



## THE CENTRE FOR FLUID DYNAMICS DEPARTMENT OF MECHANICAL ENGINEERING INDIAN INSTITUTE OF TECHNOLOGY INDORE



Announces



5 days, 1 Credit Course on Advances and Opportunities in passive Micro & Miniature Technologies for Energy and Thermal Systems

January 9 - 13, 2017

http://people.iiti.ac.in/~sdhina

Course Instructor

Prof. Amir Faghri Professor Department of Mechanical Engineering University of Connecticut United States of America

#### Course Coordinator

Dr. Shanmugam Dhinakaran Associate Professor Department of Mechanical Engineering Indian Institute of Technology Indore INDIA

## **Important Topics**

# **Heat Pipes**









Science and Technology of Heat Pipes

Design Fabrication and Simulation of Heat Pipes

## **Important Topics**

# **FUEL CELLS**





Introduction to Fuel Cells Science and Technology

Direct Methanol Fuel Cells: Analysis and Simulation

## **Important Topics**

# THERMAL ENERGY STORAGE



Concentrating Solar Power with Thermal Energy Storage



**Thermal Energy Storage:** District heating accumulation tower from Theiss near Krems an der Donau in Lower Austria with a thermal capacity of 2 GWh



The **Crescent Dunes Solar Energy Project** is a 110 megawatt (MW) net solar thermal power project with 1.1 gigawatt-hours of energy storage

## Challenges and Opportunities in Thermal Energy Storage Systems



Enhanced Latent Heat Thermal Energy Storage for Concentrating Solar <u>Power</u>

## **Course Overview**

The 21st century will see the development of a wide range of active miniaturized energy devices with applications in energy management and power sources, electronic cooling, energy storage and bioengineering. Although these active devices are effective, they are often cumbersome and inefficient considering the auxiliary supporting devices such as pumps, fans, and other moving parts they require for operation. A more efficient and novel approach involves use of passive small energy and thermal devices with no moving parts. Advances and opportunities in several major research thrusts for passive micro and miniature technologies for energy and thermal systems including heat pipes, fuel cells, energy storage devices and solar systems will be presented in detail in a series of presentations.

## **Course Objectives**

To expose the participants about the Advances in micro and miniature technologies

To introduce Design, Fabrication and Simulation of HEAT PIPES

To introduce Fuel Cells and Thermal Energy Storage Systems

### **Course Contents**

- Advances and Opportunities in Passive Micro and Miniature Technologies for Energy and Thermal Systems
- Introduction to Heat pipe Science and Technology
- ☆ Analysis and Simulations of Heat Pipes
- ☆ Design and Fabrications of Heat Pipes
- Introduction in Fuel Cells Science and Technology
- Direct Methanol Fuel Cells- Analysis and Simulation
- Challenges and Opportunities in Thermal Energy Storage Systems
- Enhanced Latent Heat Thermal Energy Storage for Concentrating Solar Power

# **Course Instructor**

Prof. Amir Faghri Department of Mechanical Engineering University of Connecticut, USA



**Brief Profile**: Dr. Faghri is presently a professor of Mechanical Engineering at the University of Connecticut. Dr. Faghri joined the University of Connecticut in 1994 and served as Head of the Mechanical Engineering Department from 1994-1998, and the Dean of the School of Engineering from 1998-2006. Dr. Faghri has authored four books, more than 300 archival technical publications (including 220 journal papers), and ten U.S. patents.

# **Editorial Positions**

- Honorary Editorial Advisory Board, International Journal of Heat and Mass Transfer (1997-Present)
- **Editorial Advisory Board, International Journal of Numerical Methods for Heat and Fluid Flow** (1998-2007)
- Honorary Member, Editorial Advisory Board, International Communications in Heat and Mass Transfer (1997-Present)
- Executive Editor, Heat Transfer Engineering Journal (Thermal Storage & Heat Pipes) (1993-Present)
- 🔀 North American Editor, Journal of Enhanced Heat Transfer (1993-2010)
- 🔀 Editorial Board, ASME Journal of Heat Transfer (1993-1996)
- **Editor-in-Chief, Frontiers in Heat and Mass Transfer (2010-Present)**
- 🔀 Editor-in-Chief, Frontiers in Heat Pipes (2010-Present)

## Patents by Prof. Amir Faghri

- ☆ Thermal-Fluids Management System for Small Direct Methanol Fuel Cells
- 汶 Vapor Feed Fuel Cells with a Passive Thermal-Fluids Management System
- 🔆 Centrifugal Heat Pipe System
- $\bigstar$  Temperature Regulation System for the Human Body Using Heat Pipes
- 🙀 Micro Heat Pipe Energy Storage System
- 🔆 Thermal Energy Storage Heat Exchanger
- 🙀 Micro Heat Pipe Embedded Bipolar Plates for Fuel Cell Stacks
- ☆ Integrated Bipolar Plate Heat Pipe for Fuel Cell Stacks
- ☆ Energy Storage and Thermal Management Using Phase Change Materials in Conjunction with Heat pipes and Foils, Foams or Other Porous Media

### Few Books authored by Prof. Amir Faghri



## **Course Coordinator**

#### Dr. Shanmugam Dhinakaran Associate Professor Department of Mechanical Engineering INDIAN INSTITUTE OF TECHNOLOGY INDORE, INDIA

## **Brief Profile**



Dr. Shanmugam Dhinakaran is an Associate Professor in the Department of Mechanical Engineering, Indian Institute of Technology Indore. He received his PhD from Indian Institute of Technology Kharagpur in the area of Computational Fluid Dynamics and Heat Transfer. He has a wide post-doctoral research experience in CFD and Heat Transfer in several European Universities. Dr. Dhinakaran joined the institute in the year 2012 and is the coordinator of The Centre for Fluid Dynamics, IIT Indore.

His research interests include flow and heat transfer from solid and porous bluff bodies; heat transfer enhancement studies using nanofluids; blood flow in diseased arteries; analysis flow and heat transfer of non-Newtonian fluids; heat pipes.

## About IIT Indore



Indian Institute of Technology Indore (IIT Indore) is one of the premier institutions established by the Ministry of Human Resource Development, Government of India at Indore in 2009. The institute is functioning in its campus at Simrol. IIT Indore offers B. Tech, M.Tech, M.Sc and Ph.D. programs in engineering, science and humanities stream. For more information about the institute, please visit <u>www.iiti.ac.in</u>



All Mechanical Engineers and Mechanical Engineering students are advised to attend this course		
Undergraduates	Scientists	
Postgraduates	Practicng Thermal Engineers	
Industries	Research Scholars	



#### Learning ...

You will learn about the latest advances in Micro and miniatures technologies

You will learn the Science and Technology of Heat Pipes

You will learn about Fuel Cells

You will learn about Thermal Energy Storage Systems

#### Opportunity to meet an expert in the area

You will get an unique opportunity to meet and listen to the lecture of a renowned person worldwide in the field who holds an editorial position in several journals and has authored several research articles, patents and books. All students are advised to make use of this opportunity

#### **Opportunity to meets researchers**

As this course attract students, researchers, PhD Scholars, Scientists from R&D organizations and Industries. You will get an opportunity to meet and discuss with all the participants.


UG & PG Students	Rs. 1,500
Research Scholars	Rs. 2,500
Faculty members	Rs. 4,000
Industry, R&D Organizations	Rs. 10,000
Foreigners	USD 250

#### How to register

 Register yourself in the IIT Kharagpur GIAN Portal and choose this course in the list to register.

Gian Portal: <u>http://www.gian.iitkgp.ac.in</u> Registration site: <u>http://www.gian.iitkg-</u> p.ac.in/GREGN/register

- Fill the registration form available in this page - <u>http://people.iiti.ac.in/~sdhina</u>
- Send the soft copy of this registration form to the course coordinator

#### Accommodation

Accommodation will be provided to participants on payment basis in institute hostel and guest house (subject to availability at the time of your registration).

#### **Registration deadline**

January 8, 2017

#### Coordinator

#### Dr. Shanmugam Dhinakaran Associate Professor

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Email: <u>sdhina@iiti.ac.in</u> Mobile: +91- 9111 74 91 91 (If you have any queries, please feel free to call)

#### Venue

Indian Institute of Technology Indore Madhya Pradesh, INDIA