Academic Course Description

SRM University
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

EC1016A Microprocessors and Microcontrollers

Fifth Semester, 2015-16 (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 both microprocessor (Intel 8086), microcontroller (Intel 8051) and ARM (nuvoTon- Nu-LB-LUC140)).

Compulsory/Elective course: Compulsory for ECE students

Credit hours: 3 credits

Course coordinator(s): Mr.A.V. M. Manikandan, Assistant Professor (Sr. Grade), Department of ECE

Instructor(s)

Name of the instructor	Class handling	Office location	Office phone	Email (@ktr.srmuniv.ac.in)	Consultations
Mrs. R. Manohari	X1	TP9S4	2055	manohari.r	Day-3 & Day-4: 9 am to 12.30 pm
Mr. R. Prithiviraj	X2	TP10S4	--	prithiviraj.r	Day-3, 4 & 5: 1.30 to 5 pm
Dr. Diwakar R Marur	X3	TP11S3	--	diwakar.r	Day-1 & 4: 1.30 to 5 pm
Mr. A.V. M. Manikandan	X4	TP12S2	--	manikandan.m	Day-1 & 4: 9 to 10.30 am
Mr. A. Joshua Jafferson	X5	TP1206A	2067	joshua.j	Day-3 & 4: 1.30 to 5 pm
Ms. D. Vijayalakshmi	Y1	TP1203A	2064	vijayalakshmi.d	Day-1 & 4: 1.30 to 5 pm
Mr. K. Ramesh	Y2	TP1106A	2063	ramesh.kr	Day-1 & 4: 9 to 10.30 am
Mrs. J. K. Kasthuri Bha	Y3	TP10S8	2070	kasthuribha.jk	Day-2, 3 & 5: 1.30 to 5 pm
Mr. M. Maria Dominic Savio	Y4	TP10S4	--	mariadominicsavio.m	Day-1 to 4: 2.30 to 5 pm
Mrs. M.K. Srilekha	Y5	TP1006A	2061	srilekha.m	Day-1 & 5: 1.30 to 5 pm
Mr. A.Sriram	Y6	TP103A	2065	sriram.a	Day-2 & 4: 3.30 to 5 pm

Relationship to other courses

Pre-requisites	:	EC1007 Digital Systems & EC1012 Electronic Circuits
Assumed knowledge	:	Satisfactory completion of basic digital electronics courses, Ability to convert decimal number into binary, octal, hexadecimal and visa versa, Ability to perform arithmetic operations in binary, octal and hexadecimal, Ability to use a computer to prepare written reports
Following courses	:	Nil

Text book(s) and/or required materials

1. A.K.Ray and K.M.Bhurchandi, "Advanced *Microprocessors and Peripherals*",Tata McGrawHill,2000.
2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, " *The 8051 – Microcontroller and Embedded systems*",7th Edition, Pearson Education , 2004.
3. Andrew N. Sloss, Dominic Symes, Chris Wright and John Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2004.
4. David Seal, "ARM Architecture Reference Manual", Pearson Education, 2007.
5. Michael J. Pont, "Embedded C", Addison Wesley, 2002.

References

6. Doughlas.V.Hall, " *Microprocessor and Interfacing : Programming and Hardware*", 2nd edition, McGraw Hill, 1991.
7. Kenneth.J.Ayala, "*8051 Microcontroller Architecture, Programming and Applications*".2nd edition, Thomson.

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-of-class 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

Class schedule : Three 50 minutes lecture sessions per week, for 15-16 weeks

Section	Schedule
X1	Day-1: 3, Day-2: 8, Day-5: 2
X2	Day-1: 3, Day-2: 8, Day-5: 2
X3	Day-1: 3, Day-2: 8, Day-5: 2
X4	Day-1: 3, Day-2: 8, Day-5: 2
X5	Day-1: 3, Day-2: 8, Day-5: 2
Y1	Day-1: 3, Day-2: 4, Day-5: 2
Y2	Day-1: 3, Day-2: 4, Day-5: 2
Y3	Day-1: 3, Day-2: 4, Day-5: 2
Y4	Day-1: 3, Day-2: 4, Day-5: 2
Y5	Day-1: 3, Day-2: 4, Day-5: 2
Y6	Day-1: 3, Day-2: 4, Day-5: 2

Instructional Objectives (IOs)

The instructional objectives of the course are:	Correlates to Student Outcomes (SOs)		
	H	**M**	**L**
1. Understand fundamental operating concepts behind microprocessors and microcontrollers.	b, d		a, c
2. Appreciate the advantages in using RISC microprocessors / microcontrollers in engineering applications.	c, d		
3. Design microprocessor based solutions to problems.	c, d	b	a
4. Understand Low-Level and Embedded C Programming.	b, c	d	a, f
5. Apply this knowledge to more advanced structures.	k	i, j	f
H: high correlation, M: medium correlation, L: low correlation			

Course Learning Outcomes

1. Students should be able to solve basic binary math operations using the microprocessor. / microcontroller
2. Students should be able to demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor / microcontroller.
3. Students should be able to program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program.
4. Students should be able to apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator.

Teaching plan

Session #	Topics	Text / Chapter	Problem Solving (Y / N)	Correlation of topics with IOs & SOs	
UNIT-I: MICROPROCESSOR- 8086					
1, 2	Register Organization, Architecture	[1] chapter(s) – 1, 4 [6] chapter(s) – 2	Y	i.	a, d, i, j
3	Signals				
4	Memory Organization		Y	iii.	
5	Operation Bus				
6	IO Addressing		Y	ii.	
7, 8	Minimum Mode, Maximum Mode operation	[1] chapter(s) – 1, 4 [6] chapter(s) – 2, 7, 8	N	i.	a, d, i, j
9	Interrupts & Service Routines		Y	v.	
UNIT-II: PROGRAMMING OF 8086					
10	Addressing Modes	[1] chapter(s) – 2, 3 [6] chapter(s) – 2 to 6	Y	ii.	c, e, f, k
11-13	Instruction Format-Instruction Set		Y	ii.	
14-16	Assembly language Programs in 8086		Y	ii.	
UNIT-III: INTERFACING DEVICES					
17	IO and Memory Interfacing concepts *(Elementary treatment only – not included in the syllabus)*	[1] chapter(s) - 5 [6] chapter(s) – 8 to 11	Y	iv.	c, d, e, f
18	Programmable Peripheral Interface (8255)				
19	Programmable Interval Timer (8254)		Y	iv.	
20	Programmable Interrupt Controller (8259A)		Y	iv.	
21	Programmable DMA Controller (8257)		Y	iv.	
22	Programmable Communication Interface (8251)		Y	iv.	
23	Programmable Keyboard and Display Controller (8279)		Y	iv.	
UNIT-IV: MICROCONTROLLER-8051					
24	Register Set	[1] chapter(s) - 17 [2] chapter(s) - 1 [7] chapter(s) – 3	N	i.	a, d, i, j
25	Architecture of 8051 microcontroller		N	i.	
26	IO and Memory Addressing		Y	iii.	a, d, j
27	Interrupts *(Do it yourself)*		Y	v.	
28-30	Instruction Set, Addressing Modes	[1] chapter(s) - 17 [2] chapter(s) – 2,3,5,6 [7] chapter(s) – 4 to 8	Y	ii.	c, e, f
UNIT-V: PROGRAMMING OF 8051					
31-32	Introduction to Embedded C Programming	[5] chapter(s) – 1 to 6	Y	ii.	c, e, f, k

Session #	Topics	Text / Chapter	Problem Solving (Y / N)	Correlation of topics with IOs & SOs	
33-34	Timer , Serial Communication	[1] chapter(s) - 17 [2] chapter(s) – 9 [7] chapter(s) – 2, 11	Y	vi.	c, d, e, f, k
35	Interrupts Programming	[1] chapter(s) - 17 [2] chapter(s) – 11, 13 [7] chapter(s) – 2	Y	v.	c, d, e, f, k
36	Interfacing to External Memory		Y	iv.	
37	Interfacing 8051 to ADC, LCD, Keyboard and stepper motor *(Do it yourself)*		Y	iv.	
UNIT-II: HIGH PERFORMANCE RISC ARCHITECTURE- INTRODUCTION					
38-39	ARM organization and implementation	[3] chapter(s) – 1, 2 [4] chapter(s) – A1, A2	N	i.	a, d, i, j, k
40	The ARM instruction set *(Elementary treatment only)*	[3] chapter(s) – 3, 4 [4] chapter(s) – A3 to A6	Y	ii.	c, d, e, f, i, k
41	The thumb instruction set *(Elementary treatment only)*		Y	ii.	
42	Basic ARM ALP (32-bit addition, subtraction, multiplication, binary sorting)		Y	ii.	
43-45	The ARM (nuvoTon –NU-LB-NUC140) architecture *(Elementary treatment only)*	Data sheets	N	i.	a, d, i, j, k

Evaluation methods

Cycle Test – I	-	10%
Cycle Test – II	-	10%
Model Test	-	20%
Surprise Test	-	5%
Attendance	-	5%
Final exam	-	50%

Prepared by: Mr. A.V.M. Manikandan, Assistant Professor (Senior Grade), Department of ECE

Dated: 24-June-2015

Revision No.: 00 **Date of revision:** NA **Revised by:** NA

Course Coordinator	Academic Coordinator	Professor In-Charge	HOD/ECE
(Manikandan A V M)	(Mrs. N. Saraswathy)	(Dr. B. Ramachandran)	(Dr. S. Malarvizhi)

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 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: Graduates will perform as a successful professional engineer in related fields of Electronics and Communication Engineering.

PEO2: Graduates will pursue higher education and/or engage themselves in continuous professional development to meet global standards.

PEO3: Graduates will work as a team in diverse fields and gradually move into leadership positions.

PEO4: Graduates will understand current professional issues, apply latest technologies and come out with innovative solutions for the betterment of the nation and society.

ATTESTATION FROM COURSE TEACHERS

Name of the instructor	Signature
Mrs. R. Manohari	
Mr. R. Prithiviraj	
Dr. Diwakar R Marur	
Mr. A.V. M. Manikandan	
Mr. A. Joshua Jafferson	
Ms. D. Vijayalakshmi	
Mr. K. Ramesh	
Mrs. J. K. Kasthuri Bha	
Mr. M. Maria Dominic Savio	
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