B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E.
Branch: Biotechnology
Course Code: 19BT3DCUO1
Course: UNIT OPERATIONS-1

Semester: III
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I	*CO*	*PO*	**Marks**
	1	a)	The pressure drop (ΔP) due to friction for the flow of fluids through pipe depends on the following variables: diameter of the pipe (D) length of the pipe (L) velocity of the fluid (u) density of the fluid (ρ) viscosity of fluid (μ). Using Rayleigh's method of dimensional analysis, obtain the relation between pressure drop and the given variables	*CO* 2	**PO1**	**10**
		b)	The right limb of a U tube manometer containing mercury is open to the atmosphere while the left limb connected to the pipe in which fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 centimeters below the level of the mercury in the right limb. Find the pressure of the fluid in the pipe; if the difference in the mercury level is 20 centimeters.	*CO* 2	**PO1**	**10**
			UNIT - II			
	2	a)	Derive the Hagen Poiseuille equation and explain its significance State all assumptions	*CO* 2	**PO 1**	**10**
		b)	Derive Ergun equation for fluid flow flowing through bed of solids. List all assumptions made	*CO* 2	**PO 1**	**10**
			UNIT - III			
	3	a)	Describe the construction and working principle of single acting reciprocating pump with a neat labelled diagram.	*CO* 2	**PO 1**	**10**
		b)	Venturi meter is to be installed in a 100 mm diameter line to measure the flow of water. The maximum flow is expected to be 73.8 m^3/h. Mercury is used as manometric fluid and the corresponding manometer reading is 1.27 m. of mercury. Determine the throat diameter required for the venturi and the power that would be required to operate the meter at the full load, if the permanent losses in the pressure is 10% of the venture	*CO* 3	**PO 2**	**10**

			differential pressure. Density of water is 1000 kg / m^3, density of mercury is 13,600 kg /m^3, coefficient of venturi is 0.98.			
			OR			
4	a)		Derive the flow equation for orifice meter.	*CO* 2	PO 1	**10**
	b)		Water at a rate of 8 m^3/h is to be pumped from a large reservoir resting on the floor to the open top of an experimental absorption tower through a 50 mm ID pipe. The point of discharge is 5 m above the floor and the frictional losses in the entire flow system amount to be 2.5 J/ kg. At what height in the reservoir the water needs to be kept if the pump can develop only 94 watts power?	*CO* 3	PO 2	**10**
			UNIT - IV			
5	a)		Illustrate the construction and working principle of ball mill with a neat diagram. Derive the equation for critical speed of the ball mill	*CO* 2	PO 1	**10**
	b)		Explain different laws of size reduction.	*CO* 2	PO 1	**05**
	c)		What is the power required to crush 100 tonnes /h of walnut if 80% of the feed passes through 1 inch screen and 80% of the product passes through and 1/8 inch screen. Work index of volunteers 12.74.	*CO* 2	PO 1	**05**
			UNIT - V			
6	a)		State Stokes law and add a note on its limitation.	*CO* 1	-	**05**
	b)		Distinguish between constant rate and constant pressure filtration.	*CO* 2	PO 1	**05**
	c)		Describe the construction and working principle of rotary drum filter with a neat illustration.	*CO* 2	PO 1	**10**
			OR			
7	a)		For a sludge filtered in a washing plate and frame the filtration equation $V^2 = Kt$ holds good where V the volume of the filtrate obtained in time t. When the pressure is constant, 30 m^3 of filtrate is obtained in 10 hours. i. Calculate the washing time if 3 m^3 of wash water is forced to the cake at the end of filtration. ii. If the filtering area is doubled keeping all other parameters constant, how long would it take to obtain 30 m^{3}of filtrate? The rate of washing is ¼ of final rate of filtration.	*CO* 3	PO 2	**10**
	b)		Derive the equation for constant pressure filtration.	*CO* 2	PO 1	**10**

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