch off your laptop/mobile devices during class activities.

14 Additional Information

Please click or scan:

Academic Calendar Spring, 2024:

Academic Information and Policies:

Proctorial Rules:

Grading and Performance Evaluation:

Jarin Tasnim Tonvi
Course Coordinator, CSE 211
February 20, 2024

Dr. Muhammad Aminur Rahaman
Chairman, Department of CSE
February 20, 2024

Appendix A : Program Outcomes

POs	Category	Program Outcomes
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 the literature and analyze complex engineering problems and reach substantiated conclusions using first 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	Investigations	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 the 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.

Appendix B : Knowledge Profile

Knowledge Profile	Attribute
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline
WK2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
WK5	Knowledge that supports engineering design in a practice area
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
WK7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability

WK8	Engagement with selected knowledge in the research literature of the discipline

Appendix C : Range of Complex Engineering Problem Solving

Attribute	Identity	Complex Engineering Problem Description
Depth of knowledge required	WP1	Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	WP2	Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	WP3	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	WP4	Involve infrequently encountered issues
Extent of applicable codes	WP5	Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	WP6	Involve diverse groups of stakeholders with widely varying needs
Interdependence	WP7	Are high-level problems including many component parts or sub-problems

Note: Complex Engineering Problems have identity P1 and some or all of P2 to P7.

Appendix D : Range of Complex Engineering Activities

Attribute	Identity	Activity Description
Range of resources	EA1	Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
Level of interaction	EA2	Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues
Innovation	EA3	Involve creative use of engineering principles and researchbased knowledge in novel ways
Consequences for society and the environment	EA4	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
Familiarity	EA5	Can extend beyond previous experiences by applying principles-based approaches

Note: Complex activities means (engineering) activities or projects that have some or all of the above activities.

Appendix E : Domain and Level of Bloom's Taxonomy

Cognitive Domain		Psychomotor Domain		Affective Domain	
C1	Remembering	P1	Perception	A1	Receive
C2	Understanding	P2	Set	A2	Respond
C3	Applying	P3	Guided Response	A3	Value
C4	Analyzing	P4	Mechanism	A4	Organize
C5	Evaluating	P5	Complex Overt Response	A5	Internalize
C6	Creating/ Designing	P6	Adaption		
		P7	Origination		