

**Indian Institute of Technology Kharagpur (WB) 721 302, INDIA**

## **Cryogenic Engineering Centre**

***Announces***

***A 6-day 48-hour Training Programme for Engineers***

### **CRYOGENIC AIR SEPARATION – 2010 (Open Course)**



**March 18 - 24, 2010 (Thursday - Wednesday) (Sunday off)**

#### **Introduction:**

Cryogenic Air Separation Plant needs an engineer who can not only operate and maintain the plant, but can also go on improving the functioning of different components with an aim to increase the production, decrease power consumption, meet purity requirements and enhance plant safety. Sometimes he may be called upon to design a small component, float enquiry to purchase equipment or anticipate problems of changing operating parameters in the plant. Cryogenic Air Separation engineer has to think and act as a combination of a Mechanical, a Chemical and a Cryogenic Engineer and it is quite a task. A formal training program such as this would help an engineer to attain these objectives and contribute substantially to the bottom-line of his company.

#### **Course Outline:**

1. Introduction to Air Separation, 2. Properties of solids and fluids at Cryogenic temperatures (with reference to Cryogenic safety, wherever applicable). Use of Tables and Charts, 3. Cryogenic Insulations, Storage and transport vessels & vacuum insulated piping, 4. Oxygen Cylinder filling calculations, 5. Air Separation Plant Safety, CGA and ASTM Guidelines on oxygen safety, 6. Psychrometric Processes: Water separation on compression, Moisture Load on mol Sieves, Design and operation of WN2-Water tower and Cooling Tower, 7. Fluid Flow and Pressure Drop: relationship with viscosity, velocity, diameter etc., 8. Heat Transfer Concepts and Equations, Heat Exchangers, Intercoolers, Aftercoolers, Oil-coolers, Cryogenic Heat Exchangers (PFHE): performance evaluation, operation, and protection, 9. Compression Process, Positive Displacement and Centrifugal Compressors and their characteristics, 10. Conventional Refrigeration Processes : Ammonia, R-22 and R-11, 11. Removal of CO<sub>2</sub>, moisture and hydrocarbons: Mol-Sieve Adsorption, 12. Cryogenic Liquefaction Cycles : Linde Cycle, Claude Cycle and their derivatives, 13. Cryogenic Distillation, 14. Air Separation Plant Configurations, 15. Intricacies of Argon separation, Effect of excess liquid or excess gas draw on product purity, packed column versus sieve trays, 16. Mass Balance and Energy Balance in an Air Separation Plant.

#### **Faculty:**

Dr. Kanchan Chowdhury, Professor of Cryogenic Engineering Centre at Indian Institute of Technology, Kharagpur will serve as the core faculty. Faculty from Industry may be involved.

#### **Eligibility:**

Engineers with degrees in any branch of engineering are eligible. Experience in industry or R&D laboratory is not essential for engineers. M. Sc., B. Sc. or Diploma holders with relevant experience in Air Separation may be allowed.

#### **Venue of Lectures:**

Visveswaraya Guest House Lecture Room,  
Indian Institute of Technology, Kharagpur 721302

#### **Class Schedule:**

**Dates:** March 18 - 24, 2010 (Thursday - Wednesday) (Sunday off)

**Timing :** Classes will begin at 9 AM sharp. There will be breaks for lunch and coffee. Classes will end at 6 PM everyday. There will be net 8 hour interaction every day. The course is a 48-hour program.

**Registration:**

Intending participants are requested to send the required information for registration to the Course Coordinator latest by January 31, 2010, along with the course fee in the form of draft drawn on any bank at Kharagpur or at par cheque in favour of 'CEP-STC, IIT Kharagpur' in full. The course fee is INR 25000.00 (Indian Rupees Twenty-five Thousand only) or US\$ 600.00 (US Dollar Six hundred only) for foreign participants paying in dollars. Drafts or cheques not drawn on Kharagpur or drawn any bank of India which are not at par have to add an extra Rs.400.00 (or US \$ 10 only) per participant to the registration fees as collection charges. Cheques drawn on other countries would not be accepted. Charges for the boarding and lodging should be paid by the participants directly to Guest House. The Course fee includes bound lecture notes, working lunch and tea/coffee provided during the course.

**Accommodation:**

Ashutosh Mukherjee Guest House: Single-bedded rooms (AC) (Rs. 200 / person per day as of Oct '09) Depending on request, participants would be booked in Guest House on a first-come-first serve basis. If the number of participants exceeds 25, Guest House cannot be assured and hotel rooms outside the campus may be arranged for those whose requests would be received late.

**General Information:**

IIT is located about 6 km from the Kharagpur Railway Station. Kharagpur, 116 km from Calcutta, is conveniently connected to Howrah (Calcutta) by many local trains every hour and also by express trains. Kharagpur has direct rail links to most major cities in India. Those travelling by air may hire a taxi from Calcutta airport, which would bring you to IIT Campus at Kharagpur (150 km one way) within 2.5 hours. The minimum charge is about Rs. 2,000. Rickshaws (Rs.40), Autorickshaws (Rs.55) and Taxis (Rs. 80) are available to come from the Kharagpur Railway Station to IIT campus. Weather at Kharagpur may just begin to be warm by end-March. Contact Damodar Maity of Saraj Travels (+91 9434146359) for travel-related help.

**Sponsors may please note:**

- a) Please inform the candidate that he/she should bring a scientific calculator to the classroom.
- b) Please give a photocopy of this brochure to the prospective participant as soon as he/she is nominated by the company and please tell them to contact the coordinator directly via e-mail.

**Information Required for Registration:**

Name, Designation/Responsibility, Name and Address of Company, Phone (Off), Phone (Res), Phone (Mobile), Fax, E-mail, Date of Birth, Highest Academic Qualification, Demand Draft details and Amount, Requirement for Guest House bed.

**Please Fax/Mail/ E-mail the information to:**

Professor Kanchan Chowdhury  
Cryogenic Engineering Centre  
Indian Institute of Technology  
Kharagpur 721 302, West Bengal, India  
Phone (Off) : (03222) 283582; Country Code for India: 91  
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Copy to : chowdhury.kanchan@gmail.com

**LAST DATE OF APPLICATION: January 31, 2010**