PUNJAB COLLEGE OF TECHNICAL EDUCATION

COURSE – PLAN (Jul 10 – Dec 10)

SUBJECT:	Introduction to Microprocessor
CODE:	BC – 305 (N2)
CLASS:	BCA – 3rd Sem
SECTION:	C, D
TEACHER:	Gursharan Singh (GS)

Course Description:

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

More specifically, we will cover the following topics:

- Introduction to Microprocessor
- Architecture and Operations of Intel 8085
- Architecture and Operations of Intel 8086
- Various types of Instructions
- Clock Generator 8284
- Interrupt Controller 8257
- DMA Controller 8237
- Arithmetic Coprocessor 8087

Prerequisites:

Students should have basic knowledge of following topics for the better understanding of concepts of microprocessor:

- Binary and Hexadecimal Number Systems
- Logic Gates, Boolean Algebra
- Sequential Digital Circuits and Design
- Combinational Digital Circuits and Design

Course Goals:

The goal of this course is for you to learn microprocessors systems, their organization and architecture, develop an understanding of programming techniques, program debug and programming languages. The course includes topics on CPU internal architecture, instruction set, CPU timing, and machine and instruction cycles. Decoding memory addresses or I/O port addresses.

The objective of this course is to:

- Students should be able to describe the architecture and organization of a microprocessor.
- Students should be able to write structured, well-commented, understandable programs in assembly language.
- Students should possess the skills to test and debug microprocessor programs in the laboratory.
- Students should understand techniques for interfacing I/O devices to the microprocessor, including several specific standard I/O devices.
- Students should understand the hardware/software tradeoffs involved in the design of microprocessor-based systems.
- Understand processor design concepts in modern computer architecture.
- 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 modern microprocessor architecture. The graduates of this course can be absorbed in the mainstream of Microcontroller Programming or many related fields like Architectural Visualization, Building Management Systems, Software Development, etc.

Grading:

MSE:	15 marks
1st One Hourly Test:	5 marks
2nd One Hourly Test:	5 marks
Presentation:	5 marks
Class Tests:	5 marks

Assignments:	5 marks
Total:	**40 marks**

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, it's your responsibility to give test on time.

Presentation:

One presentation will be held for microprocessor. 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 formals 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
Content:	10 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 microprocessor 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.

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

INTRODUCTION TO MICROPROCESSOR

BC – 305 (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.

Introduction to Microprocessor, its historical background and its applications.

Intel 8085

Introduction, Microprocessor Architecture and its operations, 8085 MPU and its architecture,8085 instruction cycle, 8085 Instructions: Data Transfer instructions, Arithmetic instructions, logical instructions, Branch instructions, RISC v/s CISC processors.

Intel 8086

Introduction, 8086 Architecture, real and protected mode memory addressing, Memory Paging, Addressing Modes.

Various types of instructions: Data movement, Arithmetic and logic; and program control. Type of instructions, Pin diagram of 8086, clock generator (8284A).

Interrupts:

Introduction, 8257 Interrupt controller, basic DMA operation and 8237 DMA Controller, Arithmetic coprocessor, 80X87 Architecture.

COURSE BREAK-UP

Subject: Introduction to Microprocessor **Code:** BC – 305 (N2)

Class: BCA **Semester:** III

No. of Lect.: 55 **No. of Assignments:** 3

No. of Tests: 3

Teachers: Mr. Gursharan Singh (GS)

Proposed Week	Lect. No.	Lect. Content	Assignments	Tests	Actual Date of Delivery
1	1.	Introduction to Course Plan			
	2.	Introduction to Microprocessor			
	3.	Historical Background of Microprocessor			
	4.	Microprocessor Applications			
2	5.	Introduction to Intel 8085			
	6.	Architecture of 8085			
	7.				
	8.	Pin Diagram of 8085			
3	9.		Assign-1		
	10.	Interrupts and Flags of 8085			
	11.	Instruction Cycle			
	12.	Fetch and Execution Cycle			
4	13.	Timing Diagrams of Memory Read/Write Operations			
	14.	**Tutorial**			
	15.			Test-1	
	16.	Instruction Set of 8085			
5	17.	Addressing Modes			
	18.	Data Transfer Instructions			
	19.	Arithmetic Instructions			
	20.	Logical Instructions			
6	21.	Branch Instructions			
	22.				
	23.	Control Instructions			
	24.	RISC vs. CISC	Assign-2		

7	25.	**Tutorial**			
	26.	Introduction to Intel 8086			
	27.	Architecture of 8086			
	28.				
8	29.	Pin Diagram of 8086			
	30.				
	31.	Real and Protected Mode			
	32.	Addressing Modes			
9	33.	Memory Paging			
	34.	**Tutorial**			
	35.			Test-2	
	36.	Instruction Set of 8086			
10	37.	Data Transfer Instructions			
	38.	Arithmetic Instructions			
	39.	Logical Instructions			
	40.	Branch Instructions			
11	41.	Control Instructions			
	42.	Clock Generator 8284			
	43.	Interfacing 8284 with 8086	Assign-3		
	44.	8259 Interrupt Controller			
12	45.				
	46.	DMA Operations			
	47.	8257 DMA Controller			
	48.				
13	49.	**Tutorial**			
	50.			Test-3	
	51.	Introduction to 8087 Coprocessor			
	52.	Architecture of 8087			
14	53.	Instruction Set of 8087			
	54.	Discussion of Previous Question Papers			
	55.	Discussion of Previous Question Papers			

Textbooks and Resources:

- Fundamentals of Microprocessors
  - Author: B. Ram
  - Publisher: Dhanpat Rai Publication
- The Intel Microprocessors
  - Author: B. Brey
  - Publisher: Prentice Hall of India
- Microprocessor Architecture, Programming and Applications with 8085
  - Author: Ramesh S. Gaonkar
  - Publisher: Penram International Publishing
- Other handouts will be provided throughout the semester

ASSIGNMENT – 1

1. **Short answer type question:**
   - **a.** Why is Data Bus bidirectional?
   - **b.** Why Accumulator is called Special Register?
   - **c.** Why Demultiplexing of AD_0 - AD_7 lines are required?
   - **d.** How many data lines are necessary in 16-bit microprocessor & what is the magnitude of the largest number that can be placed on its data bus?
   - **e.** Define bit, byte & word.
2. **Long answer type questions:**
   - **a.** Draw & explain the functional Block Diagram of 8085.
   - **b.** Discuss the chronological development of Microprocessor.

     (or)

     Explain the history of Microprocessor.
   - **c.** Draw the Pin Diagram of 8085 Microprocessor.

ASSIGNMENT – II

1. **Short answer type questions:**
   - **a.** Registers of 8085 Processor contain the following data:-

     A = 01011011, B = 10101011, H = 01000000, L = 00100000

     What will be the contents of Register A & Register B after execution of the following instructions:

     XRA B

     RAL

     ADD L

     ANA B
   - **b.** What will be the status of Carry Flag after executing CMP L Instruction?
   - **c.** What will be the contents of PC after the execution of RST 6 Instruction?
   - **d.** Write three different methods to clear Accumulator.
   - **e.** Calculate the time required to execute the following two instructions if the system clock frequency is 750 KHz:

     MOV C, B (5 T-States)

     JMP 2050 H (10 T-States)

2. **Long answer type questions:**
    - **a.** List 4 categories of 8085 instructions that manipulate data.
    - **b.** A block of data is stored in memory location from DE55 H to DE5A H. Write a program to transfer the data to the memory locations EF20 H to EF25 H in the reverse order.
    - **c.** Illustrate the timing of data flow when the instruction code 4F H (MOV C, A) stored in location C45A H is being fetched.

ASSIGNMENT – III

1. **Short answer type questions:**
    - **a.** How do you calculate the Physical Address of 8086?
    - **b.** What is Word Size of 8086 microprocessor? Which bus decides the Word Length of a Microprocessor?
    - **c.** What is the function of Segment Register in 8086?
    - **d.** In 8086, give the sum & flag settings for AF, SF, ZF, CF, DF and PF after hexadecimally adding 62A0 H to each of the following:
        - **i.** 1234 H
        - **ii.** 4321 H
        - **iii.** CFA0 H
        - **iv.** 9D60 H
        - **v.** EA04 H
    - **e.** What are conditional and control flags in 8086?
2. **Long answer type questions:**
    - **a.** Explain the Addressing Modes of 8086.
    - **b.** Draw the Block Diagram of 8284 Clock Generator. Discuss its main features.
    - **c.** What is Real & Protected Mode Memory Addressing?
    - **d.** What are the broad classes of instruction set of 8086? Illustrate them with the help of examples.

PROGRAMS

Using 8085 microprocessor kit, do the following programs:

Complement:

1. Program to Find 1's Complement of 8-bit Number.
2. Program to Find 2's Complement of 8-bit Number.
3. Program to Find 1's Complement of 16-bit Number.
4. Program to Find 2's Complement of 16-bit Number.

Addition:

1. Program to Add Two 8-bit Numbers Without Carry.
2. Program to Add Two 8-bit Numbers With Carry.
3. Program to Add Two 16-bit Numbers Without Carry.
4. Program to Add Two 16-bit Numbers With Carry.
5. Program to Add Two 8-bit Numbers and Show Result in Decimal.

Subtraction:

1. Program to Subtract Two 8-bit Numbers Without Borrow.
2. Program to Subtract Two 8-bit Numbers With Borrow.
3. Program to Subtract Two 16-bit Numbers Without Borrow.
4. Program to Subtract Two 16-bit Numbers With Borrow.

Shift Operation:

1. Program to Shift Left 8-bit Number by 1 Bit.
2. Program to Shift Left 8-bit Number by 2 Bits.
3. Program to Shift Right 8-bit Number by 1 Bit.
4. Program to Shift Right 8-bit Number by 2 Bits.

Miscellaneous:

1. Program to Divide a Byte into Two Nibbles.
2. Program to Find Largest of Two 8-bit Numbers.
3. Program to Find Smallest of Two 8-bit Numbers.
4. Program to Find Largest from a Series of N Numbers.
5. Program to Find Sum of Series of 8-bit Numbers

PRESENTATION TOPICS

1. Evolution of Microprocessor
2. Applications of Microprocessor
3. Block Diagram of Intel 8085
4. Pin Diagram of Intel 8085
5. Interrupts of Intel 8085
6. Instruction Cycle
7. Timing Diagram of Memory Read/Write
8. Timing Diagram of I/O Read/Write
9. Addressing Modes of Intel 8085
10. Data Transfer Instructions of 8085
11. Arithmetic Instructions of 8085
12. Logical Instructions of 8085
13. Branch Instructions of 8085
14. Control Instructions of 8085
15. RISC vs. CISC
16. Block Diagram of Intel 8086
17. Pin Diagram of Intel 8086
18. Addressing Modes of Intel 8086
19. Configuration of Intel 8086
20. Interrupts of Intel 8086
21. Pin Diagram of 8284
22. Block Diagram of 8284
23. Connection of 8284 with 8086
24. DMA Controller
25. System Bus of Intel 8085
    a. Address Bus
    b. Data Bus