Fuel Cells for Automotive Applications

Overview

Fuel cell technology for automotive applications is an attractive prospect for automotive manufacturers and consumers alike as it provides a low carbon solution to mobility without the limited range associated with battery electric vehicles. There are number of fuel cell technologies with varying energy densities, efficiencies and can utilize a variety of fuels. Automotive applications lean towards proton exchange membrane (PEM) fuel cells due to their low temperature operation and high efficiency. The course is designed to provide practical overview of fuel cell systems for transportation applications based on load/duty cycle requirement including transient operation. Various fuel cell systems would be analyzed and selection criteria introduced towards automotive applications. The course would focus with a comprehensive treatise of technologies that constitute the solar-hydrogen cycle for hydrogen generation, hydrogen storage and distribution and fuel cells. The course is planned with 14 contact hours along with 6 hours of Lab Experiments.

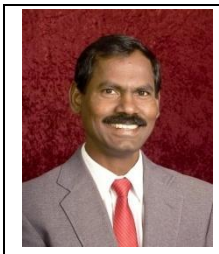
Objectives

The primary objectives of the course are as follows:

- To understand the concepts of various Fuel Cell operation.
- To emphasize on emerging technologies and advanced materials for Fuel cells projected for Transportation Applications.
- To impart knowledge on the assembly and testing of fuel cell, characterization of new materials for fuel cell applications.

Course Module	**Fuel Cells for Automotive Applications**
Course Period	**12th Dec.2016 – 15th Dec.2016**
Host Institute	**NIT, Tiruchirappalli**
Who can attend	• Students at all levels (BTech/MSc/MTech/PhD) or Faculty from academic institutions and technical institutions. • Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories.
Maximum No. of Participants	**30**
Fees	**Participants from abroad** : US $500 **Industry/ Research Organizations:** Rs.30000/- **Academic Institutions:** Rs.6000/- The above fee is towards **participation in the course, use of fuel cell lab facilities, all instructional materials, computer use for tutorials, 24 h free internet facility, food and accommodation**. The participants will be provided with twin sharing air-conditioned/ single non-A/C accommodation on first come first served basis. **Mode of payment:** Demand draft in favour of "Director, NIT, Tiruchirappalli" payable at Tiruchirappalli. The demand draft is to be sent to the Course Coordinator.
How to Register	**Stage 1**:Web (Portal) Registration: Visit GIAN Website at the link: http://www.gian.iitkgp.ac.in/GREGN/index and create login User ID and Password. Fill up the registration form and do web registration by paying Rs. 500/- online through Net Banking/ Debit/ Credit card. This provides the user with lifetime registration to enroll in any number of GIAN courses. **Stage 2**: Course Registration (Through GIAN Portal): Log in to the GIAN portal with the user ID and Password created. Click on "Course Registration" option given at the top of the registration form. Select the course titled "**Fuel Cells for Automotive Applications**" from the list and click on "Save" option. Confirm registration by Clicking on "Confirm Course".

The Faculty



Teaching Faculty

Dr. A. M. Kannan is a Professor at the Polytechnic School of the Ira A. Fulton Schools of Engineering, Arizona State University, USA. Dr. Kannan earned his Ph.D. degree (1990) from IISc, Bangalore with a focus on Metal/Air Batteries and Alkaline Fuel Cells. Dr. Kannan has been involved in Fuel Cell and Battery R & D for >30 years. He joined Arizona State University in 2005 after working in renewable energy industry for 15 years at Hoku Scientific Inc., Honolulu managing a scientific research group for developing materials for PEMFC towards automotive applications. His areas of expertise and research interests include low temperature Fuel Cells including Bio-Fuel Cells and PEMFCs, their components, evaluation of single cells and stacks. He has more than 100 energy related peer reviewed international publications and currently his H index is 27. He is also serving as part of the active editorial board in various Journals and an Editor-in-Chief for the Reports in Electrochemistry. Dr. Kannan was a Fulbright Specialist Fellow (2012) at the Tampere Technological University and VTT Technical Center, Finland. Dr. Kannan was selected as a Baltic-American Foundation Fellow for organizing a week long workshop on **Contribution of renewables to energy security** at the Institute of Energy Systems and Environment, Riga Technical University, Latvia (2015). Dr. Kannan's current research also involves development of automotive hybrid drive trains (with Li-Ion Batteries) of GM's performance car (Chevy Camaro) through EcoCAR3 program.

Host faculty

Dr. L. Cindrella is the Professor and Head, Department of Chemistry, National Institute of Technology, Tiruchirappalli. Dr. Cindrella got her Ph.D. degree from Madurai Kamaraj University specializing on solar selective coatings and convection suppression devices for application in solar thermal systems. Her current research areas are development of catalysts, membrane electrode assembly for PEM fuel cells, energy materials for solar thermal and photovoltaic conversion systems and their real time evaluation. Dr.Cindrella has 25 years of teaching experience at NIT, Tiruchirappalli. She was selected for the TCT programme on Storage of solar energy at Salford University, UK in 1997 and received training on PEM fuel cell at Arizona State University, USA in 2007 & 2009. She has completed seven research projects, and one R & D project is in progress. Dr.Cindrella has guided 3 Doctoral thesis and is currently guiding 10 scholars in the fields of energy materials and their applications. Dr.Cindrella has established an electrochemical lab for assembling and testing PEM fuel cell and has also developed a Computational Chemistry Lab for molecular modeling.

Course Coordinator

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Course Details:		
12th December, 2016	Welcome & opening remarks on the event **Overview** of energy fundamentals: fossil fuels for Automotive applications Renewable energy technologies: Technical fundamentals **Elements** of hydrogen economy Introduction: Basic operating principles of Fuel Cells	Prof. L. Cindrella NITT Prof.A.M. Kannan Arizona State University, USA Prof.A.M. Kannan
13th December, 2016	Renewable energy technologies : Transition from fossil fuel based to hydrogen economy PEM Fuel Cell Components: Electrolyte, electrodes, Gas Diffusion Layer and Membrane Electrode Assemblies. **Fuel Cell** Performance, Durability and Cost aspects for Automotive applications.	Prof.A.M. Kannan Prof.A.M. Kannan
14th December, 2016 Laboratory Experiments	PEM Fuel Cell components, Fuel Cell assembly and Evaluation under simulated Automotive operating Conditions Evaluation of PEM Fuel Cells under simulated Automotive operating Conditions	Prof. L.Cindrella Prof.A.M. Kannan Prof. L.Cindrella Prof.A.M. Kannan
15th December, 2016	**Analysis** of Experimental Results Economic and social aspects of PEM Fuel Cells for automotive applications Future of Hydrogen Roadmap Sustainable energy economy	Prof. L.Cindrella Prof.A.M. Kannan