CSE11116	Computer Organization and Architecture	L	T	P	C
Version 1.0	Contact Hours 45 Hours	3	0	0	3
Pre-requisite/Exposure	Digital Logic				
Co-requisite	NIL				

Course Objectives:

- To study the basic organization and architecture of digital computers (CPU, memory, I/O, software). Discussions willinclude digital logic and microprogramming. Such knowledge leads to better understanding and utilization of digital computers, and can be used in the design and application of computer systems or as foundation for more advanced computer-related studies.
- To
- help the
- student to acquire knowledge of software evolution process.
- To enable students modelling software project with appropriate metric and precision at workplace.
- To give the students a perspective to software design process variables by exposing them to software specification document; and also, to enrich their software testing ability.
- To enable students, acquire testing and quality assessment of model required for their profession.

Course Outcomes:

On the completion of this course the student will be able to

CO1: Define functional block of a computer and relate data representation

CO2: Explain and understand memory hierarchy design, memory access time formula, performanceimprovement techniques, and trade-offs.

CO3: Analyze the concepts of memory utilization in a computer system.CO4: Analyze the concepts of memory utilization in a computer system.

CO5: Define the implementation of parallel processors and Analyze the synchronization techniques

On completion of this course, the students will be able to CO1.Interpret the impact of software engineering.

CO2. Communicate with proper software model paradigm to pupils.

CO3. Enhancement of software metric engineering application in industry. CO4. Effectively analyse testing and maintenance of software project.

CO5. Illustrate software metric analysis for an effective model.

Course Description:

The architecture of computer systems and associated software. Topics include addressing modes, interrupt systems, input/output systems, external memory systems, assemblers, loaders, multiprogramming, performance evaluation, and data security.

This task is challenging for several reasons. First, there is a tremendous variety of products that can rightly claim the name of computer, from single-chip microprocessors costing a few dollars to supercomputers costing tens of millions of dollars. Variety is exhibited not only in cost, but also in size, performance, and application. Second, the rapid pace ofchange that has always characterized computer technology continues with no letup. These changes cover all aspects ofcomputer technology, from the underlying integrated circuit technology used to construct computer components, to theincreasing use of parallel organization concepts in combining those components. In spite of the variety and pace of change in the computer field, certain fundamental concepts apply consistently throughout. The application of these concepts depends on the current state of the technology and the price/performance objectives of the designer. The intentof this paper is to provide a thorough discussion of the fundamentals of computer organization and architecture and to relate these to contemporary design issues.The subtitle suggests the theme and the approach taken in this book. It has always been important to design computer systems to achieve high performance, but never has this requirement been stronger or more difficult to satisfy than today. All of the basic performance characteristics of computer systems, including processor speed, memory speed, memory capacity, and interconnection data rates, are increasing rapidly. Moreover, they are increasing at different rates. This makes it difficult to design a balanced system that maximizes theperformance and utilization of all elements.

There is a growing need for talented software developers across every industry. As technology advances, the ability to build quality software while considering design, development, security, and maintenance is sought after amongst all kinds of companies, from finance and banking to healthcare and national security.

Software Engineering applies the knowledge and theoretical understanding gained through computer science to building high-quality software products. As a maturing discipline, software is becoming more and more important in our everyday lives. Our software development and engineering professional program is Pace University's response to the tremendous growth of the software development industry.

Course Content:

Units	Lecture Hours
Unit-I: Introduction: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressingmodes.	**8**
Unit-II: Computer Arithmetic : Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division andlogic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers Control Unit: Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro	**10**

Units	Lecture Hours
operations, execution of a completeinstruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: microprogramme sequencing, concept of horizontal and vertical microprogramming. RISC Scalar Procesors, CISC Scalar Process, Super Scalar and Vector Procesor and its Instruction Set Architecture.	
Unit-III: Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk,magnetic tape and optical disks Virtual memory Technology, Virtual Meory Models, TLB, Paging, Segmentaion & its concept of implementation, Shared Memory Organization, Interleaved Memory Organization, Cache Memory Optimization Input / Output: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**12**
Unit-IV: Pipeline and Superscalar: Linear Pipeline, Non- Linear Pipeline, Instruction Pipeline Design, Arithmetic Pipeline Design, Super Scalar & SuperpipelineDesign Paralle Computing Models: PRAM & VLSI models, Shared & Distributed memory multi Computers, Vector Super Computers & SIMD Super Computers	**10**
Unit-V: Motivation: why parallel computing, Fundamentals of parallel computing, PCA components & systems, PCA architectures:ARM Architectures, x86 Architectures, Other Sample Architectures.	**5**
Unit-I: Software - Evolving role of it, a crisis on the Horizon and its Myths, Software process models: linear sequential model, prototyping model, RAD model, Evolutionary model, Formal methods model, Component based development, fourth generation techniques, Software development and requirement analysis using Agile, Scrum framework.	**9**
Unit-II: Management spectrum, people, problem, process, project and few Critical approach, Software Process and project metrics: Measure, Metrics and Indicators, Process and Project Domain related metrics, Software Measurement, Reconciling of Different, Metrics Approaches, Software quality metrics, Validation management, Software project planning: Observations on estimation, Objectives of Project planning.	**10**
Unit-III: Resources: Software project estimation, Empirical models for estimation, Automated estimation tools, Risk management and Software risks:	**8**

Units	Lecture Hours
Identification, Risk projection, safety risks and hazards; RMMM plans, Risk management	
Unit-IV: Project scheduling and tracking: Definition of task set and task network, Scheduling, earned value analysis, Tracking of Errors, Project planning, Software quality assurance: Concepts of Software Quality, Quality movement, Review of software quality assurance, Software reliability, Software quality metrics (MTTF, MTTR, MTBF ETC.)	**9**
Unit-V: Software configuration management: Object identification in software configuration, Configuring audit-SCM standards, Analysis concepts and principles: Requirement analysis, Software prototyping, Specification Review Analysis modeling, Data modeling, Functional modeling, Behavioral modeling, Software design, Software testing techniques: White box and black box testing, Software testing strategies - Unit testing, Integrating testing, System testing.	**9**

Text Books:

- Computer Organization 1.and Design: The Hardware/Software Interface, 5th Edition by David A. Patterson and John
- L. Hennessy, Elsevier.
- Computer Organization and Embedded Systems, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.
- Software Engineering: A practitioner's approach, 8th Edition, Roger S. Pressman, McGraw Hill
- An integrated approach to Software Engineering, Springer/Narosa Edition, Pankaj Jalote.

Reference Books:

- mputer Architecture and Organization, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, PearsonEducation.
- mputer System Design and Architecture, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education
- Fundamentals of Software Engineering, 4th Edition, Rajib Mall, Prentice Hall, India.

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

Relationship between Course Outcomes (COs) and Program Outcomes (POs):

1 = Weakly Mapped

2 = Moderately Mapped3 = Strongly Mapped

1=weakly mapped

2= moderately mapped 3=strongly mapped

Course Code	Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE11	Compute	CO111	2	3	3	3	2	2	1	-	2	-	-	2	3	2	3
116	r	16.1															
	Organiza	CO111	2	2	3	3	3	1	2	-	1	-	-	2	3	3	1
	tion and	16.2															
	Architect ure	CO111 16.3	2	3	3	2	2	2	2	-	1	-	-	3	3	1	3
		CO111	2	3	2	2	3	2	2	-	1	-	-	3	2	1	3
		16.4															
		CO111	3	3	3	2	2	3	3	-	3	-	-	3	3	2	3
		16.5															
		CO111	2.	2.	2.	2.	2.	2.	2.	-	1.	-	-	2.6	2.8	1.8	2.6
		16	2	8	8	4	4	0	0		6						

Course Code	Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE11	Softwar	CO111	3	1	2	1	3	2	3	-	3	3	2	2	3	1	2
117	e	17.1															
	Enginee ring	CO111 17.2	2	2	1	2	3	1	3	-	3	-	-	1	1	1	1
		CO111	3	1	2	1	2	2	1	-	1	-	-	3	2	1	1
		17.3															
		CO111	3	3	3	3	3	2	1	3	3	-	-	3	2	2	2
		17.4															
		CO111	2	1	3	3	2	3	2	3	3	-	-	3	2	3	2
		17.5															
		CO111	2.	1.	2.	2.	2.	2.	2.	3.	2.	3.0	2.0	2.4	2.0	1.6	1.6
		17	6	6	2	0	6	0	0	0	6						