CSE - - - - : Network-On-chip

Programme: B.Tech (CSE)	Year:	Semester: 4/5 /6
Course: Program Elective	Credits: 3	Hours: 40

Course Context and Overview (100 words):

In the field of interconnection networks, there is a growing interest and amount of research in the on-chip domain. The integrated circuit technology has evolved to accommodate a multiprocessing device capable of high-performance computation. As a result of the high integration scale in the deep sub-micron domain and the increasing number of connecting elements, on -chip interconnection has become a need and will influence the performance of the final system. Therefore, any gain in the efficiency of the on-chip interconnection layer will be highly beneficial.

Prerequisites Courses:

Basics of computer networks

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1: Understanding of basic principles of on-chip interconnection networks.
CO2: Understanding of various techniques of on-chip interconnection topologies.
CO3 Understanding of switching, flow control, routing techniques and router microarchitecture.
CO4 Ability to valuate future technologies for implementing the on-chip interconnection network

Course Topics:

Contents	Lecture Hours	Unit Hours
UNIT – 1: Introduction to Network-On-chip (NoC)		6
1. Introduction of Interconnection Networks (Off-Chip and On-Chip)	1	
2. Network Basics (Topology, routing, flow control, switching), Network Design Considerations.	2	
3. Classification of Interconnection Networks (Topology, Properties of various topologies)	2	

4. Performance Parameters	1	
UNIT - 2: Topology Exploration		7
1. Topology basics: Channels and Nodes, Direct and Indirect networks, Cuts and Bisections, Paths, Symmetry	1	
2. Topology parameters: Node Degree, Diameter, Link Complexity, Bisection Width, Path Diversity	1	
3. Direct Networks: Characterization, Popular Topologies	2	
4. Indirect Networks: Characterization, Popular Topologies	2	
5. Case Study on various topologies	1	
UNIT–3: Switching and Flow Control		10
1. Network and Router Model, Basic concepts: Switching, flow control	2	
2. Circuit Switching	1	
3. Packet Switching	1	
4. Virtual Cut Through (VCT) Switching	1	
5. Wormhole Switching	1	
6. Virtual channels	1	
7. Flow control and Arbitration	3	
UNIT-4: Routing Algorithms and Implementation Mechanisms		12
1. Routing Basics, Taxonomy of Routing Algorithms 2. Deadlock, Livelock and Starvation	2	
3. Deterministic Routing Algorithms	2	
4. Adaptive Routing Algorithms	2	
5. Topology Agnostic Routing Algorithms	1	
6. Table-Based Routing: Source Routing, Node-Table Routing	2	
7. Algorithmic Routing	1	
8. Logic-Based Distributed Routing	2	
UNIT-5: Application Mapping and Performance Analysis		5

1. Application Mapping Strategies for NoC	2	
2. Measures of On-Chip Interconnection Network Performance	1	
3. Network workloads	1	
4. Case Study: Comparison of Routing Techniques/ Switching Techniques	1	

Text Books:

1. Principles and Practices of Interconnection Networks by William Dally and Brian Towles.
2. Interconnection Networks: An Engineering Approach by Jose Duato, Sudhakar Yalamanchili, Lionel M. N

Reference Books:

1. Networks on Chip by Axel Jantsch, and Hannu Tenhunen.
2. Designing Network On-Chip Architectures in the Nanoscale Era by Jose Flich , Davide Bertozzi.

Additional Resources (Video Lectures, Web resources etc.):

Evaluation Methods:

Component	**Weightage (%)**
Quiz-1	10%
Quiz-2	10%
Mid-Term	30%
End Term	50%

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Last Update: / /