University of Asia Pacific (UAP)

Department of Computer Science and Engineering (CSE)

BSc in CSE Program

Course Outline – Course Name

Part A – Introduction

1. **Course No. / Course Code:** CSE 316

2. **Course Title:** Microprocessors and Microcontrollers Lab

3. **Course Type:** Core Course

4. **Level/Term and Section:** 6th Semester (3rd Year 2nd Semester)

5. **Academic Session:** Spring 25

6. **Course Instructor:** A S Zaforullah Momtaz, Rashik Rahman,
   Baivab Das,
   Zaima Sartaj Taheri,
   Jayonto Dutta Plabon.

7. **Pre-requisite (If any):** None

8. **Credit Value:** 1.5

9. **Contact Hours:** 3.0

10. **Total Marks:** 100

11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Provide students with practical knowledge and skills in working with microprocessors and microcontrollers.
2. Enable students to develop and debug programs for hardware-level control and embedded system behavior.

3. Build students’ ability to interface sensors, actuators, and peripheral devices with microcontrollers.
4. Encourage the design and implementation of real-time embedded systems to solve practical problems.
5. Foster teamwork, responsibility, and effective technical communication through collaborative mini-projects and presentations.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Demonstrate fundamental proficiency in microprocessor/microcontroller systems.
CLO 2	Implement programs on microprocessor/microcontroller platforms for hardware control and device interfacing.
CLO 3	Propose a feasible hardware-software solution using microcontrollers for a real-world problem and identify the corresponding system requirements.
CLO 4	Function effectively in a multidisciplinary team.
CLO 5	Develop a microcontroller system with peripheral interfacing.
CLO 6	Present the implemented solution through technical documentation and presentation.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO):

<table>
<tr><th>CLO No.</th><th>Corresponding PLOs (Appendix-1)</th><th>Bloom’s taxonomy domain/level (Appendix-2)</th><th>Delivery methods and activities</th><th>Assessment Tools</th><th>Ks</th><th>Ps</th><th>As</th></tr>
<tr><td>CLO 1</td><td>a</td><td>1/Apply</td><td>Lab demonstrations</td><td>Lab Evaluation</td><td rowspan="3">K3, K4, K5, K6</td><td rowspan="3">P1, P2, P7</td><td rowspan="3">A1, A2, A5</td></tr>
<tr><td>CLO 2</td><td>c</td><td>1/Apply</td><td>Programming exercises</td><td>Lab Evaluation, Project Report and Demonstration, Continuous Project Evaluation</td></tr>
<tr><td>CLO 3</td><td>b</td><td>1/Analyze</td><td>Problem-based learning, Final project proposal discussions</td><td>Presentation Followed by Viva, Project Report and Demonstration, Continuous Project Evaluation</td></tr>
</table>

CLO 4	i	3/Valuing	Collaborative Group Projects	Presentation Followed by Viva, Project Report and			
				Demonstration, Continuous Project Evaluation			
CLO 5	c	1/Create	Progressive Project-Build Sessions	Project Report and Demonstration			
CLO 6	j	1/Apply	Team-Based Review of Project Reports and Slides	Presentation Followed by Viva, Project Report and Demonstration, Continuous Project Evaluation			

Part B – Content of the Course

14. **Course Content:** Introduction to microprocessors and microcontrollers, understanding assembly basics and addressing modes. Writing and executing assembly programs and recalling 8086 programming concepts. Introduction to embedded development boards, uploading programs, and peripheral interfacing. Development of hardware control programs through mini projects including traffic light control, distance measurement, door lock system, water pump automation, theft detection, remote bulb control, plant watering system, and weather station. Final project integrating hardware and software for real-world applications, followed by technical documentation, presentation, and viva.

15. **Alignment of topics of the courses with CLOs:**

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Intro to Microprocessors and Microcontrollers, Assembly Basics	CLO1
2	Addressing Modes and Assembly Programming	CLO1, CLO2
3	8086 Recap, Embedded Boards, Peripheral Interfacing	CLO1, CLO2
4	Project Proposal and Discussion	CLO3, CLO4
5	Mini Projects	CLO1, CLO2
6	Final Project Development	CLO2, CLO3, CLO5

7	Final Project Presentation and Viva	CLO3, CLO4, CLO5, CLO6

16. **Class Schedule/Lesson Plan/Weekly plan:**

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Intro to Microprocessors and Microcontrollers, Assembly Basics	• Understand microprocessor and microcontroller fundamentals • Explain the role of assembly language in system programming	Week 1	Introductory discussion, identify processor components	Lecture, multimedia, demonstration	CLO1
Addressing Modes and Assembly Programming	• Describe different addressinlg modes • Write and execute simple assembly programs	Week 2	Problem-sol ving, sample code writing	Lecture, problem solving, lab practice	CLO1, CLO2
Overview and Recap of 8086 Programming, Introduction to Embedded Boards, Uploading Code, and Interfacing with Peripheral Device	• Recall 8086 programming concepts • Set up embedded boards and upload programs • Interface microcontrollers with basic peripherals	Week 3	Hardware setup, uploading code, demo	Lecture, demonstration , lab	CLO1, CLO2

Project Proposal Presentation and Discussion, Students propose their complex engineering problem project integrating embedded systems	• Identify real-world problems suitable for embedded solutions • Propose feasible hardware-software solutions • Work effectively in a team setting	Week 4	Group proposal preparation, presentation	Group work, discussion, presentation	CLO3, CLO4
Mini Projects	• Implement hardware control programs	Weeks 5–12	Circuit connection, Hands-on	Lab practice, demonstration	CLO1, CLO2
	• Interface sensors and actuators with microcontrollers • Demonstrate program execution on hardware		hardware programmin g and interfacing		
Final Project Development and Integration	• Develop integrated embedded project • Apply system design and interfacing skills	Week 13	Prototype building, progress review	Group work, supervision	CLO2, CLO3, CLO5
Final Project Demonstration, Presentations, and Viva	• Prepare technical documentation • Present project outcomes effectively • Defend work in viva session	Week 14	Report submission, final presentation, viva	Presentation, report writing, viva	CLO3, CLO4, CLO5, CLO6

17. **Teaching-Learning Strategies:** Students are engaged through hands-on lab exercises, mini-projects, and a final project. The course promotes teamwork, problem-solving, and hardware interfacing skills via demonstrations, guided experiments, and collaborative project work.

18. **Assessment Techniques of each topic of the course:**

SL. No	Topics / Content	Assessment Techniques
1	Intro to Microprocessors and Microcontrollers, Assembly Basics	Lab Task, Lab Evaluation
2	Addressing Modes and Assembly Programming	Lab Task, Lab Evaluation
3	8086 Recap, Embedded Boards, Uploading Code, Peripheral Interfacing	Lab Task, Lab Evaluation
4	Project Proposal Presentation and Discussion	Continuous Project Evaluation, Project Report, Viva
5	Mini Projects	Lab Evaluation, Continuous Project Evaluation, Project Report and Demonstration
6	Final Project Development and Integration	Project Report and Demonstration, Continuous Project Evaluation
7	Final Project Presentation and Viva	Presentation Followed by Viva, Project Report and Demonstration

Part C – Assessment and Evaluation

Assessment Type	% Weight	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6
Lab Evaluation *(Assembly + Mini Projects)*	20%	8	12	–	–	–	–
Presentation Followed by Viva	20	–	–	4	6	10	–
Project Report and Demonstration	40	–	4	6	6	4	20
Continuous Project Evaluation	20	–	4	6	4	6	

Total	**100%**	**8**	**20**	**16**	**16**	**20**	**20**

19. Assessment Strategy

Lab Exercises: Students will complete assembly programming exercises during lab sessions. Evaluation is based on correctness, functionality, and completion.

Mini Projects: Students will implement hardware-based mini projects using microcontrollers. Assessment is based on program correctness, peripheral interfacing, and demonstration of the project.

Final Project: Students will work in groups to develop an integrated microcontroller project. The instructor will monitor group performance and assess design, implementation, project report, and presentation including viva.

Lab Exercises and Mini Projects (20 marks)

Bloom's Category	**Lab Exercises (Assembly)**	**Mini Projects**
1/Apply	8	12

Final Project (80 marks)

Bloom's Category	**Continuous Project Evaluation (20)**	**Project Report & Demonstration (40)**	**Presentation & Viva (20)**
1/Apply	4	24	–
1/Analyze	6	6	4
3/Valuing	4	6	6
1/Create	6	4	10

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Lab Evaluation 20%
2. Project 80%

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**

80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Barry B. Brey, The Intel Microprocessors, Processor Architecture, Programming, and Interfacing, Eighth Edition, 2009, Prentice Hall
2. Assembly Language Programming and Organization of the IBM PC by Ytha Yu and Charles Marut.
3. C the complete reference by Herbert Schildt (4th edition)
4. Getting Started with Arduino by Massimo Banzi 4th edition
5. Kolban's Book on the ESP32 and ESP8266" by Neil Kolban
6. ESP8266 and ESP32 Official Documentation

Appendix-1:

Washington Accord Program Learning Outcomes (PLO) for engineering programs: (a) Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.

(b) Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (K1 to K4)

(c) Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)

(d) Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

(e) 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 their limitations.

(f) Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)

(g) Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7) (h) Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)

(i) Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.

(j) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(k) Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(l) Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Appendix-2:

Knowledge Profile (K):

No.	Attribute
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline

K5	Knowledge that supports engineering design in a practice area
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
K8	Engagement with selected knowledge in the research literature of the discipline

Range of Complex Engineering Problem Solving (P):

Attribute	**Complex Engineering Problems have characteristic P1 and some or all of P2 to P7:**
Depth of knowledge required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	P2: Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	P3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	P4: Involve infrequently encountered issues
Extent of applicable codes	P5: Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	P6: Involve diverse groups of stakeholders with widely varying needs
Interdependence	P7: Are high-level problems including many component parts or sub-problems

Range of Complex Engineering Activities (A):

Attribute	**Complex activities** means (engineering) activities or projects that have some or all of the following characteristics:
Range of resources	A1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
Level of interaction	A2: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues
Innovation	A3: Involve creative use of engineering principles and research-based knowledge in novel ways

Consequences for society and the environment	A4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
Familiarity	A5: Can extend beyond previous experiences by applying principles-based approaches