

PUNJAB COLLEGE OF TECHNICAL EDUCATION**COURSE – PLAN (Jul 09 – Dec 09)**

SUBJECT:	Computer System Architecture
CODE:	BC – 301 (N2)
CLASS:	BCA – 3 rd Sem
TEACHERS:	Mrs. Maninder Kaur (MN) Mr. Harinder Pal Singh (HPS)

Course Description:

This course is an introduction to computer architecture. In this class, we will focus on microprocessor design, including CPU and memory, the interface between hardware and software, and an introduction to multiprocessors.

More specifically, we will cover the following topics:

- Computer Organization & Design
- Instruction Set Architecture
- Timing & Control Unit
- Stack Organization
- Control Unit Architecture
- I/O Architecture
- Memory Hierarchy
- Introductory Study of 8-bit Microprocessor

Course Goals:

The goal of this course is for you to develop an understanding of the factors influencing modern microprocessor and parallel processor designs, and a working knowledge of the specific choices made in some current designs. You will also gain an understanding of mechanisms employed in a general purpose microprocessors, such as instruction set architecture, timing and control unit, I/O architecture and memory hierarchy. By the end of the course you should be able to read between the lines of a newly-announced architectural specification and anticipate its impact on software, to take architectural considerations into account when optimizing software performance, and to make well-reasoned choices among different architectures for specific application scenarios.

The objective of this course is to:

- Understand processor design concepts in modern computer architecture.
- Understand and evaluate constraints and tradeoffs in microprocessor design.
- Enable you to design and build a mini computer.

Scope and Opportunities:

This course offers an opportunity to be at the forefront of the emergent practice of digital architecture. The graduates of this course can be absorbed in the mainstream Architecture or many related fields like Architectural Visualization, Building Management Systems, Software Development, etc.

Grading:

Assignments:	12.5%
Tests:	25%
Presentation:	12.5%
MSEs:	37.5%
Attendance:	12.5%

Rules for Assignments:

Purpose:

The assignments will primarily be practice problems for the exams. Thus, you should not collaborate on it with others by splitting the work and sharing answers. You will gain the most benefit from doing it by yourself. You can, of course, ask me for help. If someone in the class asks you for help on assignments, handle the situation as if you are a course instructor. Don't just give them an answer, but make sure they know how to find the answer on their own. *If I feel that people have submitted answers that are merely copies of each other, I will grade the one solution and divide the credit for it equally among the copies.*

Due Date:

As indicated in the course break-up below.

Late Policy:

You must do your work on time because we'll be correcting/discussing it in class. *No assignment will be accepted after the due date.* If you know that you have a specific

time conflict, make arrangements with me in advance for a separate assignment for late submission.

Format:

All assignments should be done according to the following format:

- Assignment must have a cover page including *title of assignment, subject, date of submission, students name, class, roll no.* and *submitted to*.
- For a sample of cover page, visit my website <http://www.eazynotes.com>.
- Use loose sheets with one side plain and other side lined.
- Write questions/headings with black pen and other text with blue pen.
- Draw diagrams (if necessary), neat and clean with pencil on plain side of paper.
- Pages should be numbered.
- Mention *Contents* at the beginning and *References* at the end of each assignment.

Tests:

Tests can be oral/written/open book. Open book test is so that you can look up formulas or data from the text or lecture notes. You need to be sufficiently familiar with the material in the book to know where to look up the information that you need. The purpose of the exams is for you to demonstrate that you have attained an operational level of understanding of the material.

The tests will be conducted on the dates mentioned in the course break-up. No extra test will be conducted for the absentees. If you have any time conflict for the test, contact me in advance so that we can make sufficient arrangements. Keep in mind that there will be no improvement test at the end of the semester. Therefore, its your responsibility to give test on time.

Presentation:

One presentation will be held for computer system architecture. You will be informed well in advance. The rules for presentation are as follows:

- Group will be of 3-4 students.
- Students can make groups of their choice.

- Students should be in strict formal for the presentation.
- Three attendances will be taken during presentation. One at sharp 9:00 am, second after lunch break, and third at the end of the presentation.
- **Present** will be counted only for those students who'll be present in all the three attendances.
- Marks will be given only to the present students.
- If the student is absent, I will deduct (– 10) marks for it.
- Marks will be deducted for each misbehavior/indiscipline during the presentation.
- Topics will be given at first-cum-first-get basis. No topic will be repeated.
- Marks for the presentation are distributed as follows:

Dress:	10 marks
Report:	10 marks
Synopsis:	5 marks
Content:	5 marks
Slides:	5 marks
Confidence:	5 marks
Query Handling:	10 marks
Total:	50 marks
Absent	– 10 marks
Indiscipline:	– 1 marks (for each misbehavior)

Class Participation:

A large component of your learning takes place in class. The actual concepts of computer architecture are fairly simple, although their implementation is often complicated by real-world constraints. Thus, I tend to give lectures to explain these concepts, and pose questions for discussion that are meant to draw out these implications. I will guide discussion, and add information here and there as necessary to carry the discussion forward or to lead it into a digression that adds depth in a different direction.

I will frequently have in-class exercises that you will do as individual/groups. Thus, it is very important that you attend class regularly. I will keep attendance throughout the semester. Please let me know in advance of any scheduled absences.

It is very important that we focus our attention during the limited time we have together. Each of us comes to the classroom distracted by thoughts from outside. Thus, each day we will take about two minutes at the beginning with a brief mind-clearing exercise, followed by a focusing exercise. During the mind-clearing exercise we will sit in silence and concentrate on our breathing. Because it is important that we not be distracted while doing these exercises, I will close the door promptly at the starting time for class. If you arrive late and the door is already closed, please wait outside until I reopen it and invite you in. I will record late arrivals on the day's attendance; three late arrivals equals one absence.

Classroom Policies:

Following are the classroom policies and they are meant to be strictly followed:

- Be punctual for the class, try to minimize your disturbance if you are late. I may reject students who come after 15 minutes from the scheduled time.
- Student coming late will be considered as *late arrival* and I will record late arrivals on the day's attendance.
- Three late arrivals equals to one absent.
- Mobile phones are not allowed in the classroom. If any student found using the mobile phone, he/she has to pay Rs. 200 as fine in the account office.
- During lecture delivery, if you have any kind of query, just raise your hand. Queries are important for the understanding of the concepts. So, do ask queries but make sure they are relevant to the subject.
- Be disciplined in the classroom and don't make any noise while we are studying.

SYLLABUS

COMPUTER SYSTEM ARCHITECTURE

BC – 301 (N2)

Internal Assessment: 40

Max. Marks: 100

External Assessment: 60

Instructions for paper setter

The question paper will consist of two sections A and B. Sections B will have Six questions and will carry 10 marks each. Section A will have 10 short answer type questions, which will cover the entire syllabus uniformly and will carry 20 marks in all.

Instructions for Candidates

Candidates are required to attempt four questions from section B and the entire section A. Use of nonprogrammable scientific calculator is allowed.

Computer Organization & Design: Instruction codes, op-codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instructions, CPU: Stack Organization, Instruction format, Addressing Formats.

Control Unit Architecture, I/O Architecture: Transfer of Information among I/O devices, CPU, Memory and I/O ports.

Memory System, Storage technologies, Memory hierarchy, Memory mapping, Main memory and Auxiliary memory, Associative and Cache memory.

Introductory study of 8-bit Microprocessor

COURSE BREAK-UP

Subject:	Computer System Architecture	Code:	BC – 301 (N2)
Class:	BCA	Semester:	III
No. of Lect.:	51	No. of Assignments:	3
		No. of Tests:	3
Teachers:	Mrs. Maninder Kaur (MN)		
	Mr. Harinder Pal Singh (HPS)		

Proposed Week	Lect. No.	Lect. Content	Assignment	Test	Actual Date of Delivery
1	1.	Introduction to Course Plan			
	2.	Introduction to Computer Architecture			
	3.	Computer Organization & Design: Instruction Codes, Opcodes			
	4.	Computer Registers			
2	5.	Common Bus System			
	6.	Computer Instructions	DOA: Assign-1		
	7.	Timing and Control Unit			
	8.	Instruction Cycle			
3	9.				
	10.	Register Reference Instructions	DOS: Assign-1		
	11.	Memory Reference Instructions			
	12.	Introduction to CPU			
4	13.	General Register Organization			
	14.	Class Discussion			
	15.			Test-1	
	16.	Stack Organization			
5	17.				
	18.	Instruction Formats	DOA: Assign-2		
	19.	Addressing Formats			
	20.	Control Unit Architecture			
6	21.	I/O Architecture			
	22.				
	23.	I/O Interface	DOS: Assign-2		

	24.	Transfer of Information among I/O Devices, CPU, Memory and I/O Ports			
7	25.				
	26.	Direct Memory Access (DMA)			
	27.	DMA Transfer			
	28.	Class Discussion			
8	29.			Test-2	
	30.	Input Output Processors			
	31.	Computer Interrupts, Interrupt Cycle			
	32.	RISC / CISC			
9	33.	Introduction to Memory			
	34.	Memory Hierarchy			
	35.	Main Memory: RAM and ROM	DOA: Assign-3		
	36.	RAM and ROM Chips			
10	37.	Auxiliary Memory			
	38.	Associative Memory: Hardware Organization, Match Logic			
	39.	Virtual Memory			
	40.	Page Replacement Policies	DOS: Assign-3		
11	41.	Cache Memory			
	42.	Cache Mapping: Associative Mapping			
	43.	Direct Mapping, Set Associative Mapping			
	44.	Cache Writing Policies			
12	45.	Class Discussion			
	46.			Test-3	
	47.	Introduction to 8-bit Microprocessor			
	48.	Architecture of 8085			
13	49.	Pin Configuration of 8085			
	50.	Discussion of Previous Question Papers			
	51.	Discussion of Previous Question Papers			

*DOA: Date of Announcement

*DOS: Date of Submission

Textbooks and Resources:

- Computer System Architecture
 - Author: Morris Mano
 - Publisher: Tata McGraw Hill
- Computer Organization & Architecture
 - Author: William Stallings
 - Publisher: Pearson Education
- Computer Architecture & Organization
 - Author: John P. Hayes
 - Publisher: McGraw Hill
- Computer Organization & Design : The Hardware / Software Interface
 - Authors: John L. Hennesy & David A. Patterson
 - Publisher: Morgan Kaufmann
- Computer System Organization & Architecture
 - Authors: Sandeep Sood, Vaishali Sood
 - Publisher: AP Publishers
- Other handouts will be provided throughout the semester

ASSIGNMENT – 1

1. Short answer type questions:

- a. What is difference between a direct and indirect address instruction?
- b. Differentiate between Hardwired Control and Micro Programmed Control Unit?
- c. What is the difference between micro operation and micro instruction?
- d. What does 8-bit signify in 8-bit microprocessor?
- e. Define bit, byte & word.

2. Long answer type questions:

- a. Which are the various Computer Registers used in Common Bus System? Explain with the help of a suitable diagram.
- b. Draw and explain the design of Control Unit.

ASSIGNMENT – II

1. Short answer type questions:

- a. Explain the meaning of memory-reference instruction ADD to AC.
- b. Explain zero address instruction with an example.
- c. What is stack? Where it is used in CPU?
- d. Express the following expression in reverse polish notation:

$$A * B + C * D$$

2. Long answer type questions:

- a. What are Addressing Modes? Explain all the Addressing Modes along with an example of each.
- b. Illustrate the influence of a number of addresses on computer programs by evaluating the following statement using zero, one, two and three address instructions:

$$X = (A + B) * (C + D)$$

- c. Explain in detail instruction cycle of basic computer.

ASSIGNMENT – III

1. Short answer type questions:

- a. Differentiate between maskable and non-maskable interrupts.
- b. Draw the block diagram of RAM and ROM chip.
- c. What is the difference between Memory Mapped I/O and Isolated I/O?
- d. Define access time of magnetic disk.
- e. Define 'Hit Ratio' and 'Locality of Reference'.

2. Long answer type questions:

- a. Discuss in detail the different types of mapping procedures used in organization of the cache memory.
- b. Explain the various I/O data transfer techniques. Discuss their advantages and disadvantages.
- c. Explain Memory Hierarchy with the help of a diagram.

TOPICS FOR PRESENTATION

1. Parallel Processing.
2. Hardwired and Micro-programmed Control Unit
3. Memory Mapping.
4. MUX & DEMUX.
5. Memory Hierarchy.
6. Compare CD vs DVD.
7. Instruction Formats.
8. I/O Channels.
9. Memory Stack.
10. Memory Protection.
11. Interrupts.
12. Page Replacement Algorithms.
13. RISC vs CISC.
14. Shift Micro-operations.
15. Instruction Cycle.
16. Data Manipulation Instructions.
17. Von-Neuman Architecture
18. Asynchronous Data Transfer.
19. Strobe vs Handshaking.
20. Modes of Communication.
21. Instruction Codes & Direct / Indirect Address
22. Computer Registers
23. Common Bus System
24. Types of Instructions
25. Timing and Control Unit
26. Encoder and Decoder
27. Memory Reference Instructions
28. How Mobiles Work
29. How Bluetooth Works
30. How Wi-Fi Works
31. How Keyboard Works
32. How Mouse Works