Title (Units): **COMP2006 Computer Organization (3,3,1)**

Course Aims: To introduce the organization of digital computers, the different components and their basic principles and operations.

Prerequisite: Nil

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Describe various data representations and explain how arithmetic and logical operations are performed by computers
2	Describe organization of digital computers and explain the basic principles and operations of different components
3	Evaluate the performance of CPU, memory and I/O operations
	Professional Skill
4	Design a basic computer system using the major components
5	Write low-level programs to perform different basic instructions

Calendar Description: This course introduces the organization of digital computers, the different components and their basic principles and operations.

Teaching and Learning Activities (TLAs):

CILOs	Type of TLA
1 - 5	Students will attend lectures to learn the principles of computer organization. They will be given tutorial questions and participate in class discussion for in-depth learning.
1 - 5	Students will work on written assignments/lab exercises/in-class exercises/quizzes to consolidate and apply what they have learnt.
4 - 5	Students will acquire hands-on experience to design and develop programs via laboratory sections.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Continuous Assessment	30%	1 - 2	Continuous assessments in the forms of written assignments/in-class exercises/quizzes are designed to measure how well students have learned the fundamentals and major concepts of computer organization and architecture.
2	Laboratory work	10%	4, 5	Lab exercises which involve program development are designed to assess students' problem solving skills.
3	Examination	60%	1, 2, 3, 4, 5	Final examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess students' knowledge on computer components and their basic principles and operations.

Assessment Rubrics:

	Excellent (A)	Good (B)	Satisfactory (C)	Marginal Pass (D)	Fail (F)

Data representation and manipulation	• Demonstrates thorough knowledge and understanding of data representation • Has a high degree of correctness in basic arithmetic operations	• Demonstrates sufficient knowledge and understanding of data representation • Has a considerable degree of correctness in basic arithmetic operations	• Demonstrates moderate knowledge and understanding of data representation • Has a moderate degree of correctness in basic arithmetic operations	• Demonstrates some knowledge and understanding of data representation • Has some degree of correctness in basic arithmetic operations	• Demonstrates limited knowledge and understanding of data representation • Has a limited degree of correctness in basic arithmetic operations
Digital components	• Demonstrates thorough knowledge and understanding of the basic principles and operations of different digital components	• Demonstrates sufficient knowledge and understanding of the basic principles and operations of different digital components	• Demonstrates moderate knowledge and understanding of the basic principles and operations of different digital components	• Demonstrates some knowledge and understanding of the basic principles and operations of different digital components	• Demonstrates limited knowledge and understanding of the basic principles and operations of different digital components
Organization of digital computers	• Demonstrates thorough knowledge and understanding of key concepts of the organization of digital computers	• Demonstrates sufficient knowledge and understanding of key concepts of the organization of digital computers	• Demonstrates moderate knowledge and understanding of key concepts of the organization of digital computers	• Demonstrates some knowledge and understanding of key concepts of the organization of digital computers	• Demonstrates limited knowledge and understanding of key concepts of the organization of digital computers
CPU, memory, and I/O	• Demonstrates thorough knowledge and understanding of key concepts of CPU, memory, and I/O • Has a high degree of effectiveness and correctness in evaluating the performance of CPU, memory and I/O operations	• Demonstrates sufficient knowledge and understanding of key concepts of CPU, memory, and I/O • Has a considerable degree of effectiveness and correctness in evaluating the performance of CPU, memory and I/O operations	• Demonstrates moderate knowledge and understanding of key concepts of CPU, memory, and I/O • Has a moderate degree of effectiveness and correctness in evaluating the performance of CPU, memory and I/O operations	• Demonstrates some knowledge and understanding of key concepts of CPU, memory, and I/O • Has some degree of effectiveness and correctness in evaluating the performance of CPU, memory and I/O operations	• Demonstrates limited knowledge and understanding of key concepts of CPU, memory, and I/O • Has a limited degree of effectiveness and correctness in evaluating the performance of CPU, memory and I/O operations

Course Content and CILOs Mapping:

Content		CILO No.
I	Data Representation and Manipulation	1
II	Digital Component	2
III	Basic Computer Organization	3,4
IV	Overview of Programming	5
V	Instruction Sets	3, 5
VI	Central Processing Unit	2, 3, 4
VII	Memory Organization	2, 3, 4
VIII	Input/Output Organization	2, 3, 4

References:

- D. A. Patterson and J. L. Hennessy, Computer Organization and Design: The Hardware Software Interface: ARM Edition, 1st Edition, Morgan Kaufmann, 2016
  10th Edition, Prentice Hall, 2015
- W. Stallings, Computer Organization and Architecture: Designing for Performance, 10th Edition, Prentice Hall, 2015
- W. Stallings, Computer Organization and Architecture: Designing for Performance,

Course Content:

Topic

I. Data Representation and Manipulation
   A. Numeric data representation
   B. Non-numeric data representation
   C. Basic arithmetic operations

II. Digital Component
   A. Gates and multiplexors
   B. Arithmetic and logic unit
   C. Registers and main memory

III. Basic Computer Organization
   A. Stored program organization
   B. Timing and control
   C. Instruction cycle
   D. I/O and interrupt

IV. Overview of Programming
   A. Machine languages
   B. Assembly languages
   C. Assemblers, compilers, and interpreters

V. Instruction Sets
   A. Operations and operands
   B. Instruction representations
   C. Instructions for making decisions
   D. Procedures
   E. Addressing modes

VI. Central Processing Unit
   A. Datapath
   B. Overview of pipelining
   C. Data hazards
   D. Control hazards

VII. Memory Organization

A. Memory hierarchy
B. Internal memory
C. Cache memory
D. External memory

VIII. Input/Output Organization
A. Peripheral devices
B. I/O modules
C. Interrupt-driven I/O
D. Direct memory access
E. I/O channels and processors