# IIT Mandi
## Proposal for a New Course

| | |
|---|---|
| **Course Number** | : CS522 |
| **Course Name** | : Distributed Algorithms |
| **Credits** | : 3-0-0-3 |
| **Prerequisites** | : CS202-Data Structures & Algorithms, CS208-Mathematical Foundations of Computer Science or Equivalent or COT |
| **Intended for** | : UG/PG |
| **Distribution** | : Discipline Elective for BTech CSE, Free Electives for others |
| **Semester** | : Even |

---

### Preamble:

The course introduces to distributed algorithms with focus on fundamental principles and correctness.

Due to their non-sequential and decentralized nature, distributed algorithms are more difficult to design, understand and verify than their sequential counterparts. It is therefore important to have clarity about underlying models and concepts. The course introduces central notions like distributed computations, logical time, consistency and complexity measures used to formulate, explain and analyse distributed algorithms. Application areas of the algorithms will be discussed along with their presentation.

Apart from a good knowledge of classical distributed algorithms and their application areas, at the end of the course students will have a sound understanding of the fundamental principles required to design and verify a distributed algorithm.

### Course Modules

| | | |
|---|---|---|
| 1. | Introduction (algorithmic challenges of distributed algorithms) | 1 hour |
| 2. | Basic definitions(System models, distributed computation, local/global states, consistency, complexity measures) | 6 hours |
| 3. | Time in distributed computing (logical clocks, vector clocks, virtual time) | 3 hours |
| 4. | Distributed graph algorithms (Spanning trees, broadcast & converge cast, shortest path) | 6 hours |
| 5. | Distributed mutual exclusion algorithms | 4 hours |
| 6. | Global state and snapshot recording algorithms (Chandy/Lamport , Lai/Yang, Mattern, Venkatesan Algorithm) | 4 hours |
| 7. | Monitoring global states (Necessary & sufficient conditions for consistent global states, zig-zag paths) | 3 hours |
| 8. | Termination Detection (Based on snapshots computations, weight throwing, spanning trees) | 3 hours |
| 9. | Deadlock detection | 2 hours |

| | |
|---|---|
| 10. Global predicate detection | 2 hours |
| 11. Checkpointing and rollback recovery (Coordinated, communication induced, …) | 4 hours |
| 12. Consensus and agreement algorithms | 4 hours |

At the end of the course students will present a research paper on a distributed algorithm and/or its application.

**Text book:**

A. Kshenkalyani/ M.Singhal: Distributed Computing, Cambridge University Press, 2008

**References:**

1. Wan Fokkink: Distributed Algorithms: an Intuitive Approach, MIT Press, 2013
2. David Peled: Distributed Computing: a Locality Sensitive Approach, SIAM Monograph, 2000
3. Nancy Lynch: Distributed Algorithms, Morgan Kaufmann, 1996
4. M. Raynals: Distributed Algorithms for Message-Passing Systems, Springer, 2013