

## Introduction

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. This initiative has now become a part of the National Mission on Education through ICT, supported by MHRD.

We have conducted 5 two-week ISTE workshops on "Effective teaching/ learning of Computer Programming., Database Management Systems", "Thermodynamics in Mechanical Engineering", and Basic Electronics. These workshops were attended cumulatively by over 4500 participating teachers across the country, at 77 remote centers, through distance mode using the AVIEW software developed by Amrita University, on the internet.

The participating teachers attended live lectures, given by IIT faculty, at a remote center close to their own college. Tutorial and lab sessions were conducted in the same centers. Each center had a course Coordinator, who supervised the conduct of tutorials and Labs. All the lectures and tutorial sessions have been recorded, and 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.

We are now organizing another 2-week workshop on **Heat Transfer** from 29<sup>th</sup> November – 10<sup>th</sup> December, 2011. This will include the delivery of live lectures through AVIEW mechanism of interaction with participants, and the local conduct of tutorials and labs.

## Teaching Faculty

**Prof. S.V. Prabhu**, Department of Mechanical Engineering, IIT Bombay

<http://www.me.iitb.ac.in/wiki/doku.php?id=svprabhu>

**Prof. Arunkumar Sridharan**, Department of Mechanical Engineering, IIT Bombay

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## Course Content

### **Introduction to heat transfer**

Introduction, Introduction to one dimensional conduction, conduction rate equation, thermal conductivity, thermal diffusivity, Heat diffusion equation, Initial and boundary conditions,

### **Conduction**

One dimensional steady state conduction, Plane wall, composite wall, cylinder, sphere, Critical radius of insulation, summary of all cases, One dimensional steady state conduction in plane wall and radial systems with thermal energy generation, Fins - Fin efficiency, effectiveness, length of the fin, Transient conduction – Lumped capacitance, Heisler charts, semi-infinite medium.

### **Convection**

Physical Mechanism of Convection, Basics of fluid mechanics, Differential Convection Equations – Navier stokes equation, Energy equation, boundary layer equations for both momentum and heat transfer, Solutions of convection equations for a flat plate, Normalised dimensionless equations and similarity, analogies of heat transfer, Convective heat transfer in external flows, for general configurations, Internal forced convection – average velocity and bulk mean temperature, laminar and turbulent flow in tubes, and Natural convection

### **Heat Exchangers**

Types, overall heat transfer coefficient, fouling factor, Analysis of heat exchangers, Log mean temperature difference for parallel and counterflow heat exchangers, multipass and cross flow heat exchangers, use of correction factor,  $\epsilon$ -NTU method – Effectiveness relations for all heat exchangers, along with the charts, selection of heat exchangers

### **Thermal Radiation**

Introduction, thermal radiation, black body radiation – Stefan Boltzmann law, Planck's law, Wien's displacement law, Radiation intensity, solid angle, intensity of emitted radiation, incident radiation, radiosity, spectral quantities,

Radiative properties, Kirchoff's law, Greenhouse effect, Radiation heat transfer – view factor, view factor relations, Black surfaces, diffuse and gray surfaces, Net radiation heat transfer between any two surfaces, methods of solving radiation problems, radiation heat transfer in two and three surface enclosure, radiation shields and radiation effects.

### **Boiling and Condensation**

Introduction to Two-Phase Flow, Nusselt's theory of condensation, Pool boiling curve, Thermodynamic aspects of boiling and evaporation, Rosehnow's pool boiling correlation.

## Duration and Venue

The duration of the workshop is **2-weeks (10 working days)**. It will begin at **09:00 am** on 29<sup>th</sup> November 2011, and end at **6:00 pm** on Saturday **10<sup>th</sup> December, 2011** with a 2 days weekend break on 3<sup>rd</sup> & 4<sup>th</sup> December. After the workshop participants are required to contribute further during the following two weeks.

The venues for the workshop will be **30 remote centers**. The list is enclosed with this brochure.

## Who may benefit

The workshop will benefit faculty colleagues who are teaching **Heat Transfer** in their colleges. They should have taught this subject at least once and should be familiar with the syllabus and examination pattern of their own college or university.

## Note

Please note that this workshop is conducted by the e-Outreach project of IIT Bombay, under the **National Mission on Education through ICT**. Live recording of the course and other created contents will be released under Open Source through a portal. The recorded CD/DVD of the course lectures will be available for distribution at cost, to any individual/ institution. All participants are required to sign an undertaking for such release of contents contributed by them during and after the workshop. The recognition and citation will naturally be made for all contributors.

## Accommodation and other support

Remote centers are being funded to provide tea/lunch on each day of the workshop, and for accommodation, wherever available\*, for limited number of outstation participants. **Travel expenses up to Rs.1000 each will be reimbursed against proof of actual expenditure.**

\* 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.

## How to Apply

Those wishing to attend this workshop should enroll online at this website

<http://ekalavya.it.iitb.ac.in/eOutreachHome.do>.

**Enrollment will be strictly online and no other applications will be entertained.**

The online form contains a list of remote centers. Please select a center close to your institute, From the list to indicate where you would wish to attend the workshop. Last date for enrollment is **16<sup>th</sup> November 2011**. A list of selected participants will be put up on this website on **18<sup>th</sup> November 2011**. The selected participants will also be informed by email.

## LAST DATE FOR ONLINE ENROLLMENT:

**Wednesday 16<sup>th</sup> November 2011.**

For queries, contact

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## Remote Centers

### Andhra Pradesh

JNTU College of Engineering, **Hyderabad**

Muffakham Jah College of Engineering and Technology,  
**Hyderabad**

### Gujarat

Institute of Technology, Nirma University, **Ahmedabad**

Sardar Vallabhbhai National Institute of Technology, **Surat**

### Karnataka

Amrita School Of Engineering, **Bengaluru**

### Kerala

National Institute of Technology, **Calicut**

Amal Jyothi College Of Engineering, **Kottayam**

St Joseph`s College of Engineering, **Palai**

### Madhya Pradesh

Maulana Azad National Institute of Technology, **Bhopal**

SGSITS, **Indore**

Truba College of Engineering & Technology, **Indore**

Jabalpur Engineering College, **Jabalpur**

### Maharashtra

VPCOE, **Baramati**

Kolhapur Institute of Technology, **Kolhapur**

VJTI, **Mumbai**

V.N.I.T., **Nagpur**

Yeshwantrao Chavan College of Engineering, **Nagpur**

K.K.Wagh institute of Engineering Education & Research,

**Nashik**

MES`s Pillai`s Institute of Information Technology, **New Panvel**

Vishwakarma institute of Technology, Bibwewadi, **Pune**

MKSSS`s Cummins College of Engineering, **Pune**

R. C. Patel Institute of Technology, **Shirpur**

### Rajasthan

Jaipur Engineering College, **Kukas**

### Tamil Nadu

Anna University, **Chennai**

PSG College of Technology, **Coimbatore**

Amrita Vishwa Vidyapeetham, **Coimbatore**

Institute of Road and Transport Technology, **Erode**

Government College of Engineering, **Salem**

National Institute of Technology, **Tiruchirappalli**

SASTRA University, **Thanjavur**

# 2-WEEK ISTE WORKSHOP

on

**Heat Transfer**

Under the

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

**29<sup>th</sup> November to 10<sup>th</sup> December, 2011**

**Conducted by IIT Bombay**

Coordinators:

**Prof S. V. Prabhu**

**Prof Arunkumar Sridharan**

Dept. of Mechanical Engineering

Project Coordinator:

**Prof. D.B. Phatak**

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