



VACUUM TECHNOLOGY & PROCESS APPLICATION

PROF. V. VASUDEVA RAO

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IIT Kharagpur

INTENDED AUDIENCE : UG, PG, Research Scholar, Industry Personnel and college teachers

INDUSTRY SUPPORT : Electronic/Electrical/Pharma/Chemical/Metallurgical/food processing/nuclear/space sectors; BHEL/Crompton Greaves/Applied Materials/Defence laboratories/ Reddy Labs/ISRO/DAE/Aurobindo Pharma/BARC/NFC & vacuum industries. I have offered this course 30 times as self-sponsored under CEP programme of IIT Kharagpur

COURSE OUTLINE :

This course starts with a lucid introduction to basic concepts & applications of vacuum technology. This is followed by production, measurement, system design, process applications along with trouble shooting and maintenance of vacuum systems. This course is quite relevant to the modern process technologies like mobile/TV/Computer manufacturing, semiconductor processing, solar energy, metallurgical processing and steel degassing, drying of pharmaceutical intermediates and processed packed food. This course also serves Indian space and nuclear sectors as vacuum is essential for space simulation, thermovac chambers for satellite testing, particle accelerators and nuclear fusion for future clean energy.

ABOUT INSTRUCTOR :

Prof. V. Vasudeva Rao obtained his PhD (1985) from IIT Madras in Experimental Physics. Since 1985, he is working as faculty member in Cryogenic Engineering Centre, IIT Kharagpur. He has taught several times (35 years) the present course on Vacuum Technology to UG and PG students of IIT Kharagpur. He has published 107 international & national journal publications and guided 10PhDs & 35 Mtech students. He received advanced training on Vacuum techniques and applications at Fachhochschule, Frankfurt, Germany. He has coauthored a text book on vacuum science and technology for colleges. He has handled research projects to the tune of Rs 3 crore in the fields of Applied Superconductivity, Cryogenic Engineering, nuclear fusion, energy storage and Advanced Materials. He acted as a consultant to power Grid Corporation-New Delhi, BHEL-Hyderabad, Crompton Greaves-Mumbai, DRDL and several other vacuum related industries. Further, he has organized 35 self-sponsored short term courses on Vacuum Technology & Process Applications under continuing education programme to college teachers, scientists from R&D labs and industry personnel working in the fields related to Vacuum Technology.

COURSE PLAN :

- Week 1:** Introduction to the course, Basic concepts of Vacuum Technology, Physical Principles behind various Vacuum process applications
- Week 2:** Action & Construction of Rotary Vane pump, Rotary piston pump, Diffusion pump and Roots Blower
- Week 3:** Screw/Diaphragm/Claw/Scroll pumps for dry vacuum production
- Week 4:** Turbomolecular, Ion & Cryopumps for ultra-high vacuum production, Selection criteria of vacuum pumps for different applications.
- Week 5:** Measurement of Vacuum using Primary & Secondary gauges (U Tube/McLeod/Bourdon/Pirani/Penning/Ionization/Capacitance)
- Week 6:** Vacuum Materials, Valves & Components, Mechanical design of Vacuum vessels, Fabrication and testing of Vacuum chambers, Degassing procedures.
- Week 7:** Fluid flow in Vacuum systems, flow conductance, Effective pumping speed and pump down time calculations for molecular and viscous regions.
- Week 8:** Design aspects of Vacuum systems for different applications, Complete design of Vacuum furnace for Metallurgical processing as an example tutorial
- Week 9:** Leak detection, troubleshooting of vacuum systems, mass spectrometric leak detectors, residual gas analyzers, Outgassing in UHV systems
- Week 10:** Application of Vacuum Technology in Chemical/Pharmaceutical/Food processing and packing/Medical/Solar thermal/Wood processing/Precise lifting applications
- Week 11:** Application of Vacuum Technology in Electrical/coating/Electronics/semiconductor and Metallurgical processes. Vacuum aspects of IC chip/Solar PV cell/Mobile/TV/Computer manufacturing
- Week 12:** Application of Vacuum in Space (ISRO) and Nuclear (DAE) applications, Nuclear fusion for future clean energy, Space simulation chambers for satellite and space shuttle testing