COURSE CONTENT

HIGH PERFORMANCE COMPUTING								
III Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
2235826	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: Computer Organization & Architecture								

Course Overview:

This course provides a comprehensive introduction to advanced computing paradigms including grid, cluster, pervasive, and quantum computing. It covers the architecture, technologies, and real-world applications of grid and cluster systems for high-performance computing. The course explores job scheduling, resource management, and communication mechanisms in distributed environments. It also introduces pervasive computing concepts, focusing on device connectivity and human–machine interaction.

Course Objectives:

1. Understand fundamentals of Grid Computing, architectures, and autonomic systems.
2. Analyze Cluster Computing architecture, communication mechanisms, and applications.
3. Evaluate job scheduling and resource management in cluster environments.
4. Explore Pervasive Computing concepts, device connectivity, and applications.
5. Understand Quantum Computing principles including gates, circuits, and algorithms.

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply the principles of data and computational grids, along with autonomic computing, to design effective distributed computing solutions.
2. Analyze cluster architectures, middleware, and lightweight communication mechanisms to assess their influence on system performance and scalability.
3. Evaluate various job scheduling and resource management strategies to enhance efficiency in cluster-based high-performance computing.
4. Integrate hardware, software, and human–machine interfaces to develop practical applications in pervasive and ubiquitous computing environments.
5. Create quantum circuits using one, two, and three-qubit gates to implement algorithms for solving complex computational problems.

UNIT - I

Grid Computing: Data & Computational Grids, Grid Architectures and Its Relations to Various Distributed Technologies. Autonomic Computing, Examples of the Grid Computing Efforts (IBM).

UNIT - II

Cluster Computing at a Glance: Introduction, A Cluster Computer and its Architecture, Cluster Classifications, Commodity Components for clusters, Network Services/Communication SW, Cluster Middleware and SSI, RMS, Programming Environments and Tools, Cluster Applications.

Lightweight Messaging Systems: Introduction, Latency Bandwidth Evaluation of Communication performance, Traditional Communication Mechanisms for clusters, Lightweight Communication Mechanisms.

UNIT - III

Job and Resource Management Systems: Need of Job management, Components and Architecture. **Scheduling Parallel Jobs on Clusters:** Introduction, Rigid Jobs with process migration, Malleable Jobs with Dynamic Parallelism, Communication-Based Coscheduling, Batch Scheduling.

Cluster Operating Systems: COMPaS.

UNIT - IV

Pervasive Computing Concepts & Scenarios: Hardware & Software; Human – Machine Interface.

Device Connectivity: Java For Pervasive Devices; Application Examples.

UNIT - V

Classical Vs Quantum Logic Gates: One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.

TEXT BOOKS:

1. Grid Computing, J. Joseph & C. Fellenstien, Pearson Education
2. High Performance Cluster Computing, Raj kumar Buyya, pearson Education.
3. Pervasive Computing, J. Burkhardt et.al, Pearson Education
4. Approaching Quantum Computing Marivesar, Pearson Education.

REFERENCES:

1. The Grid 2: Blue Print for a New Computing Infrastructure, Ian Foster and Carl Kesselman, 2nd Edition, The Elsevier Series.
2. Quantum computing and Quantum Information, Neilsen & Chung L, Cambridge UniversityPress.
3. A networking approach to Grid Computing, Minoli, Wiley

ELECTRONIC RESOURCES:

1. https://www.ibm.com/topics/grid-computing?utm_source=chatgpt.com.
2. https://www.redhat.com/en/topics/high-performance-computing/what-is-high-performance-computing?utm_source=chatgpt.com
3. https://www.oracle.com/java/technologies/javame-overview.html?utm_source=chatgpt.com
4. https://azure.microsoft.com/en-in/products/quantum?utm_source=chatgpt.com
5. https://nptel.ac.in/?utm_source=chatgpt.com

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)