USN | | | | | | | | | |

BBT302

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
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.	Explain in brief Reynold's experiment with a neat sketch.	10	L1	CO1
	b.	Taking pressure into consideration, derive Euler's equation of motion.	10	L3	CO2
		OR			
Q.2	a.	Explain the neat sketch of Rheological Behavior of fluid and Newton's law of viscosity.	10	L1	CO1
	b.	Define Hydrostatic Law and derive the expression of pressure variation in a fluid at rest.	10	L3	CO2
		Module – 2			
Q.3	a.	Derive an expression for coefficient of discharge in a venturimeter.	10	L3	CO2
	b.	Explain the working, principle and applications of Ball Mill with a neat sketch.	10	L2	CO3
		OR			
Q.4	a.	Water is flowing at a rate of 500 cm^3/s through an orifice of 25 mm diameters installed in a 75 mm diameter pipe. What will be the difference in the level on mercury manometers connected across the meters? The coefficient of orifice meters is 0.65.	10	L3	CO2
	b.	Define and explain sedimentation and crushing laws.	10	L2	CO3
		Module – 3			
Q.5	a.	Deduce or equation for heat conduction through composite plane wall.	10	L3	CO4
	b.	An exterior wall of house may be approximated by a 100 mm layer of common brick (K_1 = 0.7 W/m.K) followed by 40 mm layer of gypsum plates (K_2 = 0.48 W/m.K). What thickness of loosely packed rock wool insulation (K_3 = 0.0635 W/m.K) should be added to the wall to reduce the heat loss by 25%.	10	L3	CO4
		OR			
Q.6	a.	Derive an expression of critical thickness of insulation of a cylinder.	10	L3	CO4
	b.	Explain with a neat sketch of shell and tube heat exchanger.	10	L2	CO4

Module – 4

Q.7	a.	Define Fick's law of diffusion. Also derive the expression for steady state equimolar counter current diffusion.	10	L3	CO5
	b.	Derive the expression $Q = V_0 A_0 \Delta T$ for forced convection in pipes.	10	L3	CO5

OR

Q.8	a.	In an $O_2 - N_2$ gas mixture at 101.325 KPa and 298K, the concentrations of oxygen at two phases 2 mm apart are 10% and 20% by volume respectively. Calculate the flux of diffusion of oxygen for the case where : i) Nitrogen is non-diffusing ii) There is equimolar counter diffusion of the two gases. Data : Diffusivity of O_2 in N_2 is 1.81×10^{5} m^2/s.	10	L3	CO5
	b.	What is Diffusivity? Show that $N_A = J_A + X_A(N_A + N_B)$.	10	L3	CO5

Module – 5

Q.9	a.	Discuss in details about the types of distillation.	10	L2	CO5
	b.	Explain Distillation of binary mixtures using McCabe Thiele Method.	10	L3	CO5

OR

Q.10		Write a short note on :	20	L2	CO5
	a.	Flash Distillation			
	b.	Drying Operations			
	c.	Liquid – liquid Extraction			
	d.	Measurement of Diffusivity.			

* * * * *