

Title of the course:
Parameterized Algorithm Design

Credit requirement:(L-T-P: 3-0-0, Credit: 3)

Please select the committee for Approval: PGPEC

Name of the Dept: CSE

Please Specify the Level of the Subject: PG level

Whether the subject will be offered as compulsory or elective: Elective

Prerequisite(s) for the subject, if any
(Please give the subject numbers and names): Algorithms-I (CS21003)

Course Objective

Parameterized algorithms has been serving as one of the key tools in algorithm design for tackling computational hardness barriers like NP-completeness for the last 30 years. Indeed, parameterized algorithms have plenty of success stories in solving many real world instances of computationally hard problems. In this course, we will introduce a bunch of techniques for designing parameterized algorithms to the students so that they can apply it in their research whenever needed.

Study Materials

In this course, we will use the following textbooks. We will also use online study materials and research articles.

Books:

1. Parameterized Algorithms by Marek Cygan (Author), Fedor V. Fomin (Author), Łukasz Kowalik (Author), Daniel Lokshtanov (Author), Dániel Marx (Author), Marcin Pilipczuk (Author), Michał Pilipczuk (Author), Saket Saurabh (Author)
2. Parameterized Complexity Theory by J. Flum and M. Grohe
3. Articles from leading CS conferences, for example, Symposium of Theory of Computation (STOC), Foundations of Computer Science (FOCS).

Syllabus:

Definition of parameterized algorithms and motivation: 2 hours

Kernelization: 4 hours

Bounded search trees: 4 hours

Iterative compression: 3 hours

Color coding: 3 hours

Robertson-Seymour Theorem: 3 hours

Treewidth: 3 hours

Seperators: 2 hours

Gallai's Theorem: 2 hours

Algebraic Techniques: 2 hours

Fixed Parameter Intractability: 3 hours

ETH based lower bounds: 2 hours

Lower bounds on kernelization: 2 hours

Applications: 2 hours

Names of the faculty members of the Department/Centers/School who have the necessary expertise and will be the willing to teach the subject (Minimum two faculty members should be willing to teach the subject)

Prof. Palash Dey, Prof. Swagato Sanyal

Do the contents of the subject have an overlap with any other subject offered in the Institute?