Skill Enhancement Courses

Annexure-4.21
EC dated 12.07.2025

Vacuum Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Prerequisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Vacuum Technology	2	0	0	2	Class XII	NIL

Learning Outcomes

Upon completion of this course, participants will:

1. Gain an understanding of the fundamentals of vacuum systems.
2. Identify and explain the types and applications of vacuum pumps.
3. Understand the construction, operation, and maintenance of vacuum pumps and gauges.
4. Develop practical skills in using and caring for vacuum systems.

Syllabus (30 hours)

Vacuum Pumps (4 weeks)

Introduction to vacuum, basic idea of exhaust pressure and base pressure. Units in vacuum and their interconversion, Need for vacuum in industrial systems, Application of vacuum in industry and research.

Vacuum pumps and their types – Positive displacement pumps, momentum transfer pumps and entrapment pumps. Categorization of vacuum pumps under primary and secondary pumps on the basis of pumping speed and throughput.

Construction and Working principle of Vacuum Pumps (8 weeks)

Positive Displacement pumps: Rotary Vane pump (direct / belt driven), Diaphragm pump, Piston pump, Roots/ Booster pump.

Momentum Transfer pumps: Turbo Molecular pump, Diffusion pump (need for water / Liquid N2 cooling), advantages and disadvantages.

Entrapment pumps: Ion-sorption pump, Cryopump

Maintenance and Care of Pumps (1 week)

Pump Care: Measures for pump care, fitting terminologies used in vacuum pumps like various types of flanges (KF series), O-rings and their material types [neoprene, viton, kalrez, teflon, Oxygen Free Copper (OFC)] etc.

Gauges for Pressure Measurement (2 weeks)

Pirani gauge (construction and working), Penning gauge (construction and working), hot cathode and cold cathode gauge (construction and working of CC - 10).

Major pump manufacturers in the world

Edwards, Pfeiffer Vacuum, Leybold, Alcatel Vacuum, Busch Vacuum Solutions, Agilent Technologies, Gardner Denver, VACUUBRAND, Bertin Technologies and RUVAC

Hands-On Activities/Experiments

1. Identification and fitting of pump components.
2. Practical demonstration and operation of rotary pump (Direct and /or Belt driven) with pirani readings
3. Practical demonstration and operation of diffusion pump with pirani and penning gauge head readings
4. Vacuum level measurement (pressure monitoring) using Pirani, Penning, hot and cold cathode gauges.
5. Practical demonstration and operation of turbo molecular pump with Display Control Unit (DCU)

List of Suggested Books

1. "Handbook of Thin Film Technology" by Leon I. Maissel and Reinhard Glang - McGraw Hill ISBN 13: 9780070397422

2. "Vacuum Technology and Applications" by David J. Hucknall - Elsevier ISBN: 978-0-7506-1145-9

3. "Materials Science of Thin Films: Deposition and Structure" - Milton Ohring - Academic Press ISBN: 978-0125249751

4. "Introduction to Vacuum Technology" - Milne Open Textbooks, Milne Library, State University of New York at Geneseo, Geneseo, NY 14454, ISBN : 978-1-942341-96-3

Examination scheme and mode:

Total Marks: 100

Internal Assessment: 25 Marks

Practical Exam (Internal): 25 Marks

End Semester University Exam: 50 Marks

The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.