

Unit	Contents	Page No
1	Fundamentals of Computer Design	1
	Introduction	1
	Classes of Computers	2
	Desktop Computing	2
	Defining Computer Architecture	3
	Trends in Technology	5
	Trends in Power in Integrated Circuits	7
	Dependability	8
	Quantitative Principles of Computer Design	10
2	Pipelining: Basic and Intermediate Concepts	13
	Basic Performance Issues in Pipelining	16
	Pipeline Hazards	16
	What Makes Pipelining Hard to Implement?	23
3	Instruction Level Parallelism-1	26
	Data Dependency and Hazard	27
	Control Dependence	28
	Basic Pipeline Schedule and Loop Unrolling	29
	Dynamic Branch Prediction	32
	ROB	35
4	Instruction-Level Parallelism-2	40
	Exploiting ILP: Multiple Issue Computers Static Scheduling	44
	Exploiting ILP: Multiple Issue Computers Dynamic Scheduling	47
	Instruction Execution Process	48
	A Real Computer: Intel Pentium 4	52
5	Multiprocessors and Thread-Level Parallelism	58
	Symmetric Shared-Memory Architectures	63
	Performance Measurement	69
	Distributed Shared-Memory Architectures	70
	Synchronization: The Basics	73

	Memory Consistency Models	75
6	Review of Memory Hierarchy	77
	Cache Optimizations	80
7	Memory Hierarchy Design	88
	11 Advanced Cache Optimizations	90
	Main Memory Background Performance of Main Memory	98
	Protection	102
8	Hardware and Software for VLIW and EPIC	107
	Loop Level Parallelism-Detection and Enhancement	107
	Scheduling and Structuring Code for Parallelism	112
	H/W Support: Conditional Execution	121
	Hardware support for Compiler Speculation	124
	IA-64 and Itanium Processor	129