



## NARSIMHA REDDY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad

Accredited by NBA & NAAC with A Grade

Program Name : EEE  
 Name of the Course : Microprocessor and Microcontroller  
 Course Code : EC3105PC  
 Semester and Year : III -I  
 Faculty Name : Dr M Shoban

### COURSE FILE

S.No	Contents	Included
1	Vision, Mission, COs, POs, PSOs, PEOs	
2	Academic calendar	
3	Syllabus	
4	CO/PO mapping	
5	Nominal Rolls of the Students	
6	Time table	
7	Lesson Plan	
8	Unit wise Question Bank	
9	Old Question Papers	
10	Question Papers (CIA & SEE)	
11	Tutorial sheets	
12	Learning Methodologies: Experiential learning (Industrial visits, Internships, Mini Projects, Academic Projects, Guest Lectures, Student Workshops etc.), Problem Solving methodologies (assignments, quiz, case study etc.) <b>Note:1. At least TWO learning Methodologies to be included in your course</b> <b>2. The above methodologies for illustration, you may add more</b>	
13	Subject notes/PPTs/self study material	
14	Feedback on Curriculum Design and development	
15	CO/PO attainment, analysis and Action taken report	

Recommendation / Remarks:

Signature of the Faculty

Signature of the Head

Signature of the Principal

### 1. Department Vision & Mission

#### Vision of the Department:

To evolve into a center of excellence in Electronics & amp; Communications Engineering through creative and innovative practices in teaching-learning and Research in consonance with the contemporary and future needs of the country.

#### Mission of the Department:

1. To inspire and encourage development of key ideas and innovations that can contribute to socio- economic development of India as well as world.
2. To identify and collaborate with experts, professionals, academicians, commercial and various governmental bodies and develop an environment conducive to research and development.
3. To offer state-of-the-art programs that inspires and motivates students in perusing the role of researchers and developers through higher learning programs.

### 2. List of PEOs, POs & PSOs

#### PEOs:

1. PEO-I: (Core competence – Discipline knowledge) To motivate and mold students in to world class professionals by cultivating a fundamental desire to learn and apply the acquired skill sets in complex constrains being faced by our social infrastructure.
2. PEO-II:(Preparation – Employment/Higher studies) To encourage students in striving for higher cognitive aspirations where they will actively participate in quality improvement of academic and industrial components of our society.
3. PEO-III (Professionalism – Professional value-knowledge development) To enlighten students and help them in understanding their role as professionals who are well groomed, ethically poised, mentally strong, passionate human beings and upstanding citizens.

#### POs:

1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental

	considerations.
4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	<b>Modern tool usage:</b> 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.
6	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	<b>Communication:</b> 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.
11	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	<b>Life-long learning:</b> 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.

### PSOs:

PSO1: Enabling the students to apply the knowledge of algorithm analysis, modeling, circuit design and verification methodologies to use and manage electro-mechanical systems that are integral part of modern socio-economic framework.

PSO2: Students will be able to examine the limitations of current implementation strategies and propose modifications and new ideas by using state-of-the-art tool chain in electronic communication systems.

PSO3: To learn, understand and adapt to continuously evolving role and ethical needs of professionals in collaborative environment.

**REVISED Bloom's Taxonomy Action Verbs**

<b>Definitions</b>	<b>I. Remembering</b>	<b>II. Understanding</b>	<b>III. Applying</b>	<b>IV. Analyzing</b>	<b>V. Evaluating</b>	<b>VI. Creating</b>
<b>Bloom's Definition</b>	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.

**B.Tech EEE Syllabus**

**EE3103PC: Microprocessors and Microcontrollers**

**B.Tech. III Year I Sem.**

**LTP C**

**3104**

**Prerequisite: Nil**

**Course Objectives:**

1. To familiarize the architecture of microprocessors and Microcontroller
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture.
4. To study the basic concepts of Advanced ARM processors,

**Course Outcomes (CO's)**

1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers
- 3 Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors
5. Undeestands the basic concepts of advanced ARM processors.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3		2	-	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-

#### UNIT -1: 8086 Architecture

8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086. Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

#### UNIT-II

##### Introduction to Microcontrollers

Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051. 8051 Real Time Control: Programming Timer Interrupts. Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

#### UNIT-III

VO and Memory Interface LCD, Keyboard, External Memory RAM, ROM Interface, ADC,DAC Interface to 8051. Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-12C Bus, SPI Bus, UART: External Communication Interfaces-RS232, USB.

#### UNIT-IV ARM Architecture

ARM Processor fundamentals, ARM Architecture - Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set - Data processing. Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

#### UNIT -V Advanced ARM Processors

Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

Lesson Plan

Ses sion	Date	Topic to be covered	Bloom's Taxonomy	Teaching Methodology	Reference Text Books
<b>Unit - 1 8086 Architecture</b>					
1	23.8.22	Introduction to subject Brief description of syllabus	L1:Remember	Chalk & Talk	T1-CH1
2	24.8.22	8086 Architecture-Functional diagram	L2:understand	Chalk & Talk	T1-CH1
3	25.8.22	Register Organization	L4:Analyze	Chalk & Talk	T1-CH1
4	26.8.22	Memory Segmentation, Programming Model	L2:understand	Chalk & Talk	T1-CH1
5	27.8.22	Memory addresses, Physical Memory Organization,	L2:understand	Chalk & Talk	T1CH3
6	30.8.22	Architecture of 8086	L4:analyze	Chalk & Talk	T1-CH2
7	1.9.22	Signal descriptions of 8086	L2:understand	Chalk & Talk	T1-CH2
8	2.9.22	interrupts of 8086	L4:analyze	Chalk & Talk	T1-CH2
9	3.9.22	Instruction Set and Assembly Assembler Directives, Macros, and Simple Programs involving Logical	L4:analyze	Chalk & Talk	T1-CH2
10	5.9.22	Language Programming of 8086	L2:understand	Chalk & Talk	T1-CH4
11	6.9.22	Instruction formats	L2:understand	Chalk & Talk	T1-CH2
12	7.9.22	Addressing modes	L4:analyze	Chalk & Talk	T1-CH2
13	9.9.22	Instruction Set , Branch and Call Instructions	L4:analyze	Chalk & Talk	T1-CH2
14	9.9.22	Sorting, String Manipulations	L4:analyze	Chalk & Talk	T1-CH2
<b>UNIT-II Introduction to Microcontrollers</b>					
21	10.9.22	Overview of 8051 Microcontroller	L2:understand	Chalk & Talk	T1-CH5

22	12.9.22	Architecture	L2:understand	Chalk & Talk	T1-CH5
23	13.9.22	Architecture, I/O Ports	L2:understand	Chalk & Talk and practical experiment	T1-CH5
24	14.9.22	Memory Organization	L4:analyze	Chalk & Talk	T1-CH5
25	15.9.22	Addressing Modes and Instruction set of 8051	L2:understand	Chalk & Talk	T1-CH5
26	16.9.22	Addressing Modes and Instruction set of 8051	L2:understand	Chalk & Talk	T1-CH5
27	17.9.22	8051 Real Time Control	L2:understand	Chalk & Talk	T1-CH5
<b>UNIT-V/O and Memory Interface</b>					
28	19.9.22	Programming Timer Interrupts	L2:understand	Chalk & Talk	T1-CH6
29	20.9.22	Programming External Hardware Interrupts	L2:understand	Chalk & Talk	T1-CH6
30	21.9.22	Programming External Hardware Interrupts,	L4:analyze	Chalk & Talk	T1-CH6
31	22.9.22	Programming the Serial Communication Interrupts	L2:understand	Chalk & Talk	T1-CH6
32	23.9.22	Programming the Serial Communication Interrupts	L2:understand	Chalk & Talk	T1-CH7
33	24.9.22	Programming 8051 Timers and Counters	L4:analyze	Chalk & Talk	T1-CH7
34	10.10.22	Programming 8051 Timers and Counters	L4:analyze	Chalk & Talk	T1-CH7
<b>UNIT-V/O and Memory Interface</b>					
36	10.10.22	LCD, Keyboard	L2:understand	Chalk & Talk	T1-CH8
37	11.10.22	External Memory RAM	L2:understand	Chalk & Talk	T1-CH8
38	12.10.22	ROM Interface	L2:understand	Chalk & Talk	T1-CH8
39	14.10.22	ADC, DAC Interface to 8051	L2:understand	PPT	T1-CH8
40	15.10.22	Serial Communication and Bus Interface	L4:analyze	Chalk & Talk	T1-CH8

41	17.10.22	Serial Communication Standards	L4:analyze	Chalk & Talk and with simulation experiment	T1-CH8
42	18.10.22	Serial Data Transfer Scheme	L4:analyze	Chalk & Talk	T1-CH8
43	19.10.22	On board Communication Interfaces-12C Bus, SPI Bus, UART	L2:understand	Chalk & Talk	T1-CH8
44	20.10.22	External Communication Interfaces-RS232, USB	L4:analyze	Chalk & Talk	T1-CH8
<b>UNIT-IV ARM Architecture</b>					
45	21.10.22	ARM Processor Fundamentals, ARM Architecture	L2:understand	PPT	T1-CH9
46	22.10.22	Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table	L2:understand	Chalk & Talk	T1-CH9
47	28.10.22	ARM instruction set - Data processing	L4:analyze	PPT	T1-CH9
48	29.10.22	Branch instructions, load store instructions	L4:analyze	Chalk & Talk	T1-CH9
50	31.10.22	Software interrupt instructions, Program status register instructions	L2:understand	Chalk & Talk	T1-CH10
51	1.11.22	loading constants, Conditional execution	L2:understand	Chalk & Talk	T1-CH10
52	2.11.22	Introduction to Thumb instructions	L4:analyze	Chalk & Talk	T1-CH10
<b>UNIT-V Advanced ARM Processors</b>					
54	3.11.22	Introduction to CORTEX Processor and its architecture	L2:understand	Chalk & Talk	T1-CH12
55	10.11.22	Introduction to CORTEX Processor and its architecture	L2:understand	Chalk & Talk	T1-CH12
56	11.11.22	OMAP Processor and its Architecture.	L2:understand	Chalk & Talk	T1-CH12
57	15.11.22	OMAP Processor and its Architecture.	L2:understand	Chalk & Talk	T1-CH12





CO4	3	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-

## UNIT I

### 8086 ARCHITECTURE

S.No	Questions	BT	CO	PO
<b>Part – A (Short Answer Questions)</b>				
1	Define Microprocessor and mention the power supply & clock frequency of 8086	L1		
2	List and explain the general purpose registers of 8086 microprocessor. Also explain its special functions.	L2		
3	Illustrate the following Arithmetic instructions of 8086 microprocessor with details.  i) AAA ii) IMUL iii) DIV iv) CWD	L3		
4	Explain the Concept of Segmentation with base address and Offset address	L3		
5	Define interrupt and explain the different interrupts presented in 8086 microprocessor.	L2		
6	Define addressing mode. Write the names of 8086 addressing modes	L1		
7	Define Each and Every flag in flag register	L1		
8	Define assembler directive. Give any two examples.	L1		
9	List out the interrupts of 8086	L2		
10	Describe ALE, MN/MX, RQ/GT Pin of 8086	L2		
<b>Part – B (Long Answer Questions)</b>				
11	a) Explain the architecture of 8086 with neat diagram			
	b) Define addressing mode and explain the different addressing modes presented in 8086 Microprocessor with examples.			
12	a) Explain the shift and Rotate instruction set of 8086 Microprocessor along with examples			
	b) Develop an assembly language program to sort the given values in ascending order.			
13	a) Explain data transfer instructions of 8086 with examples.  Define assembler directive and explain different assembler directives used in 8086 Microprocessor in detail.			

	b)	Describe the 8086 microprocessor pin-diagram.			
14	a)	.Enumerate the structure of physical memory organization of 8086 with neat diagram.			
	b)	Draw the interrupt cycle of 8086 Microprocessor and explain the nested interrupt concept in detail.			

15	a)	Explain minimum mode control signals of 8086			
	b)	Enumerate the functions of the following pins. i) TEST ii) Hold iii) QS0 & QS1 iv) S3, S4			
16	a)	Differentiate jump & loop instructions.			
	b)	Write the logical instructions available in 8086.			

## UNIT-II

### INTRODUCTION TO MICRO CONTROLLER

S.No	Questions	BT	CO	PO	
<b>Part – A (Short Answer Questions)</b>					
1	Compare between MOVX and MOV				
2	Draw the blocks of Micro controller and explain each block				
3	Mention the special function registers used for serial communication in 8051				
4	Express the PSW register format in 8051 and give example instructions which effect the respective flags				
5	Explain the modes of operation of timers in 8051				
6	Explore the interrupt management of 8051 microcontroller				
7	Write short notes on Logical Instructions of 8051.				
8	Explain the use of EA bit.				
9	Explain how external interrupts are serviced in 8051				
10	Write the function of the bits PSW.3 & PSW.4.				
<b>Part – B (Long Answer Questions)</b>					
11	a)	Discuss the register set of 8051 and also discuss how memory and I/O addressing is done in 8051.			
	b)	Discuss internal architecture of 8051 microcontroller in detail.			
12	a)	List the format of PSW register of 8051 and explain each bit.			
	b)	Discuss about the memory organization and special function registers in 8051 microcontroller			

13	a)	Compare timer & counter? Analyze the 16-bit timer mode and 8-bit auto-reload mode of 8051 microcontroller.			
	b)	Describe how interrupts are handled in 8051 micro controller with details corresponding SFR"s.			
14	a)	Classify the types of serial communication with examples.			
	b)	Explain about TCON &TMOD operation with an example.			
15	a)	Discuss about the Data Memory organisation of 8051.			
	b)	Describe the register set of 8051 Microcontroller with examples			
16	a)	Enumerate the addressing modes of 8051 microcontroller with examples			
	b)	Explain TCON & TMOD ,IE,IP operation with an example in 8051.			

### UNIT-III

#### MEMORY AND I/O INTERFACE

S.No	Questions	BT	CO	PO	
<b>Part – A (Short Answer Questions)</b>					
1	What is the necessity of interfacing .				
2	Write Process of transferring data serially using 8051.				
3	Compare the features of SPI and I2C communication				
4	Write a ALP program to toggle the p1.2 . port				
5	When are timer overflow bits set and reset?				
6	What is the use of timing and control unit?				
7	Draw the blocks of Micro controller and explain each block				
8	Explain SJMP and LJMP instruction				
9	Explain about SMOD and SCON register .				
10	Explain about Each and every bit in IE and IP register				
<b>Part – B (Long Answer Questions)</b>					
11	a)	Explain with a neat diagram how an External Memory RAM is interfaced to 8051.			
	b)	Interface 8 bit ADC 0800 with 8051. Explain procedure with neat diagram			

12	a)	Discuss the various serial data transfer schemes.			
	b)	Demonstrate how a digital to analog converter is interfaced with 8051 microcontroller with schematic.			
13	a)	Design the circuit diagram to interface a keyboard with microcontroller and explain how microcontroller recognizes the key pressed			
	b)	Explain the serial communication and write ALP to send bytes of data serially?			
14	a)	Explain the steps involved in the generating a delay using Timers..			
	b)	Write a ALP program to toggle all the bits of P0 continuously with 250 ms delay.			
15	a)	Interface two chips of 8kb EPROM with 8051 consider starting address as 0FFFH .			
	b)	Write short notes on synchronous and asynchronous communication standards.			
16	a)	Explain about how to communicate I/O devices using RS-232?			
	b)	Enumerate how to interface an LCD display with microcontroller.			

#### UNIT IV

#### ARM ARCHITECTURE

S.No	Questions	BT	CO	PO	
<b>Part – A (Short Answer Questions)</b>					
1	List various fundamental features of ARM processor.				
2	Write applications & advantages of ARM Processors.				
3	Define CPSR SPSR in ARM and draw its format .				
4	Illustrate the registers organization in ARM Architecture.				
5	Explain the concept fast interrupt request and IRQ .				
6	Explain about thumb instructions.				
7	What is mean by load store instructions.				
8	Where arm chips are used.				
9	Explain about Thumb instruction set of ARM controller.				
10	Explain about MUL,MLA intructions				
<b>Part – B (Long Answer Questions)</b>					
11	a)	Explain the core Data Flow model of ARM processor.			
	b)	Write about multiple Register Data Transfer Instructions.			
12	a)	List out Program flow control instructions and give Examples for each one			
	b)	Write about the fundamental features of ARM processor.			
13	a)	Differentiate between ARM instruction and Thumb instructions Mention the advantages of Thumb instructions			
	b)	Discuss the various modes of operation of ARM with neat diagram.			
14	a)	Discuss briefly about Thumb instruction set of ARM. How is a Thumb instruction differentiated from an ARM instruction.			

	b)	Using the following instruction set of ARM write syntax for different examples (a)Data Processing (b)Load Store (c)Conditional Execution			
15	a)	Explain with a neat diagram the architecture of ARM Processor.			
	b)	Explain in detail about Exceptions handling, interrupts & interrupt vector table of ARM			
16	a)	Explain the programming model of Registers in ARM			
	b)	List all arithmetic instructions in ARM			

UNIT-V  
ADVANCED ARM PROCESSORS

S.No	Questions	BT	CO	PO
<b>Part – A (Short Answer Questions)</b>				
1	Illustrate different Registers and Special Registers in Cortex M3 processor			
2	Briefly describe the features of the Cortex M3 based microcontrollers memory organization.			
3	Write about Bus Interfaces in ARM Cortex M3 processor.			
4	What are the major address ranges in Memory Map of Cortex M3			
5	What is Pipeline mechanism? Explain briefly the pipeline mechanism in Cortex-M3 Processor.			
6	Introduce a GPIO pin handling with a Cortex M core controller			
7	Introduce the typical energy-saving modes of 8-bit and 32-bit microcontrollers			

8		Briefly compare the properties of Cortex M0, M3, M4, M7 cores			
9		Discuss the features of OMAP processor			
10		Explain about combined program status register			
<b>Part – B (Long Answer Questions)</b>					
11	a)	What are the features of arm cortex processor			
	b)	Explain about memory mapping of cortex processor			
12	a)	List out all general purpose registers and Special purpose Registers with application			
	b)	Discuss Combined program status Register and explain each flag			
13	a)	Draw and explain “Thumb programmer’s model			
	b)	Differentiate between ARM processor and OMAP processor			
14	a)	Briefly describe the features of the Cortex M3 based microcontrollers memory organization. What are the major address ranges? What is bit banding, what is nonaligned memory access. What are the main differences comparing to ARM7-based controllers?			
	b)	Describe a typical clock tree of a Cortex M core microcontroller. Explain the meaning and necessity of each clock signal source as well as clock signal divisions.			
15	a)	Briefly describe the features of the Cortex M3 based microcontrollers memory organization.			
	b)	What is Pipeline mechanism? Explain briefly the pipeline mechanism in Cortex-M3 Processor.			
16	a)	Differentiate between CORTEX processor and OMAP processor			
	b)	Discuss the features of OMAP processor			

\* **Blooms Taxonomy Level (BT)** (L1 – Remembering; L2 – Understanding; L3 – Applying; L4 – Analyzing; L5 – Evaluating; L6 –Creating)

**Course Outcomes (CO)**

**Program Outcomes (PO)**