Bangladesh University of Business and Technology (BUBT)
Faculty of Engineering& Applied Sciences (FEAS)
Department of Computer Science and Engineering (CSE)

THEORY COURSE OUTLINE

1	**Program**	B.Sc. Engg. in CSE
2	**Course Code**	CSE 315
3	**Course Title**	Microprocessor and Microcontroller
4	**Course Type**	Core Course
5	**Academic Session**	Spring 2022
6	**Credit Hour**	3.0
7	**Intake**	44
8	**Section**	6
9	**Pre-requisites**	CSE 215 Computer Architecture
10	**Campus**	Permanent Campus
11	**Course Teacher**	**Name:** Sohel Rana | **Designation**: Lecturer **Specialization**: Network Security **Room No. 503/B3** | **Email:** sohel.rana@bubt.edu.bd | **Cell No**. 01785699130
12	**Class Schedule**	
13	**Counselling Schedule**	
14	**Course Objectives**	This course will build up student's ability to understand fundamental concepts of microprocessor and microcontroller based embedded systems. Also, discuss about architecture and programming concepts of 8086 based microprocessor family as well as different microcontrollers (8051, Arduino, etc.). Analyze different tools for integrating hardware and software components in micro-controller based embedded systems. This course will emphasize different techniques & tools and how to apply them as a solution of real life problem.
15	**Course Synopsis**	This course provides basic concept of architecture of 8086 microprocessor family, addressing mode, data movement instructions, interfacing of bus, memory and I/O with microprocessor, handling of interrupts and direct memory access (DMA). The 8051 Microcontrollers: Microcontrollers and embedded processor, introduction to 8051 assembly programming, PSW, register bank, stack, jump, loop and control instructions, I/O port programming, addressing modes, arithmetic & logic instructions. 8051 hardware connection and intel hex file, 8051 timer & serial port programming in assembly and C, LCD & keyboard interfacing & sensor interfacing. Motor control: relay, PWM, DC & steeper motor. Mapping between

Class Schedule

Class Day	Class Hours	Class Room

Counselling Schedule

Class Day	Class Hours	Class Room

		languages and hardware; Embedded Systems Hardware/ Software Co-design, Introduction to Arduino and Arduino based application.
16	**Text Book**	1. The 8051 Microcontroller and Embedded Systems - Muhammad Ali Mazidi , Janice Gillispie Mazidi 2. The Intel Microprocessors *architecture, programming and interfacing* – Barry B. Brey
17	**Reference Book**	1. Programming and Customizing the AVR Microcontroller - D. V. GADRE 2**.** Assembly language programming and Organization of the IBM PC- Ytha Yu, Charles Marut
18	**Course Outcomes (COs)**	Upon completing this course students will be able to: **CO1:** Describe different microprocessor and microcontroller's internal architecture, pin diagram and its operation in the area of embedded system. **CO2**: Understand the 8086 based assembly & 8051 Microcontroller assembly language program, data movement instructions, different addressing mode, register banks, arithmetic logic instructions and various others functions etc. **CO3**: Apply the knowledge of microprocessor and microcontroller fundamentals and different components of embedded system to design a solution for a given problem. **CO4**: Design and Analyze the real world problems with Microcontrollers based Embedded systems.
	Mapping of COs to POs	

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4		√										

CO No.	PO No.	Bloom's Domain / Level	Delivery Methods / Activities	Assessment Tools
CO1	PO1	Cognitive / Understanding	Class Lecture	Midterm
CO2	PO1	Cognitive / Understanding	Class Lecture	Midterm and Final
CO3	PO3	Cognitive / Applying	Class Lecture	Midterm and Final
CO4	PO2	Cognitive/ Analyzing	Class Lecture	Final

19	**Teaching Strategy**	Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

20 Assessment and Marks Distribution:

Class Participation	:	10%
Assignment/Presentation	:	10%
Class Test	:	10%
Midterm Examination	:	30%
Final Examination	:	40%

21 Lecture Plan (Weekly Schedule)

Week	Lecture #	Selected Topics	Chapter #	COs	Assessment
1	1	**Introduction:** Numbering and coding Systems, Digital primer, 8051 assembly language programming	(8051 Micr) Ch-0, (Barry) Ch-1	CO1	
	2	Introduction to the microprocessors, The 8051 Microcontrollers: 8051 assembly language programming	(Barry) Ch-1 (8051 Micr) Ch-1,2	CO1	
2	3	Understand Assembling and running an 8051 program, The program counter and ROM spaces in the 8051, data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack	(8051 Micr)Ch-2	CO2	
	4	Physical address calculation both real and protected mode operation of microprocessor	(Barry) Ch-2	CO2	
3	5	Internal architecture of microprocessor, real & protected mode addressing ,different data addressing mode operation of 8086 based microprocessors	(Barry) Ch-2, 3	CO2	**Mid Term Exam 30**
	6	Data movement instructions (machine language to assembly & assembly to machine conversion) for 16-bit and 32-bit.	(Barry) Ch-4	CO2	
4	7	8086 based assembly language: arithmetic and logic instructions , flow control operation(IF-ELSE, Loop)	(Marut) Ch-5,6	CO3	
	8	8051 Assembly programming using Loop, Jump (conditional & unconditional)Call instructions, time delay calculation for various 8051 chips, I/O port programming of 8051	(8051 Micr) Ch-3,4	CO2	
5	9	8051 Addressing Modes: Immediate and register addressing modes, accessing memory, bit addressing I/O and RAM	(8051 Micr) Ch-5	CO2	
	10	Arithmetic Logic instructions and programming	Ch-6	CO2	
6	11	Logic, rotate instruction & data serialization**,** BCD,ASCII and other application programs	Ch-6	CO2	
	12	Hardware connection and INTEL HEX file, Timer programming in Assembly and C	Ch-8,9	CO3	
	13	LCD and Keyboard interfacing	Ch 12	CO4	

7	14	***Review class for Semester Mid Term***		CO2	
8	**Midterm Examination**				
9	15	Motor control: Relay, PWM, DC and stepper motors	(8051 Micr) Ch-17	CO4	Final Exam 40
	16	Introduction to Arduino and Arduino based application like keypad, PIR sensor interfacing	Online source	CO4	
10	17	servo motor, LCD display interfacing with Arduino	Online source	CO4	
	18	Mapping between languages and hardware; Embedded Systems Hardware/ Software Co-design	Online source	CO3	
11	19	8051 serial port programming in Assembly and C, 8051 interfacing with the 8255	(8051 Micr) Ch-10,15	CO3	
	20	8086 Hardware, De-Multiplexing operation of 8088/8086	(Barry) Ch-9	CO2	
12	21	Buffering, basic BUS timing, read & write operation of microprocessor	Ch-9	CO2	
	22	Memory interfacing with microprocessor for RAM & ROM	Ch-10	CO4	
13	23	I/O interfacing with microprocessor: LCD, Keypad etc.	Ch-11	CO4	
	24	Basic interrupt processing, hardware interrupt. Basic DMA operation, DMA controller	Ch-12,13	CO2	
14	25	***Review class for Semester Final Examination***		CO4	
	26	Final Exam Review Class			
15	**Final Exam**				

22 Overall CO Assessment Criteria

Assessment methods of COs are given below:

Assessment Area	**CO**				**Assessment Area Mark**
	CO1	**CO2**	**CO3**	**CO4**	
Class Participation					
Assignment/Presentation					
Class Test					
Midterm Exam	10	10	10		30
Final Exam		10	10	20	40
Total Mark	**10**	**20**	**20**	**20**	**70**

23 Rubrics

COs (Bloom's Level)	**Excellent (80%-100%)**	**Good (70%-79%)**	**Satisfactory (60%-69%)**	**Poor (40%-59%)**	**Unsatisfactory (0-39%)**	**Marks (70)**
CO1 (Understanding)	Answer is complete and sufficient detail provided to support issues related to the question. And also deals fully	Answer is brief with sufficient detail provided to support issues were introduced. And most of the basic details are included but some are missing.	Answer is brief with insufficient detail provided to support issues were introduced.	Answer is incomplete and excessive discussion of unrelated issues.	None of the relevant details were included or didn't answer.	

			with the entire question.			And serious gaps in the basic details.		
		CO2 (Understanding)	Answer is complete and sufficient detail provided to support issues related to the question. And also deals fully with the entire question.	Answer is brief with sufficient detail provided to support issues were introduced. And most of the basic details are included but some are missing.	Answer is brief with insufficient detail provided to support issues were introduced.	Answer is incomplete and excessive discussion of unrelated issues. And serious gaps in the basic details.	None of the relevant details were included or didn't answer.	
		CO3 (Applying)	The question is answered appropriately by applying the suggested method in the question.	The question is answered briefly by applying the suggested method in the question.	The question is answered correctly by applying the suggested method in the question but some steps are missing.	The question is answered incompletel y by applying the suggested method in the question but some steps are correct.	No attempt to implement the suggested method.	
		CO4 (Analyzing)	A clear, complete, and properly ordered chain of analyzing steps (i.e. proper explanation of the procedure) is followed to answer the question.	The chain of analyzing steps is complete and correctly ordered but lack of expected explanation.	One or more intermediate analyzing steps are missing or unclear, but the correctness of the analysis is not compromised.	One or more intermediate analyzing steps are missing or unclear to answer the question.	The stated chain of analysis does not lead to the stated question.	

24 Grading Policy

The following chart will be followed for grading. This has been customized from the guideline provided by the School of Engineering and Computer Science.

A+	A	A-	B+	B	B-	C+	C	D	F
≥ 80	75-<80	70-<75	65-<70	60-<65	55-<60	50-<55	45-<50	40-<45	<40

25 Additional Course Policies

Assignments	There will be at least two assignments. Average marks of the assignments will be counted. No late homework will be accepted. ***Any kind of copy/manipulation in assignment will carry zero mark.*** Two or more copied assignments will carry zero mark in all assignments. **Zero tolerance will be shown in this regard.** Solutions to assignment problems will be provided through web and on hand.
Class Test	There will be at least three class tests (CT).Best two of three or best three of four CTs will be counted. Both of regular and surprise CTs can be conducted.
Exams	CT, Mid-term and final exam will be closed book, closed notes. Mobile phone is strictly prohibited in exam hall. Students are insisted to carry their own watch and synchronize time during exam hours.

		Test Policy	If a student is absent from class test anyway and made no report to the class teacher personally beforehand, his/her score for that test will be zero. No make-up for the class test will be allowed as 2 of 3 or 3 of 4 CTs are being considered. No make-up for Mid-exam will be entertained without physical presence and recommendation of the guardian along with written permission of the department. Make-up of Mid-exam may be much harder than the regular one.
26	**Additional Information**	a. Academic Calendar Spring 2022: https://www.bubt.edu.bd/Home/page_details/Academic_Calender b. Academic Policies: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. c. Grading & Evaluation: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. d. Proctorial Rules: http://www.bubt.edu.bd/administrator/proctors-office.	

27 Bloom's Taxonomy for Teaching-Learning

Bloom's Taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in Cognitive, Affective and Psychomotor domains. The Cognitive domain list has been the primary focus of most education and is frequently used to structure curriculum learning objectives, assessments and activities. The three domains and respective levels are illustrated below.

Cognitive [C] (Knowledge-based)	**Affective [A]** (Emotion-based)	**Psychomotor [P]** (Action-based)
1. Remembering	1. Receiving	1. Imitating
2. Understanding	2. Responding	2. Manipulating
3. Applying	3. Valuing	3. Précising
4. Analyzing	4. Organizing	4. Articulating
5. Evaluating	5. Characterizing	5. Naturalizing
6. Creating	--- --- ---	--- --- ---

28 Descriptions of Cognitive Domain (Anderson and Krathwohl's Taxonomy 2001):

The **cognitive domain** involves the development of our mental skills and the acquisition of knowledge.

Level	Category	Meaning	Keywords
C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information.	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
C2	Understanding	Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining.	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
C3	Applying	Carrying out or using a procedure through executing, or implementing. Applying relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use

		C4	Analyzing	Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
		C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, Monitor
		C6	Creating	Putting elements together to form a coherent or functional whole ;reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product. This process is the most difficult mental function.	Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce

29 Graduate Attributes (Program Outcomes) for B.Sc. in Engineering Program based on Washington Accord

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the Time of graduation. These relate to the knowledge skills and attitudes that students acquire while progressing through the program. The students of the B.Sc. in EEE program are expected to achieve the following graduate attributes or program outcomes at the time of graduation.

PO1–Engineering knowledge (Cognitive): Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2–Problem analysis (Cognitive): 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 (Cognitive, Affective): 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–Investigation (Cognitive, Psychomotor): 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 (Psychomotor, Cognitive): 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 (Affective): 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 (Affective, Cognitive): Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8–Ethics (Affective): Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.

PO9–Individual work and teamwork (Psychomotor, Affective): Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

PO10–Communication (Psychomotor, Affective): 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 (Cognitive, Psychomotor): 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 (Affective, Psychomotor): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

30	**Social & Moral Capital**		
	Our promises are based on the three cardinal principles: (a) What we do believe (b) What we do practice, and (c) What we will promote However, students are advised to undertake the following commitments for moral development.		
	1. To be punctual and attentive in class **2.** To maintain inclusive learning environment **3.** To ensure mutual respect **4.** To be cooperative in group learning. **5.** To be innovative and Creative **6.** To follow dress code and wearing ID card **7.** To be always proactive	**8.** Try to follow and review day to day class **9.** To avoid conspiracy **10.** To prioritize honesty & faith **11.** To be motivated for asking question and encourage feedback **12.** To develop attitude for speaking in English **13.** Do not ignore to carry out any assignments or commitments **14.** To be clean and decent in all levels.	**15.** To be sincere for class preparation **16.** Do not forget to switch-off the cell phone in class **17.** Do not forget to carry course pack and learning stuffs in class **18.** To maintain loyalty and trust to the university **19.** Must avoid unfair means and plagiarism in exam, reports and assignments **20.** Must maintain eco-friendly environment in the campus.

Prepared by: **Checked by:** **Approved by:**

Sohel Rana