Elective course IDC 600

Course Title: Introduction to High Performance Computing for scientists and engineers

Course No: IDC 600 level (Modular course)

Instructor: Mahendra K. Verma (PHY)

About the course: This is an introductory course on parallel programming on scientific applications that will enable the students to write and analyse parallel programs. The focus would be on general parallel programming tools, specially MPI and OpenMP programming. These tools would useful to all students irrespective of their branch.

We expect the specific departments or group of departments to teach more advanced courses like Parallel Computational Fluid Dynamics, Parallel Molecular Dynamics, etc. The proposed course would enable the students to take advanced courses on parallel computing.

Participating Departments for floating the course: Physics, Chemistry, Biological Science and BioEngineering, Aerospace engineering, Mechanical Engineering, Chemical Engineering, Computer Science and Engineering

Departments from which students can take course for credit: Physics, Chemistry, Biological Science and BioEngineering, Aerospace engineering, Mechanical Engineering, Chemical Engineering, Computer Science and Engineering

Units: 3-0-0-0-5 [Modular course, 3 lectures, 5 credits]

Prerequisite: Basic knowledge in computer programming

Who can take the course: Ph. D., M. Sc., and Advanced UG students.

Course Contents:

1. Introduction to HPC and scientific computing. Overview of major applications [1 lecture]
2. Supercomputing architecture; multicores; shared memory; switch etc. [3 lectures]
3. Review of basics of C/Fortran programming [2 lectures]
4. Programming in Message Passing Interface (MPI) [8 lectures]
5. Programming in OpenMP [3 lectures]
6. Case study on one major application [2 lectures]

Textbooks and References:

1. P. S. Pacheco, An Introduction to Parallel Programming, Elsevier (2011)
2. M. Quinn, Parallel Programming in C and OpenMP, McCraw Hill Education (India) (2003)
3. A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, Pearson (2007)