SEMESTER VII

CS-701: ADVANCE COMPUTER ARCHITECTURE

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exams	Total	
3	1	0	4	40	60	100	3Hrs

COURSE OBJECTIVE:

With increase in availability of system resources, concept of parallel architecture has obtained immense popularity. This course provides a comprehensive study of scalable and parallel computer architectures for achieving a proportional increase in performance with increasing system resources.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**The State of Computing:** System attributes to performance, multiprocessors and multicomputer, shared memory and distributed memory, taxonomy of MIMD computers, multivector and SIMD computers, PRAM and VLSI models. **Parallelism:** Data and resource dependencies, hardware and software dependencies; program partitioning and scheduling: grain sizes and latency, grain packaging and scheduling; program flow mechanism: control flow versus data flow, demand driven mechanism, comparisons of flow mechanisms; system interconnect architectures: network properties and routing, static connection networks.	10
II	**Performance Metrics and Measures:** Parallelism profile in programs, harmonic mean performance, efficiency, utilization and quality, standard performance measures, speedup performance law: Amdahl's law for a fixed workload, Gustafson's law for scaled problems, scalability analysis and approaches, scalability metrics and goals, evolution of scalable computers. **Advance Processor Technology:** Design space of processors, instruction set architecture, CISC and RISC scalar processors; superscalar and vector processors: superscalar processors, the VLIW architecture, vector and symbolic processors; memory hierarchy technology: hierarchical memory technology, inclusion, coherence and locality, memory capacity planning.	10
III	**Multiprocessor System Interconnects:** Hierarchical bus system, crossbar switch and, multiport memory, multistage and combining networks; cache coherence and synchronization mechanism, the cache coherence problem, snoopy bus protocol, directory	10

	based protocols, hardware synchronization mechanisms. **Vector Processing principles:** Vector instruction types, vector access memory schemes. **Multivector Multiprocessors:** Performance directed design rules, Cray Y – MP, C-90 and MPP, SIMD computer organization: implementation models, the CM-2 architecture, introduction to multicore architecture	
IV	**Parallel Programming Models:** Shared variable model, message passing model, data parallel model, object oriented model, function and logic models. **Parallel Language and Compilers:** Language feature for parallelism, parallel language constructs, optimizing compiler for parallelism. **Parallel Programming Environment:** Software tools and environment, Y-MP, Pargon and CM-5 environment, visualization and performance testing. **Synchronization and Multiprocessing Modes:** Principles of synchronization, multiprocessor execution models, shared-variable program structures, locks for protected access, semaphores and applications, monitors and application, message-passing program development, distributing the computation, synchronous message passing, asynchronous message passing. **Mapping Programs on to Multicomputer:** Domain decomposition techniques, control decomposition techniques, heterogeneous processing.	9

Text Books:

1. Kai Hawang: ***"Advance Computer Architecture – Parallelism, Scalability and Programmability"***, McGraw Hill International Edition.