GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. - Electronics & Communication Engineering
(VLSI &Embedded Systems Design)
Semester: I

Subject Name**: Advanced Computer Architecture (Elective –I)**
Subject Code: **715205**

Objective:

The main objectives of the course are

- To study the modern computer organization by following the examples of Pentium 4, Itanium 2, OpenSPARC T1 and T2, PowerPC and ARM processors
- To study the virtual memory (paged and segmented) and multilevel cache memory organization.
- To study the organization of instruction pipelining.
- To study the methods of input/output organization

Lecture:

UNIT I - Introduction & Performance measurement in computer architecture

Basic concepts of computer organization. The stored program model. Classes of computer architecture. Processor vs. System architecture. Elements of computer systems – processors, memories, I/Os, disks, buses etc.
Goals of computer architecture – performance, throughput, latency, power, cost. Processor performance vs. system performance. Comparison of various platforms in terms of performance and efficiency.

UNIT II- Processor Architecture

Internal elements and architecture of processors. Instruction execution. Instruction set architectures, CISC vs. RISC architectures. Bus architecture. Multi Processor architecture. Memories and Caches. Cache coherency. Pipelining and data path elements.

UNIT III - System and System on Chip architecture

System architecture elements. H/W component selection and datasheet analysis. Bill of Materials. IP selection and System on Chip integration. Standard interfaces and I/Os. Analog and Mixed signal element integration. Reset and clocking elements. Multi processor system.

UNIT IV - Special processor/system architecutes

Application specific processors. Packet processing. Microcontrollers. Network controllers. DSP and Multimedia processors. GPU elements.

UNIT V - Current Architectural survey

An overview of the latest Intel, ARM, TI, SPARC and Power PC architectures as modern SOC architectural elements.

Lab :

Tools used during laboratory works: Linux, Perl, Gcc,Gdb.

- Study and implementation of processor performance using opencores.
- Study and implementation of performance of openSPARC and ARM / ARC processors.
- Study and implementation of SOC architectures

Course Project:

A project of suitable complexity, comprising of program design, coding, compilation and debug must be completed.

Course Material:

The field of VLSI and Embedded Systems is getting updated constantly and to keep up to date with the latest research, technology and industry trends, Instructor for this course will decide and provide the course material. This could be a combination of slides or research material or text book references or any other relevant documentation depending on a) the nature of the curriculum and b) relevant skills to be imparted as outcome of the course.

Reference Books:

1. V.C. Hamacher, Z.G. Vranesic, S.G. Zaky. "Computer Organization". 5th Edition. "Peter", 2003. 832p.
2. David A. Patterson and John L. Hennessy. Computer Organization and Design, Revised Printing, Third Edition, Third Edition: The Hardware/Software Interface (The Morgan Kaufmann Series in Computer. Series in Computer Architecture and Design). Morgan Kaufmann; 3rd Edition. 2007. 741p.
3. Andrew S. Tanenbaum. Structured Computer Organization Prentice Hall; 5th Edition. 2005. 800p.
4. W. Stallings. "Computer Organization and Architecture. Designing and Performance". 7th Edition. Prentice Hall. 2005. 792p.
5. J.L. Hennessy, D.A. Patterson. "Computer architecture: A Quantitative Approach", 4th Edition. Morgan Kaufmann, 2006. 704p.
6. UltraSPARC T1™ Supplement to the UltraSPARC Architecture 2005. Sun Microsystems. 2006
7. OpenSPARC™ T2 Core Microarchitecture Specification. Sun Microsystems. 2008