CBCS SCHEME

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BBT302

Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 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.	Derive Bernoullis theorem stating all the assumptions.	10	L3	CO1
	b.	Define fluid. Give the classifications of fluids with examples.	5	L1	CO1
	c.	With a neat sketch, explain Reynolds experiment.	5	L2	CO1
		OR			
Q.2	a.	The right limb of U-tube manometer containing mercury is open to atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe, if the difference of mercury level in 2 limb is 20cm.	10	L3	CO1
	b.	Define free settling, hindered settling and sedimentation.	5	L1	CO1
	c.	With a neat sketch, explain continuous thickener (Dorr thickener).	5	L2	CO1
		Module – 2			
Q.3	a.	With a neat sketch, explain working of reciprocating pump.	7	L2	CO2
	b.	State and explain different laws of size reduction.	6	L2	CO2
	c.	Derive the discharge equation for venturimeter.	7	L3	CO2
		OR			
Q.4	a.	Explain the working and construction of Rotary drum filtration.	7	L2	CO3
	b.	Write a note on the following: i) Differential analysis ii) Cumulative analysis iii) Rotameter.	6	L2	CO3
	c.	An orificemeter with an orifice diameter of 10cm is inserted in a pipe of 20cm the pressure gauge fitted at upstream and downstream of a orificemeter gives the reading of 19.62N/cm^2 and 9.81N/cm^2 respectively. Find the discharge if discharge coefficient C_d is 0.6.	7	L3	CO2
		Module – 3			
Q.5	a.	Briefly explain the different modes of heat transfer.	4	L2	CO4

	b.	Derive an expression for heat flow through a composite wall (flat surface) with 3 layers in series by conduction.	8	L2	CO4
	c.	A steel pipe of 115mm outside diameter and a wall thickness of 5mm is covered with 50mm thickness magnesia insulation. Inside temperature is 150°C and that of outside surface temperature is 32°C. Determine: i) Heat loss per metre length of pipe (O/L). ii) Temperature at the surface between steel pipe and insulation. Data: $K_{pipe} = 43.03 W/mK$ $K_{magnesia} = 0.07 W/mK$	8	L3	CO4
		OR			
Q.6	a.	With a neat sketch, explain the construction and working of 1-2 shell and tube heat exchanger.	7	L3	CO5
	b.	Derive an expression for Log Mean Temperature Difference (LMTD).	7	L4	CO5
	c.	Write a note on the following: i) Fouling factor ii) Fourier's law iii) Overall heat transfer coefficient.	6	L3	CO5
		Module – 4			
Q.7	a.	Derive an expression for diffusion of a component through a stagnant fluid from Fick's law of diffusion.	10	L3	CO4
	b.	Explain the experimental method for measurement of diffusivity (Stefan's experiment).	10	L3	CO4
		OR			
Q.8	a.	Derive an expression for diffusion of component for an equimolar counter diffusion.	10	L3	CO4
	b.	Briefly explain mass transfer coefficient and their correlations.	10	L2	CO4
		Module – 5			
Q.9	a.	A liquid mixture has a relative volatility (α) of 2.5. Compute VLE data for the liquid mixture. The above mentioned liquid mixture is to be fed to the distillation column for separation. Feed is a liquid at its boiling point with 50 mol% of more volatile component. The product contains 95 mol% more volatile component and residue contains 10 mol% MVC. Reflux ratio R is 2.5. Calculate the number of theoretical plates required and also the position of feed plate.	10	L3	CO5
	b.	With a neat sketch, explain the working of simple distillation.	10	L3	CO5
		OR			
Q.10	a.	With a neat sketch, explain the working of tray dryer.	10	L3	CO5
	b.	Discuss briefly an applications of extractions. Add a note on rotating disc contactor type extraction.	10	L3	CO5

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