**Advanced Computer Architecture**

**BEG478CO**

**Year: IV Semester: II**

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| **Teaching Schedule**  **Hours/Week** | | | **Examination Scheme** | | | | |
| **Theory** | **Tutorial** | **Practical** | **Internal** | | **Final** | | **Total** |
| **3** | **1** | **-** | **Theory** | **Practical** | **Theory** | **Practical** | **100** |
| **20** |  | **80** | **-** |

**Course Objectives**: To gain the knowledge needed to design and analyze high performance computer architecture

1. **Concept [5 Hrs]**
   1. Basic computational model
   2. Key concept relating to computational models
   3. Concept of Computer Architecture with interpretations and descriptions
2. **Introduction to Parallel Processing [6 Hrs]**
   1. Introduction, architectural classification schemes.
   2. Evolution of parallel processors, current & future trends towards parallel processors.
   3. Principles of pipelining and array processing.
   4. Scalar and vector pipelines.
3. **Vector and pipelined processors [6 Hrs]**
   1. Classification of pipelined processors, performance evaluation factors.
   2. Vector processing concepts, pipelined vector processors, Cray type vector processor

-design example.

* 1. Array processors, an example of data routing in array processor.
  2. Systolic arrays and their applications.

1. **Different parallel processing architectures [6 Hrs]**

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|  | * 1. Introduction to Associative memory processors. |  |
|  | * 1. Multithreaded arch –principles of multithreading, Latency hiding techniques. |
|  | * 1. Scalable coherent multiprocessor model with distributed shared memory. |  |

1. **Distributed Memory Architecture [6 Hrs]**
   1. Loosely coupled and tightly coupled architectures.
   2. Cluster computing as an application of loosely coupled architecture. Examples – CM\* and Hadup.
2. **Programmability Issues [3 Hrs]**
   1. Types and levels of parallelism.
   2. Operating systems for parallel processing, Models of parallel operating systems - Master-slave configuration, Separate supervisor configuration, Floating supervisor control.

1. **Program and Network Properties [5 Hrs]**
   1. Conditions of parallelism
      1. Data and Resource Dependences.
      2. Data dependency analysis - Bernstein’s condition
      3. Hardware and Software Parallelism.
      4. The role of Compilers.
   2. Program Partitioning and Scheduling
      1. Grain Sizes and Latency.
      2. Grain Packing and Scheduling.
      3. Static Multiprocessor Scheduling.
   3. System Interconnect Architectures
      1. Network Properties and Routing.
      2. Static Connection Networks.
      3. Dynamic Connection Networks.
2. **Parallel Models, Languages and Compilers [8 Hrs]**
   1. Parallel Programming Models
      1. Shared-Variable Model.
      2. Message-Passing Model.
      3. Data-Parallel Model.
      4. Object Oriented Model.
      5. Functional and Logic Models. f.
      6. Study of Open MP.
   2. Parallel Languages and Compilers
      1. Language Features for Parallelism.
      2. Parallel Language Constructs.
      3. Optimizing Compilers for Parallelism.
   3. Dependence Analysis of Data Arrays
      1. Iteration Space and Dependence Analysis.
      2. Subscript Separability and Partitioning.
      3. Categorized Dependence Tests.
   4. Code Optimization and Scheduling
      1. Scalar Optimization with Basic Blocks.
      2. Local and Global Optimizations.
      3. Vectorization and Parallelization Methods.
      4. Code Generation and Scheduling.
      5. Trace Scheduling Compilation

**Reference Books :**

1. Advanced computer architecture – Kai Hwang (MGH).
2. Computer Architecture and Parallel Processing – Kai Hwang And Briggs (MGH).
3. Advanced computer Architecture – Dezso Sima, Terence Fountain & Peter Kacsuk (Pearson Education)
4. Parallel Programming Techniques & Applications using Networked Worksataions & Parallel Computers-Barry Wilkinson & Michael Allen–Second Edition (Pearson Education).
5. Introduction to Parallel Processing – M. Sasikumar, D. Shikare & P. Ravi Prakash (PHI).
6. Internet for Open MP, Hadup and others.

**Student Work** :

It should consist of minimum 10-12 assignments with emphasis on solving problems.

**Board Exam Questions patterns**

Total 10 questions and 8 questions to solve 10\*8=80 marks