<table>
<thead>
<tr>
<th>1. Course Title</th>
<th><strong>Parallel, Distributed and Dynamic Algorithms</strong></th>
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| 2. Credit Structure | Lecture hours per week: **3**  
| | Tutorial hours per week: **0**  
| | Practical hours per week: **0**  
<p>| | Total Credits: <strong>3</strong> |
| 3. Course Code | <strong>SC5XX</strong> |
| 4. Program/Semester | <strong>M.Tech, Semester III</strong> <em>(not to conflict with SC5XX: Advanced Topics in Algorithms)</em> |
| 5. Category | <strong>Specialisation Core</strong> |
| 6. Prerequisite courses | <strong>Design and Analysis of Algorithms/Introduction to Algorithmics</strong> |
| 7. Foundation for |  |
| 8. Abstract Content | <strong>Design and Analysis of (a) Parallel Algorithms, (b) Distributed Algorithms, and (c) Dynamic Algorithms</strong> |</p>
<table>
<thead>
<tr>
<th>Topic Name</th>
<th>Content (2 - 3 lines per 4 – 6 lectures)</th>
<th>No. of lectures</th>
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| Parallel Algorithms        | • Modelling Parallel Computations (Multiprocessor models, Work-depth models, Emulation among models)  
  • Parallel Algorithmic Techniques (Divide-and-conquer, Randomization, Parallel pointer techniques)  
  • Parallel algorithms for: prime number sieving, matrix multiplication, iterative solution to linear systems, FFT/prefix, searching, sorting, graph matching, graph colouring, shortest path, minimal spanning tree |                 |
| Distributed Algorithms     | • Modelling Distributed Computations (PN model, Local model, Congest model)  
  • Distributed algorithms in the PN model for path colouring, bipartite maximal matching, vertex cover.  
  • Local symmetry-breaking technique for graph problems such as graph colouring and maximal independent set  
  • Distributed algorithms in congest model for shortest paths, BFS, leader election problems |                 |
| Dynamic Algorithms         | • Dynamic algorithms for Fibonacci numbers, binomial coefficients, optimal binary search trees, matrix chain multiplication, longest common subsequence  
  • Dynamic algorithms for graph connectedness, reachability, shortest paths, minimum spanning trees, min-cut, planarity testing, k-connectivity  
  • Sparsification technique for speeding up dynamic graph algorithms |                 |
| Outcomes and Objectives | On completion of the course, a student should be able to  
| | • design a parallel algorithm and prove its correctness  
| | • analyse the cost of parallel algorithms in terms of computing time, communication time, and synchronization time  
| | • design a distributed algorithm and prove its correctness  
| | • analyse the cost of distributed algorithms in terms of computing time, communication time  
| | • prove the limitations of distributed graph algorithms  
| | • design a dynamic algorithm and prove its correctness  
| Comments |  
| **Explanatory Notes** |  

Enter a discipline (see master list for guidance) and a first digit followed by xx.

Please indicate the program and desired semester in which it is to be offered. Comment on what additional courses in that semester it should not conflict with.

Appropriate categories: Program core, Group elective, Technical elective, Open elective, Specialisation core, Specialisation elective

Indicate the subsequent courses for which the course would be needed.

The Instructor is permitted a certain degree of flexibility in each course. The following ratios of primary to optional content in terms of lecture hours are given as guidelines: Foundation Courses – 75:25, Track Core (Group Elective)/M.Tech. Specialization Core – 66:33, Electives – 50:50. For example, a 3-0-0-3 course is expected to have 40-42 lectures in the semester, and the primary content should specify 30 lecture hours worth of material in a Foundation Level course and only 20 hours of material in an Elective Course. The primary content is what the instructor must cover in the course; the remaining is at the discretion of the Instructor.

The outcomes and objectives should give on the one hand the skills and competencies acquired by the student as well as the value of the course towards industry/research/academic objectives.
Prospective reviewers:
1. Dr. Srikrishnan Divakaran, DAIICT
2. Dr. Sayan Bhattacharya, IMSc
3. Dr. John Augustine, IIT Madras
4. Dr. C. Siva Ram Murthy, IIT Madras
5. Dr. C. Pandu Rangan IIT Madras
6. Dr. Kavitha Telikepalli, TIFR

Similar course offerings outside DA-IICT
1. Exclusively for topics in Parallel Algorithms http://nptel.ac.in/syllabus/106106112/
5. For a course on Parallel and Distributed Algorithms http://www.dcg.ethz.ch/lectures/podc/
7. Exclusively for topics in Distributed Algorithms https://services.brics.dk/java/courseadmin/DynamicF13/pages/Course+Description