LANDMARK UNIVERSITY, OMU-ARAN

COURSE COMPACT TEMPLATE

COLLEGE: College of Science & Engineering
DEPARTMENT: Electrical & Information Engineering
PROGRAMME: Electrical & Information Engineering

COURSE COMPACT for:

Course

Course code: EIE 411
Course title: COMPUTER ORGANIZATION & ARCHITECTURE
Credit unit: 3
Course status: Alpha Semester

Lecturer's Data

Name of the lecturer: ENGR A.B. ADEDAYO

Qualifications obtained: B. Eng, PGD CSc, PGDM, M.Tech , Reg COREN
Department: EIE
College: College of Science & Engineering
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Office Location: Engineering Lab Room A014

Consultation Hours: Tuesday 2-6pm & Friday 10 am- 2pm

Lecture Period:

INTRODUCTION TO THE COURSE

Course Description:

The course teaches the students the physical & internal composition, functioning integral components and internal structure of a beast called computer system. The teacher displays a "motherboard" in the lecture room as a total circuit that 'housed' the entire components. The computer comprises of Central Processing Unit (CPU) and other peripherals. Peripherals like Primary memory (RAM), secondary memory (Hard disk), printers, mouse, key board.
The Software in computer are broken into: Operating software, Application software and Utility software. Examples of each are given.

Course Justification:

The computer is a working tool for Electrical & Electronic Engineers, hence its detail technical and engineering knowledge will enhance the flow of project planning, design & implementation. Detail knowledge of hardware and software of computer will make the student a better engineer. There are series of computer system from different manufacturers. No manufacturer can lay claim to a "total computer", that is to say; different parts of computer come from different manufacturer for purposes of integration to make a functional whole. Analysis of internal structure of computer as laid on mother

board will boost their technical and engineering knowledge. Mode of operation of computer and its routine maintenance will be a common asset in their engineering career.

Course Objectives:

At the end of the course, the students should be able to:

1. Develop a thorough understanding of the origin of computer and historical evolutionary trends to today internet pad computer (i Pad)

2. The students will be able to describe and draw the block diagram of basic composition of a computer system and analyze its subsystems.

3. Give explanation on what constitute hardware and software of computer system

4. Give historical view of the two main computer architecture:
Von Neumann architecture comprises of 4,3,2,1 address machines and Zero-address machine that form the stack architecture.

5. Define computer architecture, Bus, Micro-computer and Micro-controller .

6. Give explanation on Registers and functions, mention offhandedly various types Register

7. The students must be able to critically analyze memories in computer systems: ROM, RAM, EPROM, EAPROM. The characteristics that constitute each of the memory.

8. Understand address format: op-code and operand. Storage procedure in microprocessors- fetch and execute cycles, interrupt and bus structures.

9. Understand SISC, RISC, PIPELINE & PARALLEL computer architecture' their common features and currencies.

10. Understand two basic computer processor programming: Hardwired control circuit an microprogramming.

11. The students must understand super scalar processor eg Motorola 1960IC and th latest from Intel family: Processor B 960

12. Give general over view of operating system eg widow based operating system (MS Window) and Network operating system (NOS)

13. Assemble a new brand of computer

14. The students should be thinking loud of how to design and produce any integral part of computer: power pack, RAM, micro-processor, mouse etc.

15. The students must be on a driving seat and get well cleared between BITS and BYTES.

Course Content:

EIE411 Computer Organization & Architecture (3 Units)

Computer Fundamentals: Development history of computer hardware and software. Hardwired vs stored program concept. Von-Neuman architecture. Havard architecture: principle of operation, advantages, disadvantages. Single address machine. Contemporary computers. Computer system: block diagram, functions, examples, dataflow, control line. Computer Arithmetic: integer arithmetic (addition, subtraction, multiplication, division), floating-point representation (IEEE), floating-point arithmetic. arithmetic and logic unit (ALU). Introduction to CISC and RISC architecture: principle of

operation, merits, demerits. Storage and Input/Output Systems: Computer function (fetch and execute cycles), interrupts, interconnection structures (Bus structure and bus types), Overview of memory system, memory chip organization and error correction, cache memory, memory storage devices. Overview of I/O, programmed and interrupt-driven I/Os, DMA, I/O channel and I/O processor. Control Unit: Micro-operations, control of the CPU, hardwired implementation, control unit operation, micro-instruction
sequencing and execution, micro-programmed control. Use INTEL family, and MOTOROLA family as case study of a CISC computer system. Instruction Set and Register: Machine instruction characteristics, types of operands and operations, instruction functions, addressing modes, instruction formats, register organization, instruction pipelining. High performance computer systems: Techniques to achieve high performance, pipelining, storage hierarchy, units with function dedicated for I/O. RISC, introduction to superscalar processor, parallel processor. Use popular RISC processor (e.g. i960, Motorola PowerPC) as case study.
Operating System: Overview of operating system, dimension and type of operating system, high level scheduling, short-term scheduling, I/O scheduling, memory management, virtual memory, UNIX/LINUX operating system: architecture, commands, programming; window based operating systems (MS windows, window XP).

Course Expectations:

S/N	GRADING	SCORE(%)
1.	Continuous Assessments • C.AI • C.AII (Mid-Semester Test) • C.AIII	 7% 15% 8%
2.	Final Examination	70%
3.	Total	100%

Course Delivery Strategies:

The method of lecture delivery and teaching aids are as Follows:

1. Lectures delivery with explanation using lecture notes, real life example and diagrams.

2. The use of the university's intranet, e-platform for quizzes, assignments, group discussion etc.

3. Giving off net assignments and class work.

4. Uploading the lecture materials on the e-leaning platform

5. Giving online assignments

6. Having practical discussion sections at the end of the lecture.

Course Duration: Monday 1-2pm & Tuesday 8 – 10 am [3hrs P/Week for 14 weeks (42hrs)]

LECTURE CONTENT

Break into module and modules into weeks, indicating objectives, description, study question and other information as posted below.

Module 1

- Week 1: Topic for the week
  - Development history of computer- Hardware/Software.
  - Detailed block diagram of generic computer systems

- Objectives (list the objectives)
  - 1. At the end of the lecture the students must be able define what is computer system.
  - 2. Explain detail part of hardware
  - 3. Explain the primary functions of a computer system: Takes input, processes, stores, and give output.
  - 4. Students should be able to draw off hand detail block diagram of a generic computer.

- Description

  First hour:

  Historical note on history of computer is given to students.

  Second hour

  Generic diagram of computer system is drawn for detail explanation.

- Study Question:
  - "What is permanent is change". Discuss the importance of Professor Chales Babbage in the evolution of computer system to a new design of Hybrid notebook called tablet computer.

- Reading List –
  - Computer Association of Nigeria conference series.
  - Computer concept, Introductory by June Dan Oja
  - Computer Architecture by John L Hennessy & David A. Patterson
  - Cloud Computing by Wang Ranjan & Chen Benarallah
  - My personal note book.

Module 2

Week II

Topic:

Definition of computer architecture, Bus, microcomputer and microcontrollers

Internal structure of a micro-processor consist of no of registers, memory cell, decoders, controllers and clocks

Von Neumann architecture and principle of operation

- Objectives:

1. At the end of the lecture the student should be able to define computer architecture, Bus
2. The students must be able to differentiate between micro-computer and micro-controller
3. The students are made to understand that the internal bus cable of computer runs parallel
4. The students must be able to differentiate between parallel and serial bus transmission

Description:
Computer architecture is again referred to explain busing in computer system. The teacher describes Micro-processor (µ-processor), Micro-computer (µ-computer) and micro-controller.
Von Neumann architecture and mode of operation is described for students.

- Study Questions:
  - The evolution of computer traversed through 3 generations:
    - ✓ 1st generation 1937- 1946
    - ✓ 2nd generation 1947- 1962
    - ✓ 3rd generation 1963- to date

Briefly discuss the developmental stages of this evolutionary trend.

  - Differentiate between Micro Processor and Macro-computer

Reading list:
1. Computer Association of Nigeria conference series.

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2. Computer concept, Introductory by June Dan Oja
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4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 3

Week III

Topic:

Instruction Codes: Operation codes (op-code) and operands
Micro-operation with micro-processor
Von Neumann architecture comprises of 4,3,2 ,1 address machines. Zero address machines that form the basis of stack machines.

- Objectives:

1. The students must understand that micro-operation on processor is broken into: operation codes(op-codes) and operands.
2. At the end of the lecture the students must be able to understand that computer architecture are broken into two: Neumann architecture & Stack architecture (zero- address machine)
3. 4-address machines, 3- address machines, 2-address machine & 1-address machine form the Neumann architecture.
4. The students are made to know that Zero-address machine form the : stack architecture

Description:

The lecturer describes op-code & operands as instruction format stored in the memory. Operand specifies the data or the location of the data in the memory or processor register. Op-code gives the address. The processor reads the instruction from the memory and interprets the op-code bits. The microprocessor issues a sequence of command functions (micro-operations) needed for the hardware implementation of the specified operation.

The lecturer describe Von Neumann architecture from 4-address machines, 3- 2-1- & 0-address machine(stack machine).

- Study Questions:

Write an assembly code using:

1.

(i) Three address instructions
(ii) Two address instructions
(iii) One address machines
(iv) Zero address
For X= (A+B) (C + D).

2. Evaluate the execution performance of the following expression in two computer systems with one accumulator and the other two accumulators:

A * (B+ C * (D – E) +F)

- Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 4

Week IV

Topic:

Registers and functional operations: Instruction Register (IR), Programme Counter (PC), Instruction Decoder (ID), Arithmetic & Logic Unit (ALU), Major State Register (MSR), Memory Cache, Flag Register (G)

Busing systems: we have Data bus, Address bus & Control bus.

Parallel and Serial transmission of signals

- Objectives:

1. At the end of the lecture, the student should be able to mention off hand, he various type of Registers that exist in computer systems.
2. Students should be to define a register and describe their functional behavior.
3. Students should be able to define what is bus system? And then mention the three types ever existing.

- Description

  The description of every register is given from lecture note to the students. The bus system in computer system is well discussed and its inter-working between modules as parallel bus is well narrated with practical computer ‘motherboard’

- Study Questions:

Quiz: What in a computer system can you compare to ‘Road network and human brain?

What do you understand by instruction format? Depicts a diagram for a memory (RAM) to show op-code & operand.

Discuss in detail, various classifications of different busing structures?

- Reading list:

1. Computer Association of Nigeria conference series.

2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 5

Week V

Topic:

WEEK 5

Memories in computer systems: ROM, RAM, EPROM, EAPROM. The characteristics of each memory.

- Objectives:

1. At the end of the lecture the students must be able to give acronyms of the above ICs.
2. Describes its mode of operation

- Description:

The lecturer describes in detail the character of each of the Integrated Circuits (ICs)

- Study Questions:

What do you understand by “size of a processor”?
A processor is 64/32 bits. What is the meaning of this statement?
Quiz: What can you compare to (i) Writing table in a computer (ii) Filling cabinet? (iii) Human brain? (iv) Road network?

- Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 6

Week VI

Topic:

Instruction handling area: Storage/retrieval procedures by microprocessor (CPU).

Objectives:

1. At the end of the lecture, the students must be able to understand how CPU translate the instructions it obtains from memory into signals that produce the desired action.

Description:

The lecture use a diagram to explain the steps the CPU will take to handle the ALU operations, for example with instruction: Add R1 and R2 and place the result in R3. The CPU instructions cycles is well explained with diagram.

Study Questions:

State the steps involved in the “CPU EXECUTION CYCLE” of a sequence of instructions.

Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 7

Week VII

Topic:

Operational function of CISC, RISC, PIPELINE computer & Parallel computing architecture.

Their common features and differences.

Objectives:

1. At the end of the lecture the students must be able to give full acronyms of RISC, CISC architecture.
2. The students must able to explain the operation of RISC, CISC, Pipeline and parallel computer architecture.
3. The students should be able to give the similarity and differences between RISC and CISC processor.

Description:

The diagram of Reduced Instruction Set computer (RISC), Complex Instruction Set Computer (CISC), pipeline computer and parallel computing systems are displayed for better understanding.

Study Questions:

1. Outline the various important features of RISCs and CISCs architecture?
2. State the procedure involved for an instruction to be executed in a pipeline computer system?

Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 8

Week VIII

Topic:

Two control methods by processors- Hard-wired control and micro-programming

- Objectives:

1. At the end of the lecture, the students should be well informed and be able to explain the two methods by which processor generate control signals to initiate and execute micro-codes for sequence of operation in computer systems: (i) Hard-wired control (ii) Micro-program control (software)
2. The students should be able to draw both diagrams off hand in order to complement their understanding.
3. The students should be able to give advantages of micro-programing over hard-wired control.

- Description:

The lecturer displays the diagram of hard-wired control and micro-programming for easy description and referencing.

- Study Questions:

1. (a) Write short note on drawback of micro-processor using Hard-wired control.
   (b) As a Computer Engineer, why will you prefer software control to hardwired control?
   (c) As a hardware Engineer, discuss this statement " A computer system is more than just the software"

- Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 9
6. Week IX
Topic:

1. Various types of Interconnection methods in CPU: Point-to-Point (PP), Common Bus System (CBS), Multiple Bus System (MBS) and Two-Bus Systems (TBS)

- Objectives:
  - At the end of the lecture, the students should be able to draw the diagrams off hand and give detail description of interconnection methods in µ-processor (CPU)
  - Give the advantages and disadvantages of each connection methods.

- Description:

Each diagram of connection method is displayed for easy description and explanation.

Study Questions:

What do consider as the vulnerability of common bus system (CBS)?

- Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 10
Week X
Topic:

Synchronous and Asynchronous micro-processor

What is VLSI

Effect of VLSI

Problems of VLSI and the solution.

- Objective:

1. At the end of the lecture the students should be able to define Synchronous and Asynchronous µ-processor.
2. The students should be able to give the acronym of VSLI and describe it.

Description:

The lecturer defines Asynchronous & Synchronous processor. Very Large Scale Integration (VLSI) is well described. The first set of computer invented made use of vacuum tubes. The tubes were interconnected to create gates, flip-flops, registers and arithmetic units with each tube acting as a

switch. The vacuum tube were later replaced by transistors and cpu became relatively smaller. Printed circuit boards were invented so that instead of using wire to inter-connect transistor, connection are marked out on the metal printing on flat boards and transistor simply soldered into place on the boards to make the required connections. The development progresses to Medium Scale Integration (MSI) and Large Scale Integration (LSI).

- Study Questions:

Differentiate between Synchronous and Asynchronous processor. State the "execution cycle" of a Synchronous-processor to fetch information from RAM?

- Reading lists:

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 11
Week XI
Topic:

Flynn's Classical taxonomy: Classification of parallel computers

SISD Single Instruction, Single Data	SIMD Single Instruction Multiple Data
MISD Multiple Instruction, Single Data	MIMD Multiple Instruction, Multiple Data

- Objectives:

1. At the end of the lecture the students must be able to classify parallel computer according to Flynn.
2. Write Assembly instruction language for each of the classification.

- Description:

2nd Hr: There are different ways to classify parallel computers. One of the more widely used classifications, in use since 1966, is called Flynn's taxonomy. Flynn;s taxonomy distinguishes multi-processor computer architecture according how they can be classified along the two independent dimensions of instruction and data. Each of these dimensions can have only one of two possible states: Single or multiple. The matrix above defines the 4 possible classifications according to Flyn.

- Study Questions:

What do you understand by Von Neumann architecture?

Describe the four possible classifications according to Flynn?

- Reading list

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 12
Week XII
Topic:

Super scalar processors (Super scalar CPU)

Objectives:

At the end the lecture, the students should be able to discuss revolutionary trend of processors. Processors ranges from Medium scale to Very large scale Integration, that is from micro-processor to macro-processor that gave rise to super-computer.

The students should be able to acknowledge the existence of :8086, 80186,80286, 80386, 80486

They should be able to familiar with other new processors with high speed: Intel B960 and i7 quad-Core processor.

Description:

The lecturer describes each of this processor in terms of no of connections pins, address pins, clock speed (Oscillator). To write into memory, the CPU first places the address of the desired memory on the AD pins (Address pins). The better speed of a processor at which the instruction is fetched from the memory made it superior to other existing processors.

Study Question:

1. Macro-processor of today is a micro-processor of tomorrow. Discuss
2. Differentiate between µ-processor and µ-computer.

- Reading list

1. Computer Association of Nigeria conference series.

2. Computer concept, Introductory by June Dan Oja

3. Computer Architecture by John L Hennessy & David A. Patterson

4.Cloud Computing by Wang Ranjan & Chen Benarallah

5.My personal note book.

Module 13
Week XIII
Topic:

General overview of software and operating systems
Window operating system
Unix operating system
Cloud computing

Objectives:

1. At the end of lecture, the students must be able to define software and classify them: operating system, Application program and Utility software.
2. Students must be give example of each of the software
3. The students must be able to differentiate between window based operating system and unix operating system.

4. The students must able to explain what is meant by Cloud Computing.

Description.

The lecturer describes software as interactive set of codes that drive the hardware. The software is classified into operating system, Application and Utility software.

Cloud computing are described as a giant network that connect other network. The lecturer displays cloud computing network diagram for easy referencing.

Study Questions:

A system is said to be single-tasking or multi-tasking. What is the meaning of this statement?

- Reading list

1. Computer Association of Nigeria conference series.
2. Computer concept, Introductory by June Dan Oja
3. Computer Architecture by John L Hennessy & David A. Patterson
4. Cloud Computing by Wang Ranjan & Chen Benarallah
5. My personal note book.

Module 14
Week XIV
Topic:

Practical discussion class

Objectives:

The lecturer and teacher interact on grey areas of studies

Module 15
Week XV
Topic:

Revision

Objectives:

The lecturer touches all areas of interest for the purpose of end of Alpha semester.

TOPICS FOR TERM PAPER/ASSIGNMENT

"What is permanent is change"

Discuss the importance of the work of Professor Chales Babbage in the evolution of

Computer system to a new of Hybrid-note-book called Tablet computer.

HOD's COMMENTS: _____

_____

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Name: _____ Signature _____ Date: _____