Academic Course Description

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

VL2103 Low power VLSI Design

Second Semester, 2014-15 (even semester)

Course (catalog) description

This is a course on the design and applications of low power integrated circuits. This course introduces various strategies and methodologies for designing low power circuit and systems. It describes the many issues facing designers at architectural, logic, circuit and device levels and presents some of the techniques that have been proposed to overcome these difficulties. The course concludes with the future challenges that must be met to design low power, high performance systems

Compulsory/Elective course: Elective Course for I Year M.Tech VLSI Design

Credit hours: 3 credits

Course coordinator(s)

Dr.P.Aruna Priya, Professor, Department of ECE

Instructor(s)

Name of the instructor	Class handling	Office location	Office phone	Email	Consultations
Dr.P.Aruna Priya	VLSI - A	TP10S6	2057	arunapriya.p@ktr.srmuniv.ac.in	**1.00 to 1.30 pm**

Relationship to other courses

Pre-requisites : EC0203 Electron Devices, courses with fundamentals in digital design in VLSI, CMOS devices

Assumed knowledge : Basic knowledge in circuit analysis

Following courses : *N.A*

Text book(s) and/or required materials

1. Gary Yeap "Practical Low Power Digital VLSI Design", 1997
2. Kaushik Roy , Sharat C. Prasad, "Low power CMOS VLSI circuit design", Wiley Inter science Publications". (1987)
3. Kiat-Seng Yeo, Kaushik Roy, “Low Voltage Low Power VLSI Subsystems”, Tata McGraw Hill, 2009.

Class schedule : Four 50 minutes lecture sessions per week, for 11 weeks

Section	Schedule
VLSI - A	DO 1 – 4, DO2 7, DO 3 – 5, DO 5 - 2

Professional component

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

Broad area : VLSI

Test Schedule

S. No.	Test	Portions	Duration
1	Cycle Test-1	Week 1 to 4	2 Periods
2	Model Test	Week 1 to 11	3 Hrs

Class Duration: 50 Mins

Weekly teaching plan

Week #	Topics	Study Material Reference
1	Introduction to low power VLSI design	[1] chapter-1
	Need for low power VLSI chips	
	Charging and discharging capacitance	
	Short circuit current, Short circuit variation	
	CMOS leakage currents	

Week #	Topics	Study Material Reference
	Sub-threshold currents,	
2	Principles of low power design	[1] chapter-1&3
	Figures of merit, Random logic signals,	
	Probability and frequency, Conditional Probability and frequency	
3	Probabilistic Power analysis techniques, Probabilistic Power analysis techniques	[1] chapter-3
	Propagation of transition density, Signal entropy, Power estimation using entropy	
	Power estimation using entropy, Sizing an inverter chain	
4	Transistor and gate sizing for dynamic and leakage power reduction, Pin ordering, Transistor network restructuring	[1] chapter-3
	Partitioning and reorganization	
	Flip flops , latch circuits, Self gating flip flop, Combinational and double edge triggered flip flop	
5	Adjustable device threshold voltage	[1] chapter-3
	Gate reorganization , local restructuring	
6	Signal gating , Logic encoding, Bus invert encoding	[1] chapter-4
	Pre-computation logic – basics, Alternate architectures, Clock gating	
	Reduced swing clock & Oscillator circuit, Frequency division	
7	CMOS floating node Low power bus	[1] chapter-4
	Memory bank partitioning, Switching activity reduction,	
	Parallel voltage reduction & Operator reduction	
	Adiabatic computation, Pass transistor logic	
8	Basics of SRAM, Memory cell	[3] chapter-6
	Pre charge and equalization circuit decoder	
	ATD sense amplifier	
	Output latch,	
9	low power SRAM technologies	[3] chapter-7
	Types of DRAM	
	Basics of DRAM, Cell refresh circuit	

Week #	Topics	Study Material Reference
	HVG, BBG	
10	BVG, RVG, VDC	[3] chapter-7
	Low power circuit design style	
	Low power circuit design style	
11	Software power estimation	[2] chapter-8
	Software power estimation	
	Co design for low power	
	Co design for low power	

Evaluation methods

Cycle Test – I	-	20%
Model Test	-	20%
Surprise Test	-	5%
Assignment	-	5%
Final exam	-	50%

Prepared by:Dr. P. Aruna Priya

Dated: 5th Jan., 2015 **Revision No.:** 00 **Date of revision:** NA

Addendum

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

a. Graduates will demonstrate knowledge of mathematics, science and engineering.
b. Graduates will demonstrate the ability to identify, formulate and solve engineering problems.
c. Graduate will demonstrate the ability to design and conduct experiments, analyze and interpret data.
d. Graduates will demonstrate the ability to design a system, component or process as per needs and specifications.
e. Graduates will demonstrate the ability to visualize and work on laboratory and multi-disciplinary tasks.
f. Graduate will demonstrate the skills to use modern engineering tools, software's and equipment to analyze problems.
g. Graduates will demonstrate the knowledge of professional and ethical responsibilities.
h. Graduate will be able to communicate effectively in both verbal and written form.
i. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

j. Graduate will develop confidence for self education and ability for life-long learning.

k. Graduate will show the ability to participate and try to succeed in competitive examinations.

Program Educational Objectives

1. To prepare students to compete for a successful career in Electronics and Communication Engineering profession through global education standards.
2. To enable the students to aptly apply their acquired knowledge in basic sciences and mathematics in solving Electronics and Communication Engineering problems.
3. To produce skillful graduates to analyze, design and develop a system/component/ process for the required needs under the realistic constraints.
4. To train the students to approach ethically any multidisciplinary engineering challenges with economic, environmental and social contexts
5. To create an awareness among the students about the need for life long learning to succeed in their professional career as Electronics and Communication Engineers.