

INTRODUCTION

IIT Kharagpur is the first of its kind in the country and has been providing trained manpower for different Industries/Research organizations through B.Tech, M.Tech and Ph.D programs. Specialized courses and workshops are also being organized under Continuing Education Programme (CEP) to train personnel from Industries/Universities. The institute has established a sophisticated **Vacuum Teaching Laboratory** in Cryogenic Engineering Centre under Indo-German Collaboration Programme, to train technicians, engineers, scientists and teachers working in the field of vacuum and its related areas. This laboratory houses several advanced vacuum equipment for production/measurement of vacuum and troubleshooting/application of vacuum systems. In addition, the institute has several high vacuum systems applied for metallurgical processes, MBE growth of thin films, microelectronic devices, Surface studies and Chemical analysis. These facilities are routinely used to solve technical problems faced by vacuum and related industries.

OBJECTIVES

Vacuum Technology has diversified applications in different areas of science and Engineering. These include major fields like Electronics, Metallurgical/ Chemical Processing, Food Processing, Space-Simulation, Nuclear Engineering, Electrical Engineering and Cryogenic systems. This has resulted in rapid development of many sophisticated vacuum instruments, pushing the range of vacuum to 10^{-12} Torr. To keep pace with this advancement in vacuum technology, it is absolutely necessary for the engineers/scientists/teachers of our country to get a first hand exposure to these modern vacuum equipment and their applications. Keeping this objective in mind, present course on **Vacuum Technology** is undertaken with special emphasis on semiconductor processing/display systems.

COURSE OUTLINE

1. Introduction to basic concepts of vacuum.
2. Application of vacuum in different processes. (Metallurgical, electronic, chemical, electrical, space, nuclear, pharmaceutical, food and cryogenics)
3. Production of Low, medium and high vacuum by using different pumps. (from Atm to 10^{-8} Torr)-their selection criteria.
4. Principles of Rotary, roots, Scroll, screw, dry membrane and different pumps.
5. Ultra-high vacuum pumps and their pumping characteristics, Handling and maintenance of Turbo-molecular, Ion and Cryo-pumps.
6. Design of interfaces for Cryo and Turbo pumps.
7. Design and Fabrication of vacuum chambers, flanges, couplings, and components for different applications/ Best practices.
8. Gas flow in vacuum systems, conductance calculations and measurements on vacuum piping networks. Design of vacuum piping in semiconductor industry.
9. Vacuum system design / safety.
10. Pressure measurement in vacuum systems using primary and secondary gauges.
11. Residual gas analysis in vacuum systems.
12. Leak detection/trouble shooting/maintenance of vacuum systems, handling of mass spectrometric leak detectors, degassing procedures.
13. Cleaning requirements for components used in vacuum to achieve good quality of vacuum for semiconductor processing.
14. Effect of surface finish on vacuum in terms of out gassing.
15. Physical and chemical phenomena including molecular flow.
16. Application of vacuum in different Semiconductor processes like PVD, CVD, ALD, Etch etc.,
17. Pump down calculation with examples.
18. Sealing materials.
19. Differential vacuum pumping concepts (used on Electron beam microscopy)
20. Vacuum Compatible non-metallic materials.
21. Latest technologies in vacuum system adopted by semiconductor and display industries.
22. Compatibility of cast Aluminum and cast Stainless steel inside vacuum.
23. Vacuum compatible Lubricants and their required characteristics and properties
24. Vacuum Feedthroughs (electrical, pneumatic, motion) – Categories, material, principles

FACULTY



Prof. V. Vasudeva Rao is a Professor of Cryogenic Engineering, Indian Institute of Technology, Kharagpur. He has 33 years teaching and research experience in the area of Vacuum Technology, Superconductivity and its applications. He is Member of many professional societies like Indian Vacuum Society, ICC & IEEE. He has handled many Sponsored Research and industrial consultancy projects and published over 70 journal papers in international journals. He has established Vacuum Technology Laboratory at IIT Kharagpur under Indo-German collaboration programme. He has co-authored a text book on "Vacuum Science and Technology" (Allied Publishers- New Delhi). He is a consultant to Power Grid Corporation of India Limited, BHEL, Crompton Greaves, DRDL, and Schneider.

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**REGISTRATION/COURSE
MATERIALS/CERTIFICATE:**

Each registered participant will be provided with a detailed lecture notes on **"VACUUM TECHNOLOGY" in electronic version**. At the end of the course, the institute will issue a certificate.



IIT Kharagpur
Presents



AN OFF-CAMPUS FIVE-DAY COURSE ON

VACUUM TECHNOLOGY

(12th Nov – 16th Nov 2018)

at

**APPLIED MATERIALS INDIA PRIVATE LIMITED,
BANGALORE**

**VACUUM TECHNOLOGY LABORATORY
CRYOGENIC ENGINEERING CENTRE
INDIAN INSTITUTE OF TECHNOLOGY
KHARAGPUR - 721 302.**

Co-ordinator

Prof. V. Vasudeva Rao