(Time: 3 Hours) **Total Marks: 80**

N.B.

1. Question No. 1 is Compulsory.
2 Attempt any **Three** Questions from remaining **Five** Questions
3. Assume Suitable Data if needed and Justify the Same
4. Figures to the right indicate full marks.

Q1 Write short notes or Explain any four of the following [20]

a) Pressure swing adsorption (PSA) technology.
b) Explain working principle of froth flotation.
c) Liquid-liquid chromatography.
d) Applications of chromatography in separation of enzymes and proteins.
e) What are the characteristics of Membrane Processes?

Q2.a. Explain the principle of HPLC and with the help of schematic diagram discuss various components of HPLC. [10]

b. What are the various Types of adsorbent? Explain with its characteristics and applications. [10]

Q3. a. Discuss the any one type of flotation equipment used for waste water treatment [10]

b. What are the different equipments used for continuous adsorption. Discuss any one of them in detail. [10]

Q4. a. Discuss the methods of Nano filtration giving details of membranes used, rate equation and industrial applications. [10]

b. Explain the principle of foam fractionation with any its application in mineral processing. [10]

Q5.a. Discus the application of adsorption process in N_2 and O_2 separation from air. [10]

b. Discuss the phenomenon of foam formation, coalescence, collapse and drainage in details. [10]

Q6 Write short note on **(any four):** [20]

a. Plate and frame module
b. Write short note on Microfiltration
c. Size exclusion chromatography.
d. Thermal swing adsorption
e. Affinity chromatography

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