

Duration: 3 hours

Total Marks: 80

1. Question number one is compulsory.
2. Attempt any three of the remaining questions.
3. Each question carries equal marks.
4. Figures to the right indicate marks.
5. Make suitable assumptions when required.

- Q1** Answer any four of the following **20**
- (a) Explain TSA for regeneration of adsorbents
 - (b) Give classification of membranes.
 - (c) Explain working principle of supercritical extraction
 - (d) Describe molecular distillation
 - (e) What is the principle of operation of ultrafiltration
 - (f) Preparative chromatography
- Q2** (a) An industrial wastewater contains 100 mg/L chlorophenol and is going to be treated by carbon adsorption. 99% removal is desired. The wastewater is discharged at a rate of 4×10^5 L/day. If Freundlich isotherm ($q=6.75 C^{0.41}$, where q is in mg/g) is used, calculate **10**
- The carbon requirement for:-
- (1) A single, mixed contactor
 - (ii) Two mixed contactors in series with intermediate concentration of 50 mg/L
- (b) Explain design of fixed bed adsorption column for separation **10**
- Q3** (a) With the help of neat sketches and examples explain reactive distillation. **10**
- (b) Illustrate commercial application of supercritical extraction **10**
- Q4** (a) Explain any two membrane modules in detail. **10**
- (b) Explain concentration polarization. **10**
- Q5** (a) A cellulose acetate membrane is used for desalination RO system. Pure water flux is $100 \text{ (L/m}^2 \text{ h)}$ at hydrostatic pressure differential of 100 bar. A 4% NaCl solution is to be desalinated at an operating pressure difference of 90bar. Salt rejection is 98%. Osmotic pressure of 3.5% NaCl solution is 17.62bar. The polarization modulus is unity. Calculate the water and salt flux. **10**
- (b) Explain in detail PSA technology. **10**
- Q6** (a) Derive the relation for liquid permeation process in 'Dialysis' **10**
- i.e. $J_{AS} = \frac{C_1 - C_2}{\left(\frac{1}{kC_1}\right) + \left(\frac{1}{kC_2}\right) + \left(\frac{1}{P_m}\right)}$
- (b) Explain Liquid liquid Chromatographic process **10**
