



National Supercomputing Mission

Guidelines for AICTE – C-DAC Master Trainer Program on High Performance Computing

Introduction

High-performance computing (HPC) has become increasingly crucial in today's technological landscape, playing a pivotal role in advancing scientific research, solving complex problems, and driving innovation across various industries. The demand for HPC has grown exponentially as researchers and organizations grapple with massive datasets, intricate simulations, and intricate modeling tasks that require immense computational power. From weather forecasting and drug discovery to financial modeling and artificial intelligence, HPC accelerates the pace of discovery and problem-solving, enabling scientists and engineers to tackle challenges that were once deemed insurmountable. The continuous evolution of technology and the emergence of new fields such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and quantum computing further underscore the escalating need for high-performance computing capabilities. As society delves into increasingly intricate problems and data-intensive tasks, the importance of high-performance computing is set to continue its ascent, shaping the landscape of scientific breakthroughs and technological advancements in the years to come.

The National Supercomputing Mission (NSM) is Government of India's initiative for building capacity and capability in the area of High Performance Computing (HPC) in the country and is being implemented by Centre for Development of Advanced Computing (C-DAC). Generation of HPC aware manpower has been one of the key deliverables of NSM-HRD mission. Various training initiatives related to HPC involving short-term, medium-term and formal education programs have been conducted, since the mission was started.

All India Council for Technical Education (AICTE) is the statutory body and a national-level council for technical education, under Department of Higher Education, Ministry of Education, and Government of India. AICTE is involved in planning and coordinated development of a technical education system throughout India and promotion of qualitative improvements of such education and its planned quantitative growth.

Considering the need for knowledge of HPC for faculties, Centre for Development of Advanced Computing (C-DAC) proposes a master trainer program providing a unique opportunity to train faculties, and contribute to the advancement of education in alignment with global advancement. This initiative aims to enhance the outreach of HPC education to the grassroots level, ensuring broader accessibility and engagement with a diverse audience.

Need of Teaching Niche Areas viz. HPC to Faculties

As technology rapidly advances, HPC becomes increasingly vital for solving complex problems and handling large datasets. Faculties need to stay updated on these advancements to equip students with the latest knowledge and skills. Similar concepts then migrate to AI/ML/DL applications. Educating faculties in HPC ensures they can integrate these tools into their teaching across different subjects, preparing students for diverse career paths. Faculties

engaged in research can benefit significantly from HPC. Teaching them about HPC allows them to leverage the power of supercomputing in their research endeavors, facilitating breakthroughs and innovations. Teaching HPC often involves understanding the infrastructure required for high-performance computing. Faculties can contribute to the development and maintenance of HPC facilities within academic institutions. Teaching HPC to faculties not only keeps them abreast of technological advancements but also empowers them to prepare students for a technology-driven future, contribute to cutting-edge research, and strengthen institutional ties with industries and research organizations.

C-DAC Expertise

With a rich history dating back to 1988, C-DAC has been at the forefront of technological innovation, contributing significantly to the growth and advancement of the IT industry in India. The centre is renowned for its expertise in areas such as high-performance computing, grid computing, multilingual computing, and embedded systems. C-DAC has played a pivotal role in the design and deployment of India's supercomputers, making significant strides in parallel and distributed computing. Moreover, the centre is actively involved in cutting-edge research, development, and deployment of various software and hardware solutions, catering to diverse sectors including healthcare, education, finance, and e-governance. With a commitment to excellence and a dedicated team of skilled professionals, C-DAC continues to be a driving force in advancing the frontiers of technology and fostering innovation on both national and international levels.

Objective

The objective of a Master Trainer Program on HPC is typically to equip participants with advanced knowledge, skills, and expertise in the field of high-performance computing. This specialized program aims to produce trainers who can effectively educate and train others in various aspects of HPC. The specific objectives may include:

1. **In-depth Understanding of HPC Concepts:** Ensure participants have a comprehensive understanding of the fundamental concepts, principles, and theories behind high-performance computing.
2. **Technical Proficiency:** Develop participants' technical skills in designing, implementing, and optimizing high-performance computing systems and applications.
3. **Advanced Programming and Parallel Computing:** Provide advanced training in parallel programming techniques and tools essential for exploiting the full potential of HPC systems.
4. **Optimization Techniques:** Teach optimization strategies and methodologies to enhance the efficiency and performance of algorithms and applications on HPC platforms.
5. **Performance Monitoring and Analysis:** Provide expertise in tools and techniques for monitoring and analyzing the performance of HPC applications and systems.

6. **Scalability and Efficiency:** Focus on strategies for designing scalable algorithms and architectures that can efficiently utilize the resources of large-scale HPC systems.
7. **Best Practices and Case Studies:** Share best practices and real-world case studies to illustrate successful implementations of HPC in various domains, fostering a practical understanding.
8. **Communication and Teaching Skills:** Develop effective communication and teaching skills so that participants can transfer their knowledge to diverse audiences, including researchers, developers, and students.
9. **Awareness of Emerging Trends:** Keep participants updated on the latest trends, technologies, and innovations in the field of high-performance computing.

Ultimately, the goal of a Master Trainer Program on High-Performance Computing is to produce skilled educators who can disseminate their knowledge, promote best practices, and contribute to the advancement and widespread adoption of high-performance computing technologies.

Proposed Program for Master Trainer

Schedule:

- a. One week of **online** training covering basic topics in week starting January 29th, 2024
- b. Two weeks of **offline** training either at Pune or at Bengaluru (see dates below) This will include theory and hands-on sessions.

Location:

- a. C-DAC Pune (5th to 16th February 2024)
- b. C-DAC Bengaluru (12th to 23rd February 2024)

Total Seats: 100 (50 each at Pune and Bangalore). AICTE to seek nominations from the affiliated institutes. C-DAC and AICTE to jointly review the nominations.

Program Contents - Topics include HPC basics, overview of computer architecture and HPC cluster, Introduction to Linux and shell scripting, Parallel Programming Models, Job Schedulers, Introduction to CUDA and its programming. A test will be conducted at the end of the training and successful candidates will be issued certificates.

Prerequisites - Good Knowledge of C programming language and using Linux Operating system

Who can apply - Faculty members who

- a. meet the prerequisites
- b. are willing participate in conducting Faculty Development Programs which are scheduled in April 2024 onwards, across the country

How to apply - Interested faculty members can fill the Google form:

<https://forms.gle/D3hWCczQeWeYjYpv9>

Boarding And Lodging - Participants will be provided with Hotel or Guest House accommodation on twin sharing basis during the training period. Participants are responsible for any overstay expenses incurred before or after the training period, as well as any costs associated with their personal visits.

Fee / Sponsorship - The programme is sponsored by the National Supercomputing Mission. All expenses related to the training program, including Fees, Food, Accommodation, and Local Transportation, will be covered.

Benefits of Enrolling in the Master Trainer Program

Enrolling in a Master Trainer Program can offer a range of benefits for individuals looking to enhance their skills, expertise, and career prospects. Master Trainer Programs often provide an in-depth exploration of a specific subject or field, allowing participants to gain a comprehensive understanding of the subject matter. It aids in building expertise within teachers to conduct HPC training on a large scale. Successful completion of a Master Trainer Program can open up new career opportunities, promotions, or advancements within the training and development sector.

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