Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Electronics and Communication Engineering

BEC502 – MICROPROCESSOR AND MICROCONTROLLER

Fifth Semester, 2017-18 (Odd Semester)

Course (catalog) description

Microprocessor is a required course for under-graduate students in the ECE program. The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor/controller implementation. Topics include Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquisition systems. Several laboratory exercises will be based on microprocessor (Intel 8086), microcontroller (Intel 8051) and ARM 7.

Compulsory/Elective course **:** Compulsory for ECE students

Credit & Contact hours **:** 3 & 45

Course Coordinator **: Ms.S.Philomina**, Assoc. Professor

Instructor(s) :

Name of the instructor	Class handling	Office location	Office Phone	Email (domain: @bharathuniv.ac.in)	Consultation
S.Philomina	III YEAR	SA 006		philomina.ece	12.30 - 1.30 PM
S.Beulah Hemalatha	III YEAR	SA 006		beulahhemalatha.ece	12.30 - 1.30 PM
V.Srinivasan	III YEAR	SA 006		srinivasan.ece	12.30 - 1.30 PM

Relationship to other courses

Pre-requisites : Principles of Digital Electronics

Assumed knowledge : Basic knowledge in Digital Electronics

Following Courses : Nil

UNIT 1 MICROPROCESSOR 8086 **9 HOURS**

Register Organization -Architecture-Signals-Memory Organization-Bus Operation-I/O Addressing-Minimum Mode-Maximum Mode-Timing Diagram-Interrupts - Service Routines – I/O and Memory Interfacing concepts.

UNIT 2 PROGRAMMING OF 8086 **9 HOURS**

Addressing Modes-Instruction format-Instruction set-Assembly language programs in 8086. RISC architecture – introduction to ARM Programming register configuration and instruction set - introduction to PIC Programming register configuration and instruction set – sample program.

UNIT 3 INTERFACING DEVICES **9 HOURS**

Programmable Peripheral Interface (8255) - Programmable Interval Timer (8254) - Programmable Interrupt Controller (8259A) - Programmable DMA Controller (8257) - Programmable Communication Interface (8251A) – Programmable Keyboard and Display Controller (8279).

UNIT 4 MICROCONTROLLER-8051 **9 HOURS**

Register Set-Architecture of 8051 microcontroller- I/O and memory addressing-Interrupts-Instruction set- Addressing modes. Timer-Serial Communication-Interrupts Programming-Interfacing to External Memory-Interfacing to ADC, LCD, DAC, Keyboard and stepper motor.

UNIT 5 SYSTEM DESIGN USING MICROPROCESSOR & MICROCONTROLLER **9 HOURS**

Case studies – Traffic light control, washing machine control, RTC Interfacing using I2C Standard- Motor Control- Relay, PWM, DC & Stepper Motor.

TOTAL 45 HOURS

Text book(s) and/or required materials

TEXT BOOKS

T1. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 -Microcontroller and Embedded systems", 7th Edition, Pearson Education, 2004.

T2. Doughlas.V.Hall, “Microprocessor and Interfacing : Programming and Hardware”, Revised 2nd edition, McGraw Hill, 1992

T3. Steve Furber, “ARM System On Chip Architecture”, Second Edition,Pearson Education, 2000.

T4. K. Ray and K. M. Bhurchandi, "Advanced Microprocessors and Peripherals – Architectures, Programming and Interfacing", Tata McGraw Hill, 2002 Reprint

T5. Design with PIC microcontroller by John B Peatman.

REFERENCES

R1. Kenneth.J.Ayala, “8051 Microcontroller Architecture, Programming and Applications”, 3rd edition, Thomson, 2007.

R2. nuvoTon Cortex M0 (Nu-LB-NUC100/140) Driver and Processor Reference Manual;

R3. www.nuvoton.com

Computer usage:

Students are expected to use the computer to write and assemble assembly language programs and also run them by downloading them to the target microprocessor. Students will also use a microprocessor software simulator that runs on the personal computer. Students will also prepare lab reports and conduct out-ofclass assignments using the computer

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Communication | Signal Processing | Electronics | VLSI | **Embedded**

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 15	2 Periods
2	Cycle Test-2	September 2nd week	Session 16 to 30	2 Periods
3	Model Test	October 3rd week	Session 31 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

The scope of this course is to provide the complete analysis of Microprocessor and Microcontroller. This knowledge helps them to acquire better application of these in Embedded system. The overall objective is to introduce the student to the basics of Microprocessor and Microcontroller . This course emphasizes:	Correlates to program outcome		
	H	M	L
1. 8086 microprocessor and its applications, introduction to ARM and PIC	a, c, d	e,f	g
2. Programming of 8086	a, c, d	e,f	g
3. Understanding the details of interfacing ICs	a, c, d	e,f	g
4. 8051 architecture and its interfacing	a, c, d	e,f	g
5. Application of Processor and controllers	a, c, d	e,f	g
6. The program prepares students to successfully compete for employment in Electronics, Manufacturing and Embedded fields.	a, c, d	ef	g

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
UNIT I - MICROPROCESSOR 8086			
1	Register Organization	No	T4/C1
2	Architecture of 8086	No	T4/C1
3	Signals	No	T4/C1
4	Memory Organization	No	T4/C1
5	Bus Operation	No	T4/C1
6	I/O Addressing	No	T4/C1
7	Minimum Mode	No	T4/C1
8	Maximum Mode	No	T4/C1
9	Timing Diagram	No	T4/C1
10	Interrupts	No	T4/C4
11	Service Routines, I/O interfacing	No	T4/C4
12	Memory Interfacing concepts.	No	T4/C5
UNIT II - PROGRAMMING OF 8086			
13	Addressing Modes	No	T4/C2
14	Instruction format of 8086	No	T4/C2
15	Instruction set of 8086	No	T4/C2
16	Assembly language programs in 8086	No	T4/C3
17	Introduction to ARM	No	T3/C1
18	ARM Programming register configuration	No	T3/C2
19	ARM instruction set	No	T3/C3
20	RISC architecture	No	T4/C13
21	Introduction to PIC	No	T5/C2
22	PIC Programming register configuration	No	T5/C2
23	PIC instruction set	No	T5/C2
24	PIC program	No	T5/C2
UNIT III - INTERFACING DEVICES			
25	Introduction to Programmable Peripheral Interface (8255)	No	T4/C5
26	Block diagram and Interfacing of 8255	No	T4/C5
27	Introduction to Programmable Interval Timer (8254)	No	T4/C6
28	Block diagram and Interfacing of 8254	No	T4/C6
29	Introduction to Programmable Interrupt Controller (8259A)	No	T2/C8
30	Block diagram and Interfacing of 8259A	No	T2/C8

31	Introduction to Programmable DMA Controller (8257)	No	T4/C7
32	Block diagram and Interfacing of 8257	No	T4/C7
33	Introduction to Programmable Communication Interface (8251A)	No	T4/C6
34	Block diagram and Interfacing of 8251A	No	T4/C6
35	Introduction to Programmable Keyboard and Display Controller (8279).	No	T2/C9
36	Block diagram and Interfacing of 8279	No	T2/C9
UNIT IV - MICROCONTROLLER-8051			
37	Register Set	No	T1/C1
38	Architecture of 8051 microcontroller	No	
39	I/O and memory addressing	No	T1/C2
40	Interrupts, Instruction set	No	T1/C11
41	Addressing modes, Timer	No	T1/C5,C9
42	Serial Communication,	No	T1/C10
43	Interrupts Programming	No	T1/C11
44	Interfacing to External Memory, ADC	No	T1/C12
45	Interfacing to LCD	No	T1/C12
46	Interfacing to DAC	No	T1/C13
47	Interfacing to Keyboard	No	T1/C13
48	Interfacing to stepper motor	No	T1/C13
UNIT-V - SYSTEM DESIGN USING MICROPROCESSOR & MICROCONTROLLER			
49	Introduction to Traffic light control	No	T2/C10
50	Design of Traffic light control	No	T2/C10
51	Introduction to washing machine control	No	T2/C10
52	Design of washing machine control		T2/C10
53	RTC Interfacing using I2C Standard	No	T2/C10
54	Introduction to Motor Control	No	T2/C10
55	Design of Motor Control		T2/C10
56	Relay	No	T2/C10
57	PWM	No	T2/C10
58	DC motor	No	T2/C10
59	Stepper Motor	No	T1/C13
60	Design of stepper motor control	No	T1/C13

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignments/Seminar/Online test / Quiz		
Attendance	-	5%
Final exam	-	70%

Prepared by: S.Philomina, Assoc Professor, Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
S.PHILOMINA	
S.BEULAH HEMALATHA	
V.SRINIVASAN	

Course Coordinator **HOD/ECE**