# COURSE CONTENT

| FUNDAMENTALS OF NANO TECHNOLOGY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **III Semester: CSE** | | | | | | | | |
| **Course Code** | **Category** | **Hours / Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **2235503** | **Foundation** | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Contact Classes: 45** | **Tutorial Classes: Nil** | **Practical Classes: Nil** | | | | **Total Classes: 45** | | |
| **Prerequisites:** cryptographic techniques to secure digital data. | | | | | | | | |

## Course Overview:

This course introduces advanced computing paradigms including grid, cluster, pervasive, and quantum computing with their architectures and real-world applications. It explains the design and implementation of distributed and high-performance systems using grid and cluster technologies. The course covers job scheduling, resource management, and communication mechanisms in cluster environments. It also explores pervasive computing concepts such as device connectivity and human–machine interaction. Finally, it presents the fundamentals of quantum computing, including logic gates, circuits, and basic algorithms.

## Course Objectives:

1. To provide knowledge of grid computing concepts, architectures, and their applications in distributed systems.
2. To understand cluster computing architecture, communication mechanisms, and middleware technologies.
3. To study job scheduling and resource management techniques in high-performance cluster environments.
4. To explore pervasive computing concepts, device connectivity, and human–machine interaction.
5. To introduce the fundamentals of quantum computing including logic gates, circuits, and algorithms.

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

1. Describe the key features of CISC, RISC, and DSP instruction set architectures (ISAs) and their implementation in VLSI chip design.
2. Analyze various scheduling and resource allocation strategies used in DSP architecture implementation to optimize performance and resource utilization.
3. Differentiate DSP instruction set implementations and architectures.
4. Demonstrate how to interface a peripheral via a specific bus.
5. Illustrate aspects of Nanoscience, technology and their applications in the real time environment

**UNIT-I:**

overview of Nanotechnology: Definition-historical development -properties, design and fabrication Nano systems, Working principle, applications and advantages of nano system. Nano materials -ordered oxides - Nano arrays - potential health effects

**UNIT-II:**

Nano Defects, Nano Partiles and Nanolayers: Nano Defects in crystals -applications - Nuclear Track nano defects. Fabrication of nano particles - LASER ablation - sol gels - precipitation of quantum dots. Nano layers - PVD, CVD, Epitaxy and ion implantation - formation of Silicon oxide- chemical composition- doping properties - optical properties

**UNIT-III:**

Nano structuring: Nano Photolithography - introduction - techniques - optical - electron beam – ion beam - X-ray and Synchrotron - nanolithography for microelectronic industry - nanopolishign of Diamond- Etching of Nano structures - Nano imprinting technology - Focused ion beams - LASER interference Lithography nanoarrays -Near-Field Optics - case studies and Trends

**UNIT–IV:**

Science and Synthesis of Nano Materials: Classification of nano structures - Effects of nano scale dimensions on various properties - structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics - Effect of nano scale dimensions on mechanical properties - vibration, bending fracture Nanoparticles, Sol - Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes - Solid carbon source-based production techniques - Gaseous carbon source-based production techniques - Diamond like carbon coating. Top down and bottom-up processes

**UNIT-V:**

Characterization of Nano Materials: Nano - processing systems - Nano measuring systems - characterization - analytical imaging techniques - microscopy techniques, electron microscopy scanning microscopy, confocal LASER scanning microscopy - transmission electron microscopy. transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques - spectroscopy techniques - Raman spectroscopy, 3D surface analysis - Mechanical, Magnetic and thermal properties - Nano positioning systems.

## Textbooks:


1. Joshy Joseph and Craig Fellenstein, Grid Computing, Pearson Education.
2. Rajkumar Buyya, High Performance Cluster Computing, Pearson Education.
3. J. Burkhardt et al., Pervasive Computing, Pearson Education.
4. Marivesar, Approaching Quantum Computing, Pearson Education.


## References


1. J. Joseph and C. Fellenstein, Grid Computing, Pearson Education.
2. Rajkumar Buyya, High Performance Cluster Computing, Pearson Education.
3. J. Burkhardt et al., Pervasive Computing, Pearson Education.
4. Marivesar, Approaching Quantum Computing, Pearson Education.
5. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.

## ELECTRONIC RESOURCES:

1. https://nptel.ac.in/courses/113104081?utm_source=chatgpt.com
2. https://ocw.mit.edu/?utm_source=chatgpt.com
3. https://www.thermofisher.com/in/en/home/materials-science/learning-center/microscopy-resource-center/scanning-electron-microscopy-sem.html
4. https://www.nature.com/nnano/?utm_source=chatgpt.com
5. https://www.cnf.cornell.edu/?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)