CBCS SCHEME

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BBT302

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Unit Operations + LAB

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Fluid. Explain with the help of the shear stress – strain behavior of different fluids.	14	L1	CO1
	b.	A pipe through which water is flowing tapers from 20cm to 10cm. Velocity of water at section (i) is 4m/s. Find the velocity head at section (1) and (2), also the rate of discharge.	6	L3	CO1
		OR			
Q.2	a.	Describe the Bernoulli's equation for the fluid flowing in a circular pipe.	10	L2	CO1
	b.	Sulphuric acid of density 1650 kg/m^3 and viscosity 8.6×10^{-3} Pa.s is to be pumped for 800m along a 500 mm inner diameter pipe at a rate of 3kg/s and raised vertically 15m by pump. Calculate the power required if the efficiency of pump is 0.5. Assume f = 0.008137.	10	L3	CO1
		Module – 2			
Q.3	a.	With a neat sketch, explain the working of Venturimeter. Give the advantages and disadvantages.	14	L2	CO2
	b.	A horizontal venturimeter with inlet and throat diameter of 30cm and 15cm respectively, is used to measure the flow of water. Reading of differential meter connected to inlet and throat is 20cm of Hg. Determine the rate of flow. Cd = 0.98. specific gravity of mercury is 13.6 and that of water is 1.0.	6	L3	CO2
		OR			
Q.4	a.	With a neat sketch of ball mall, explain the working of ball mill and obtain the expression for the optimum speed of ball mill.	8	L2	CO2
	b.	i) Explain the Crushing laws. ii) What is the rotational speed recommended for ball mill of 1200mm in diameter discharged with 75mm balls?	7 5	L1 L2	CO2 CO2
		Module – 3			
Q.5	a.	Obtain the expression for heat transfer by conduction through the composite plane wall.	12	L2	CO3
	b.	A steam pipeline of 150/160mm in diameter is covered with a layer of insulating material of thickness 50mm. Temperature inside the pipeline is 393K and that of outside surface of insulation is 313K. Calculate the rate of heat loss per unit length of pipeline. $\underline{K}\|_{pipe}$ = 50w/mk ; $\underline{K}\|_{insulation}$ = 0.08w/mk.	8	L3	CO3

		OR			
Q.6	**a.**	i) Explain the types of convection. ii) Derive the expression $Q = U_i \, Ai \, \Delta T$.	**4** **8**	**L1** **L2**	**CO3** **CO3**
	b.	With a neat sketch, explain the construction and working of 1 – 1 STHE.	**8**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Define Fick's law of diffusion and the types of diffusion.	**8**	**L1**	**CO4**
	b.	Ammonia gas (A) diffuses through nitrogen gas (B) under steady state conditions with nitrogen as non diffusing. Partial pressure of A at location (1) is 1.5×10^4 Pa and that at location (2) is 5×10^3 Pa. Locations (1) & (2) are 0.15m apart. Total pressure is 1.103×10^5 Pa and temperature is 298K. Calculate the flux of diffusion of ammonia also calculate the flux of diffusion in equimolar counter diffusion assuming nitrogen is also diffusing. Diffusivity factor is 2.3×10^{-5} m^2/s.	**12**	**L3**	**CO4**
		OR			
Q.8	**a.**	Intrepret on the theories of mass transfer across a plase boundary at the interphase.	**8**	**L2**	**CO4**
	b.	Obtain the expression for steady state equimolar counter current diffusion.	**12**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the different types of distillation.	**6**	**L1**	**CO5**
	b.	Explain the McCabe – Thiele's method to determine the theoretical plate in distillation of binary mixtures.	**14**	**L2**	**CO5**
		OR			
Q.10	**a.**	Describe the drying characteristic's curve.	**8**	**L1**	**CO5**
	b.	Describe the factors considered for the selection of solvent for extraction.	**8**	**L1**	**CO5**
	c.	Explain the following : i) Belt extraction ii) Basket extraction.	**4**	**L2**	**CO5**

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