

**B.E. CHEMICAL ENGINEERING FOURTH YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM 2024**

INTERFACIAL SCIENCE AND ENGINEERING

Time – 3 hrs

FM-100

CO-1	(i) The critical coagulation concentrations for NaCl, MgCl₂ and AlCl₃ for negatively charged As₂S₃ colloids are 65 mol/m³, 0.8 mol/m³ and 0.07 mol/m³, respectively. Verify whether these values are consistent with the Schulze-Hardy rule or not. (ii) A 1.5 μm diameter quartz particle (density=2700 kg/m³) suspended in water is placed in a centrifuge. The centrifuge rotates at a speed of 1000 rad/s. Calculate the sedimentation coefficient. What will be radial position of the particle with respect to its initial position after operating the centrifuge for 60 seconds? (iii) Write short notes on: Donnan Equilibrium, Peclet and Deborah number	5+10+10
CO-2	(i) The Lennard-Jones parameters for argon are: $A = 1.5 \times 10^{-77} \text{ J m}^6$ and $B = 2.0 \times 10^{-134} \text{ J m}^{12}$. Calculate the distance at which the energy will be minimum. Calculate the minimum energy. (ii) Estimate the van der Waals force between two sapphire spheres of 2.0 mm radius which are 5 nm apart in vacuo. (iii) Write short note on: Debye-Huckel Approximation or Derjaguin approximation. (iii) Derive the relationship between the interfacial charge density and the potential at the interface.	8+5+5+7
CO-3	(i) The interfacial tension between oil and water is 100 mN/m. The oil density is 800 kg/m³. If angular velocity is 900 rad/sec. Calculate the radius of cylindrical drop. (ii) Derive the expression for the pressure difference to the shape of the surface and state its significance. (iii) Write short note on: surfaces of revolution, Bond Number.	5+10+10
CO-4	(i) The aggregation number of sodium dodecyl sulfate micelle in water is 80. Calculate the packing parameter, and predict the shape of the SDS micelles. (ii) Derive the equation for BET adsorption isotherm and write down the assumptions made.	10+15