

Course Code	Course Name	Credits
26PH104	VACUUM SCIENCE	04

### Course Objectives

- To know the properties of rarefied gases
- To know the basic working mechanism of vacuum pumps

### Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Understand then kinetic theory of gases.
- Understand the vacuum parameters.
- Understand the various applications of vacuum pumps.

### Unit 1 - Physics of Rarefied gases (12 Hrs.)

Kinetic theory of gas, Gas law, mean free path, viscosity of gas, diffusion of gases, resistance and conductance of vacuum pipework, gas flow in pipework, Pump down time, absorption and desorption of gases, Solubility of gases, Permeation of gases through solid, vapor pressure.

### Unit 2 – Production of vacuum (12 Hrs.)

Classification, type and ranges of vacuum pumps, Vacuum pump variables, baffles and traps

### Unit 3 - Measurements of vacuum parameters (12 Hrs.)

Classification, types, and ranges of vacuum gauges, measurement of partial pressure, Flow measurement, leak testing.

### Unit 4 – Vacuum system components (12 Hrs.)

Vacuum system engineering, vacuum joints, seals, valves, feed-through, view ports, vacuum materials.

### Unit 5 - Applications of vacuum technology (12 Hrs.)

Vacuum system and components for electronics, metallurgy, chemical and nuclear field.

### Reference Books:

1. Fundamental of vacuum technique by A Pipko, V. Pliskovsky, B.Korolev, V.Kuznetsov, Mir Publisher, Moscow 1984
2. Scientific foundations of vacuum Technique, by S Dushman, John Wiley & Sons Inc. New York 1962.
3. Vacuum Technology and Applications, by D.J. Hucknall, Butter-Heinemann, Oxford, 1991

### Websites and eLearning Sources:

1. [https://onlinecourses.nptel.ac.in/noc22\\_ge30/preview](https://onlinecourses.nptel.ac.in/noc22_ge30/preview)
2. <https://youtu.be/XpKAiBAO0Sc?si=C3m24OsI83zmZdNL>
3. [https://youtu.be/xT2x7okaqQM?si=3C02JbJIN8d\\_xrA2](https://youtu.be/xT2x7okaqQM?si=3C02JbJIN8d_xrA2)



**COs and Bloom's Taxonomy Mapping – 26PH104**

<b>Course Outcomes</b>	<b>On completing U.G. program the students will be able to</b>	<b>BTL</b>
<b>CO1</b>	Recall and list key concepts, laws, and equations related to the physics of rarefied gases and vacuum technology, including the kinetic theory of gases and gas laws.	K1
<b>CO2</b>	Explain the principles behind the behavior of rarefied gases, including viscosity, diffusion, and the mean free path.	K2
<b>CO3</b>	Apply theoretical concepts and mathematical techniques to solve problems related to vacuum measurements and gas flow in vacuum systems.	K3
<b>CO4</b>	Analyze the components of vacuum systems, including vacuum pumps and gauges, and evaluate their performance in various applications.	K4
<b>CO5</b>	Critically evaluate the effectiveness of different vacuum systems and propose innovative solutions for specific applications in electronics and metallurgy.	K5, K6

**BTL K1 and K2 – remembering and understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6 - Create**

**Relationship Matrix – 26PH104**

<b>Course Outcomes</b>	<b>Programme Outcomes (POs)</b>						<b>Programme Specific Outcomes (PSOs)</b>						<b>Mean Score of Cos</b>
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	
<b>CO1</b>	3	2	2	1	1	1	3	1	2	1	1	1	1.58
<b>CO2</b>	2	3	2	1	1	1	1	3	2	2	1	1	1.67
<b>CO3</b>	2	2	3	2	1	1	1	2	3	2	1	1	1.75
<b>CO4</b>	2	3	2	1	2	1	1	2	2	3	2	1	1.83
<b>CO5</b>	3	3	2	3	2	3	1	2	3	2	3	3	2.50
<b>Total</b>													1.87

Mean Score: 3- High, 2- Medium/Moderate, 1-Low

