

**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 AND OXYGEN SAFETY – 2012 (Open Course)**

**February 27 – March 03, 2012 (Monday - Saturday)**



[This brochure may also be downloaded from [http://www.iitkgp.ac.in/downloads/air\\_separation.pdf](http://www.iitkgp.ac.in/downloads/air_separation.pdf)]

### **Course Outline:**

**Cryogenic Air Separation topics:** 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. Cryogenic and Air Separation Plant Safety, 6. Psychrometric Processes: Water separation on compression, Moisture Load on mol Sieves, Design and operation of WN<sub>2</sub>-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.

**Safety Topics:** 1. General Concepts of Fire triangle. 2. Characterization of materials (metals and non-metals) along with data such as Oxygen Index, Heat of Combustion etc. and effects of pressure, temperature, humidity etc on them. 3. Ignition mechanism and the mitigation: Adiabatic Compression, External Friction, Mass Impact, Particle Impact, Static Electricity, Resonance in Cavities, Internal Friction etc. 4. Selection of Materials: Metals and Non-metals. 5. System or Component Design based on the Critical Operating Parameters. 6. Analyses of designs of components: Valves, Pipelines, Bends, Filters, regulator. 7. International Safety Codes and Standards.

### **Faculty:**

Dr. Kanchan Chowdhury, Professor of Cryogenic Engineering Centre at Indian Institute of Technology, Kharagpur will serve as the core faculty.

### **Eligibility:**

Engineers with degrees in any branch of engineering are eligible. 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:** February 27 – March 03, 2012 (Monday - Saturday)

### **Sponsors may please note:**

- Please inform the candidate that he/she should bring a scientific calculator to the classroom **without fail**.
- Companies located outside India please note: “Additional Information Required for Registration of Participants holding Foreign Passports”.
- 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.

**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:**

For participants from within India, the course fee is INR 35,000.00 (Indian Rupees Thirty-five Thousand only), which may be sent as demand draft on any bank at Kharagpur or at par cheque or as bank transfer in favour of 'CEP-STC, IIT Kharagpur' in full.

For participants coming from outside India, course fee is US\$ 800 (US Dollar Eight Hundred only), which may be sent as bank draft or bank transfer in favour of 'CEP-STC, IIT Kharagpur' on any bank in India.

Bank transfer would be accepted for all participants: both from within and outside India. A scanned copy of the bank transfer document may be sent as proof of payment.

Bank details: (a) Name of Bank : Syndicate Bank, IIT-SRIC Extension, Kharagpur 721302, India; (b) In favour of (Account Name): CEP-STC, IIT Kharagpur; (c) Address of Beneficiary: Indian Institute of Technology, Kharagpur, PIN: 721 302, West Bengal, India; (d) Account Number: 9556 220 000 2955; (e) IFSC/RTGS Code : SYNB 0009556 (f) Bank Swift Code: SYNBINBB 120. All Bank charges are to be borne by the company.

The Course fee includes bound lecture notes, working lunch and tea/coffee provided during the course.

**Information Required for Registration for all participants:**

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

**Additional Information Required for Registration of Participants holding Foreign Passports:**

The following additional information may be provided for all participants holding foreign passports: Name, Fathers name, Nationality, Date of Birth, Place of birth, Number, Date and Place of Issue of Passport, Current Residential Address, Permanent Residential Address, Profession, Place of Employment, Academic Credentials. Please use separate pages for each participant.

**Accommodation:**

Rooms will be booked at the New Technology Guest House. Single occupancy in a double-bedded room (AC) (Rs. 800 / person per day), Double occupancy in a double-bedded room (AC) (Rs. 600 / person per day) and Suites (AC, with a big bed in one room, sofa set and fridge in another) (Rs. 1,500 / room per day) are available. All rooms have TV and internet facility. Please specify the type of room to be booked.

Charges for the boarding and lodging should be paid by the participants directly to the Guest House.

**General Information:**

IIT is located about 6 km from the Kharagpur Railway Station. Kharagpur, 116 km from Calcutta by train, is conveniently connected to Howrah (Kolkata) 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. 2,500. Rickshaws (Rs.70), Autorickshaws (Rs. 80) and Taxis (Rs. 120) are available to come from Kharagpur Railway Station to IIT campus. Weather at Kharagpur would be pleasant in February. Please contact Mr. Arjun Kumar Saha of J K Travels (+91 94341 93014, +91 99325 73310) or Damodar Maity of Saraj Travels (+91 94341 46359, +91 3222 277015) for travel-related help. You may request any one of them to send a vehicle to Kolkata airport to pick you up. Please give my reference.

**Please E-mail Information to:**

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**REGISTRATION CLOSES ON: FEBRUARY 01, 2012**