

Introduction to the Workshop

An important initiative has been taken by IIT Bombay to work with Engineering Colleges in the country, to enhance the teaching skills of our faculty colleagues in core Engineering and Science Subjects. Under this project called **“Empowerment of Students & Teachers through Synchronous & Asynchronous Instruction,”** IIT Bombay conducts two-week ISTE workshops during the vacation period in summer and winter. Live lectures are given by IIT faculty. The participating teachers attend at a remote center close to their own college, and also attend tutorial and lab sessions conducted in the same center. The lecture transmission and live interaction takes place through distance mode using the AVIEW technology and the internet, at selected remote centers across the country. This initiative is part of the National Mission on Education through ICT, supported by MHRD. Faculty coordinators are appointed at each remote center, to handle the technology infrastructure and other operational logistics. Additionally, for each workshop, there is a workshop faculty coordinator for that subject who will help in the conduct of labs and tutorials at that center.

We invite expert faculty from various remote centers to a five-day Coordinators' training workshop which is held in IIT Bombay, at least two months before the main workshop. These Coordinators then act as Workshop Coordinators during the main workshop, liaising between the participants at their Remote Centers and IIT Bombay from where the workshop is transmitted live. During the main workshop, the Workshop Coordinator at every center supervises the conduct of tutorials and Labs. All the lectures and tutorial sessions are recorded. The final edited audio-visual contents, along with other course material will be released under Open Source. These contents can be freely used later by all teachers and students.

Since December 2009, we have conducted two-week ISTE workshops on "Effective teaching/ learning of Computer Programming," "Database Management Systems," "Basic Electronics," "Thermodynamics," "Software Development Techniques for Teachers of Engineering and Science Colleges," "Heat Transfer," and "Solar Photovoltaics." We have reached more than 7,500 teachers and helped them to enhance their teaching skills at around 45 distinct Remote Centers across the country.

In the backdrop of the success of these workshops, we now announce another two-week ISTE workshop, this time on **Computational Fluid Dynamics**, to be held in **June 2012**.

Five-Day Coordinators' Workshop

The proposed Coordinators' Workshop, to support the above, is being organized at IIT Bombay from 12th to 16th March 2012. This workshop will provide a complete orientation to the prospective Workshop Coordinators, on the methodology to be followed in this project. This will include the delivery of live lectures through the AVIEW mechanism of interaction with participants, and the local conduct of tutorials and labs. Since the final contents are meant to be adopted by most colleges across the country, this workshop will finalize the following for the subject of **Computational Fluid Dynamics**:

- (a) Definition of common syllabus to be covered.
- (b) Graded coverage from simple to difficult levels for each topic and subtopic.
- (c) Nature of tutorials, keeping the above gradation and the typical examination pattern in mind, but leading to the typical advanced levels reached in such subject teaching, at the top institutions of the world.
- (d) Discussion of laboratory environment and the experiments to be conducted, if any.
- (e) Use of the learning management system, audio-visual equipment, editing tools.
- (f) Other logistic details for conducting the main workshop.

Tentative syllabus, proposed for a first course in Computational Fluid Dynamics, is given on page 2 of this brochure.

Teaching Faculty

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Duration and Venue

The duration of the workshop is five days (12-16 March, 2012), and it will be conducted in IIT Bombay.

Who may benefit

The workshop is likely to benefit faculty colleagues who are willing to be prospective Workshop coordinators for the larger main workshop to be held in **June 2012**.

It is mandatory that the prospective coordinators should have taught Fluid-Mechanics or Heat-Transfer or Numerical-Methods at the UG or PG level.

Furthermore, they should be either from Mechanical, Chemical, Civil, Aerospace or Metallurgical engineering departments. He/she should be familiar with the syllabi and examination pattern of their own college or university. It is preferable that they should have at least 3 years of teaching experience with some experience in conduct of ISTE, QIP workshops.

Important Note:

It is mandatory that the participant's Institute is well equipped to conduct the workshop through the NKN/ internet for a minimum of 30 participants. For a remote center a primary requirement is provision of one computer per participant, with Windows as the operating system. This is for the laboratory component of the course.

It is also mandatory that the participants bring a document from the Heads of their institutes to the effect that the institute is willing to be part of this project.

Note

Please note that this workshop is conducted under the eOutreach project of IIT Bombay. Live recording of the course and other created contents would be released under Open Source, through a portal. The recorded CD/DVD of the course lectures would be available for distribution at cost, to any individual/ institution. All participants are required to sign a No Objection certificate for such release of contents contributed by them during and after the workshop. All contributors will be acknowledged.

Accommodation & other support

Shared Guest House accommodation with standard boarding will be provided free to the participants depending on availability. However, accommodation is not guaranteed.

Course Fee

Since the workshop is funded by the National Mission on Education through ICT (MHRD, Government of India), there is no course fee for participation. Travel fare reimbursement will be made for up to A/C 2-tier or lowest return airfare, as per GOI entitlement.

How to Apply

Those wishing to attend this course should register online at <http://ekalavya.it.iitb.ac.in/>

Due to limited seats, registration will be on a first-come-first-served basis. Confirmation of registration will be sent by email. **Enrollment will be strictly online.**

**LAST DATE FOR ONLINE ENROLLMENT:
20th February, 2012**

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Introduction to the Course

Computational Fluid Dynamics (CFD) is a methodology for computer simulation of fluid mechanics and heat transfer problems. The simulation results in prediction of the flow fields in the domain of interest, and of engineering parameters, which are very useful in the design and optimization of processes and equipment. It is an open ended application of undergraduate core courses of fluid mechanics and heat transfer. CFD reduces the time and cost for designing and analyzing engineering systems, and is slowly becoming part and parcel of Computer Aided Engineering (CAE).

In academics, CFD is taught in different branches of engineering: aerospace, chemical, civil, mechanical, and metallurgy. In industry, CFD is rapidly developing as a powerful analysis tool used in diverse areas like aerospace, automobile, turbomachinery, chemical, electronics cooling, biomedical, etc. The increasing importance of CFD simulation-software development, application, and analysis, in the Indian industry and research organizations, along with the lack of trained

manpower in this area, has greatly increased the significance of this course. However, there is a lack of trained teachers for this course.

The objective of this course is to introduce the fundamentals of CFD. This will be achieved through the computer simulation of carefully designed exercise problems. The level of the material will be appropriate for an advanced undergraduate student. At the same time, it is hoped that the course will develop an understanding of the theory behind the computer screen, so that CFD software can be developed/used intelligently.

The course starts with the essentials of Fluid Mechanics to build the foundation. Sufficient topics in the subject of Fluid Mechanics will be covered, since a good understanding of these concepts is highly essential before taking up learning CFD. Then, a discretization method more commonly used nowadays, the finite volume method, will be discussed for the mass, momentum and energy conservation equations. For the set of algebraic equations obtained after the discretization, the implementation details and solution algorithms needed to develop programs and solve with the help of computer, will be discussed in detail.

For the lab sessions of FVM, a set of computer programs and a detailed documentation, developed at IIT Bombay, will be given to the participants. The programs are written in Scilab, a free open source software for numerical computation. Carefully designed example problems will be given; to be solved using the computer programs.

Course Contents

Essentials of Fluid Mechanics:

Introduction; Eulerian and Lagrangian descriptions of fluid motion; Kinematics of fluid motion.

Derivation of governing differential equations and their Non-dimensionalization; Sub-models for simplified situations; Some analytical solutions of the Navier-Stokes equations; An example of numerical solution of a model equation, using the Finite Difference Method.

Integral form of the governing equations of motion, and their physical interpretation.

Finite Volume Method for Fluid Dynamics and Heat Transfer Governing Equations:

2-D Unsteady State Heat Conduction: Finite Volume Discretization; Explicit and Implicit methods; Implementation details; Solution algorithm. Special topics: Multi-solid and non-linear Heat Conduction. Example problems.

2-D Unsteady State Heat Convection (Advection-Diffusion): Finite Volume Discretization; advection schemes; solution algorithm; Example Problems.

2-D Unsteady State Fluid Flow and Heat Transfer: Finite Volume Discretization; pressure-velocity coupling; Explicit and Implicit methods; Solution algorithm; Example problems.

Grid Generation: Structured Grid. Algebraic and Elliptic method.

Five-day ISTE Workshop for Coordinators

on

Computational Fluid Dynamics

Under the

**National Mission on Education through ICT
(MHRD, Govt. of India)**

12-16 March 2012

Conducted by IIT Bombay



Coordinators:

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