Course Code: CSE 231 & 232 **Credits**: 1+2
Course Title: Microprocessor and Assembly Language + Lab **CIE Marks**: 60
SEE Marks: 40

Course Description (from syllabus)/Rational:

Microprocessors and assembly language have been the most used methods of incorporating intelligence into automated devices. It is therefore necessary to develop a good understanding of their operation and how they can be used as building blocks for automated systems and control applications. This course explores the inner workings of a microprocessor from the programmer's perspective and several laboratory exercises will be based on microprocessor utilizing the assembly language.

Course Objective

The goal is to enrich the students' regarding the following.

- To learn about the internal architecture and addressing modes of Intel 8086 Microprocessor and analyse the comparison between several microprocessor of the same thread.
- To apply the arithmetic and logical operations using assembly language based instructions for Intel 8086 microprocessor.
- To apply branching and looping structures for solving computational problems using assembly instructions in simulation based software.
- To learn and analyse the theoretical and practical implications of memory access in microprocessor.

Course Learning Outcome: (at the end of the course, student will be able to do :)

CLO1	Demonstrate the internal architecture and its general operations of microprocessors and describe the difference between the 8086 and advanced microprocessors.
CLO2	Classify and articulate the addressing modes and memory access methods within the microprocessor.
CLO3	Apply the instruction set of Intel 8086 microprocessor and distinguish the use of different arithmetic, logical, shifting, rotating instructions to apply in assembly language programming.
CLO4	Design and analyze assembly programming code to use the branching structures, looping structures flags, stacks, procedures, macros, and interrupts.

Mapping of Course Learning Outcomes to Program Learning Outcomes [attainment level used for COs from 1(weak)-3(strong) correlation]

PLO's **CLO's**	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO10**	**PLO11**	**PLO12**
CLO1	3											
CLO2	2	3										
CLO3		3	2		3							
CLO4				3	3							

Teaching and Learning Activities (TLA)

TLA1	Interactive discussion using online tools/multimedia twice a week on different topics.
TLA2	Active discussion in class regarding efficient solving of the logical and mathematical problems.
TLA3	Group discussion and presentation regarding diverse problems and corresponding lectures.
TLA4	Evaluation of class performances to reach each student in a class for every topic.

Course Delivery Plan (include Lab)

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite**	**Mapping with CLO**
Week 1 Lesson 1 (1.5 hrs)	Discussion on Course Rationales, Objectives, Outcomes, Syllabus, Books etc. -History and evolution of microprocessor, The components of a Microcomputer System. (Ref. Text: Ytha Yu: Ch. 1, Page-3-7)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1**	CLO1

	Instruction Execution, Programming Languages, Assembly Language Programs, Number Systems (Ref. Text: Ytha Yu: Ch. 1, 2, Page-9-11, 19-36)		
Week 1 Lab Session 1 (3.0)	**Lab 01:** Introduction to Assembly Language Programming Environment	**Lab 01:** Introduction to Assembly Language Tools and Familiarization with Emu8086 environment, Learn to install EMU 8086 and execute sample assembly program.	CLO1
Week 2 Lesson 2 (1.5 hrs)	Internal Architecture of the 8086/8088 Microprocessors, Data Registers, Segment Registers (Ref. Text: Ytha Yu: Ch. 1, 3 Page-8-9, 37-42) Physical Memory Address and Logical Address Calculations, Pointer and Index Registers, Instruction Pointer, Flag Register (Ref. Text: Ytha Yu: Ch. 3 Page- 42-43)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2**	CLO1, CLO2 **Assignment 1:** (will be due by Week3) -Using LMS (BLC)
Week 2 Lab Session 2 (3.0)	**Lab 02:** Introduction to basic syntax of Assembly language	**Lab 02:** Introduction to Assembly Language basic syntaxes , Use these syntaxes to solve small problems	CLO2
Week 3 Lesson 3 (1.5 hrs)	Assembly Language Syntax, Program Data, Variables, Named Constants. (Ref. Text: Ytha Yu: Ch. 4 Page-53-64) A Few Basic Assembly Language Instructions, Translation of High-Level Language to Assembly Language (Ref. Text: Ytha Yu: Ch. 4 Page-64-67)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2,TLA3,TLA4** **Student Submit Assigment-1 in LMS or BLC (online)**	CLO3

Week 3 Lab Session 3 (3.0)	**Lab 03:** Arithmetic Operations in Assembly Language	**Lab 03:** Learn to implement arithmetic operations on data , Learn to use these operations to solve problems	CLO2, CLO3
Week 4 Lesson 5 (1.5 hrs)	Program Structure and Segments, Input and Output Instructions, INT 21h Instruction Details. (Ref. Text: Ytha Yu: Ch. 4 Page-67-70) **Lesson 8:**Creating and Running a Program, Displaying a String, Case Conversion Program (Ref. Text: Ytha Yu: Ch. 4 Page-70-76)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2**	CLO3 **Class Test# 1** (Either online or onsite based on Week1-Week3 discussion) based on CO1, CO2 & CO3
Week 4 Lab Session 4 (3.0)	**Lab 04:** Branching operations in assembly language	**Lab 04:** Learn to implement branching instructions in assembly language, Learn to use these instructions to solve problems *Course Project Allocation among teams.*	CLO2, CLO3
Week 5 Lesson 6 (1.5 hrs)	The FLAGS Register, How Instructions Affect the Flags (Ref. Text: Ytha Yu: Ch. 5 Page-81-91) Jump, Conditional Jumps, The JMP Instruction (Ref. Text: Ytha Yu: Ch. 6 Page-93-98)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA3**	CLO2, CLO3, CLO4
Week 5 Lab Session 5 (3.0)	**Lab 05:** Looping operations in assembly language	**Lab 05:** Learn to implement looping instructions in assembly language, Learn to use these instructions to solve problems	CLO2, CLO3
Week 6 Lesson 7 (1.5 hrs)	High Level Structures, Branching Structures	Online/Onsite discussion; Review Feedback online; Using	CLO3, CLO4, CLO1 **Class Test# 2** (Either online or onsite based

	(Ref. Text: Ytha Yu: Ch. 6 Page-98-104) Microprocessor Pin Configuration, Direct Memory Access, Addressing banking (Ref. Text: By B.V.Hall and B.Berry)	Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA3,TLA4**	on Week4 & Week5 discussion) based on CO2 & CO3
Week 6 Lab Session 6 (3.0)	**Lab 06:** Solving complex problems using branching and looping operations	**Lab 06:** Learn to more about combining branching and looping operations for solving problems , Learn to use these operations to solve problems	CLO2, CLO3 **PRN#1: Project Concept Presentation by Team**
Week 7	**Midterm Exam Week** **Topics: Week 1 – Week6**		
Week 8 Lesson 8 (1.5 hrs)	High Level Structures, Looping Structures (Ref. Text: Ytha Yu: Ch. 6 Page-104-108) Computational problem solving using branching and looping structures (Ref. Text: Ytha Yu: Ch. 6 Page-108-116)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA3**	CLO3, CLO4 **Assignment 2** (will be due by Week 9)
Week 8 Lab Session 7 (3.0)	**Lab 07:** Logic, Shift and Rotate operations	**Lab 07:** Learn to implement logical operations on data , Learn to use these operations to solve problems	CLO2, CLO3
Week 9 Lesson 9 (1.5 hrs)	Revision on Flag Registers and their effects on Arithmetic Operations. (Ref. Text: Ytha Yu: Ch. 5 Page-81-91) Logical, Shift and Rotation Instructions & their operation in problem solving (Ref. Text: By Ytha Yu: Ch. 7 Page-117-138)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2,TLA3,TLA4**	CLO3, CLO4

Week 9 Lab Session 8 (3.0)	**Lab 08:** Solving problems using Stack	**Lab 08:** Learn to implement stack in assembly language , Learn to use stack as a means to solve relevant problems	CLO2, CLO3
Week 10 Lesson 10 (1.5 hrs)	The Stack and Stack operations in Microprocessor 8086, Applications of Stack operation in problem solving. (Ref. Text: Ytha Yu: Ch. 8 Page-139-145) Procedures, Types of procedures, Design procedures for specific problem (Ref. Text: Ytha Yu: Ch. 8 Page-146-151)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2**	CLO1, CLO3, CLO4
Week 10 Lab Session 9 (3.0)	**Lab 09:** Solving problems using string manipulation operations	**Lab 9:** Learn to use string manipulation operations in assembly language , Learn to solve relevant problems using string manipulation	CLO2, CLO3
Week 11 Lesson 11 (1.5 hrs)	Signed and Unsigned Multiplication-Division in Microprocessor 8086 (Ref. Text: Ytha Yu: Ch. 9 Page-161-167) Computational Problem solving using Multiplication-Division instructions (Ref. Text: Ytha Yu: Ch. 9 Page-161-167)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1**	CLO3 **Class Test# 3** (either online or onsite based on Week 8, Week 9 and Week 10 discussion) based on CLO1,CLO3 & CLO4
Week 11 Lab Session 10 (3.0)	**Lab 10:** Discussion Session	**Lab 10:** Discussion on Lab 1 to Lab 9 and Lab project	CLO1,CLO2, CLO3
Week 12 Lesson 12 (1.5 hrs)	Directional Flag and use of it in String operations, Moving and Storing Strings in Microprocessor 8086 (Ref. Text: Ytha Yu: Ch. 11	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1,TLA2**	CLO3

	Page-205-211) Copy, Load and Compare Strings and its operations (Ref. Text: Ytha Yu: Ch. 11 Page-211-219)		
Week 12 Lab Session 11 (3.0)	**Lab 11:** Project based assessment of lab projects	**Lab 11:** Lab project presentation by Students	CLO1,CLO2, CLO3 **PRN#3: Project Implementation Presentation by Students**
Week 13 Lesson 13 (1.5 hrs)	Introduction to Interrupts, Interrupt Vectors and Instructions. (Ref. Text: Barry B. Brey: Ch-6, Page-213-214) Interrupt Control, Interrupt in the Personal Computer. (Ref. Text: Barry B. Brey: Ch-6, Page-214-218)	Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1**	CLO1, CLO4
Week 13 Lab Session 12 (3.0)	**Lab 12**: Lab Performance Test and Project based assessment of Lab projects.	**Lab 12**: Solve problem using Emu8086 of for the lab performance test	CLO1,CLO2, CLO3 **Lab Assessment Test** (based on lab project presentation and final test)
Week 14	**Final Exam Week** **Topics: Week 8 - Week 13**		

Text Books:

1. Assembly Language Programming and Organization of the IBM PC

Author: Ytha Yu and Charles Marut

Reference Books:

1. Microprocessor and Interfacing, By B. V. Hall

2. The Intel Microprocessors, BY Barry B. Brey.

CIE – Breakup (Theory) [60 marks]

Bloom's Criteria	**Attendance (07)**	**Class Test (15)**	**Assignment (05)**	**Presentation (08)**	**Mid Exam (25)**
Remember		03			
Understand		03	02	02	05
Apply		03		03	05
Analyze		03	03		05
Evaluate		03			05
Create				03	05

CIE – Breakup (Lab) [100 marks]

Bloom's Criteria	**Attendance (10)**	**Lab Performance (25)**	**Lab Report (25)**	**Lab Final (40)**
Remember				
Understand		05	05	05
Apply		05	05	10
Analyze		05	05	10
Evaluate			10	05
Create		10		10

SEE – Semester End Examination [40 marks] {Theory}

Bloom Criteria	Score for the Test
Remember	05
Understand	05
Apply	15
Analyze	05
Evaluate	05
Create	05

Appendix-1: 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.