CSPE3017 ADVANCED COMPUTER ARCHITECTURE (3-0-0)

Course Objective:
The objective of this course is to gain in depth knowledge of architecture, learn parallel processing and its application to solve workloads, and understanding pipelined and non-pipelined processing.

Module - I: (10 Hours)
Flynn‟s classification: SISD, SIMD, MISD, MIMD, message passing, Loosely coupled and tightly coupled system, Basic ideas on parallel algorithm: SIMD algorithm for matrix multiplication. Parallel Processing: Definition, Theory of Parallelism. Parallel Computer Models, Parallelism in Uni-processor computers, Implicit Parallelism vs. explicit parallelism, Levels of parallelism. Software Parallelism, Hardware Parallelism. Pipelining : Linear pipe line processor, Asynchronous and Synchronous models, speed up,Efficiency,Throughput,Nonlinearpipelineprocessor,Instructionpipeline,Conditions of Parallelism pipeline hazards, Arithmetic pipeline

Module - II: (08 Hours)
Parallel Interconnection Systems: Static and Dynamic Networks, Linear Array, Ring, Star, Tree, Mesh, Systolic Array, Chordal ring, Completely connected network, Cube connected cycles, Torus, K-ary-n cube, Barrel shifter, single stage interconnection network, Multistage Interconnection Networks, Control Structure, Node degree, diameter, Bisection width, symmetric, functionality, Network Latency, Bandwidth, Scalability, Data routing functions:- Permutation, Perfect shuffle exchange, Hypercube Routing function.

Module - III: (06 Hours)
Instruction level parallelism: Concepts and challenges – Hardware and software approaches, Dynamic scheduling, Speculation, Branch prediction. Amdahl's Law.

Module - IV: (10 Hours)
Cache performance, Reducing cache miss penalty and miss rate, Reducing hit time, Main memory and performance, Mapping Techniques, Write Through and Write Back Protocols, Memory Interleaving technology, Buses, RAID

Module - V: (06 Hours)
Software and hardware multithreading, SMT and CMP architectures, Design issues, Case studies, Intel Multi-core architecture, SUN CMP architecture, heterogeneous multi-core processors, Case study: IBM Cell Processor.

Course Outcomes:
CO1: Gain in depth knowledge of architecture
CO2: Learn parallel processing and its application to solve workloads
CO3: Understanding pipelined and non-pipelined processing

Text Books:
1. Advanced Computer Architecture, byKai Hwang Mc Graw Hill.
2. Computer Architecture –A quantitative approach By J.L Hennessy and D.A.Patterson (Morgan)