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Question Paper Code: 95D03

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Fifth Semester

Biotechnology

19UBT503- Heat and Mass Transfer Operations

(Regulations 2019)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1. Mention the statements and its corresponding equation of different laws in radiation heat transfer CO3- Ana
2. In a nutshell, Mention the concept of Black body CO1- U
3. A man X is confused with the terms - Rate , gradient and flux .How they differ among themselves CO2- U
4. Distinguish between steady state and transient state CO2- U
5. A reactor is filled with component A and is allowed to diffuse to another reactor holding component B through a pipe. Suddenly, the temperature of both the reactors are increased. Analyze the changes that occur in the transfer of mass in the system. CO3- Ana
6. Classify the types of diffusion. CO1- U
7. Sketch the diagram of an absorption column. CO2- App
8. Predict the nature of the feed based on q value CO2- App
9. Analyze the advantages of tank crystallizer. CO3- Ana
10. Compare leaching and extraction. CO3- Ana

PART – B (5 x 16= 80Marks)

11. (a) Derive the general concept of temperature field , temperature gradient in conduction and combined mechanism of heat transfer with various special cases CO1- U (16)

Or

- (b) Discuss the concept of heat transfer from extended surfaces and also elaborate in detail including the generalized equation for fin, fin efficiency and effectiveness, thermal insulation etc CO1- U (16)
12. (a) Derive the LMTD for parallel flow heat exchanger and also analyze the overall heat transfer coefficient CO3- Ana (16)
- Or
- (b) Explain in detail the principle, mechanism and application of Double pipe heat exchanger. CO3- Ana (16)
13. (a) Ammonia gas (A) diffuses through a non-diffusing nitrogen gas (B) under steady state conditions. The partial pressure of A at location 1 is 1.5×10^4 Pa and that at location 2 is 5×10^3 Pa (Pascal). The locations 1 and 2 are 0.15 m apart. The total pressure is 1.103×10^5 Pa and temperature is 298 K. Calculate the flux of diffusion of ammonia. Also calculate the flux of diffusion for equimolar counter diffusion considering that nitrogen is also diffusing. The diffusivity of ammonia at the prevailing conditions is 2.30×10^{-5} m²/s. CO2- App (16)
- Or
- (b) Calculate the rate of diffusion of acetic acid (A) across a film of non-diffusing water (B) which is 1 mm thick at 290 K if the concentrations of acetic acid on the opposite sides of the film are 9% and 3% respectively. The densities of 9% and 3% solutions are 1012 kg/m³ and 1003.2 kg/m³ respectively. The diffusivity of acetic acid in water is 0.95×10^{-9} m²/s. CO2- App (16)
14. (a) Harry wants to separate components in a binary mixture of solution. Help him in writing a report analyzing the equilibrium that exists in the system and explain the corresponding mechanism of separation. CO3- Ana (16)
- Or
- (b) Dumbledore is in need to separate a mixture of gases using liquid. Help him in analyzing the factors that are to be considered in choosing the liquid and derive an expression for single component absorption. CO3- Ana (16)

15. (a) Analyze the rate of drying using drying rate curves and explain the corresponding mechanism and application. CO3- Ana (16)

Or

(b) Baker's yeast plays a major role in baking industries. Analyze the method that is used in preserving them and elucidate its principle and advantage. CO3- Ana (16)

