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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E.   **Semester: III**

Branch: Biotechnology   **Duration: 3 hrs.**

Course Code: 23BT3PCFME/22BT3PCFME   **Max Marks: 100**

Course: Fluid Mechanics

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

			UNIT - I	*CO*	*PO*	**Marks**
	1	a)	The pressure drop due to friction for the flow of a fluid through a pipe depends on the following variables. (i) diameter of the pipe (D), (ii) length of the pipe (L), (iii) velocity of the fluid (u), (iv) density of the fluid (ρ), (v) viscosity of the fluid (μ). Using Rayleigh's method of dimensional analysis, obtain a relation between pressure drop (ΔP) and given variables.	*CO2*	*PO 1*	**10**
		b)	Explain Reynold's experiment with a suitable diagram. Differentiate the laminar flow from turbulent flow of fluids.	*CO2*	*PO 1*	**10**
			OR			
	2	a)	Explain in detail the flow in boundary layers with a suitable diagram.	*CO2*	*PO 1*	**10**
		b)	Explain the construction and working principle of U-tube manometers with a neat labelled diagram. Derive an expression for pressure drop in U-tube manometer using the concept of hydrostatic equilibrium.	*CO2*	*PO 1*	**10**
			UNIT - II			
	3	a)	Derive Ergun equation for pressure drop in flow through porous media. State the assumptions.	*CO2*	*PO 1*	10
		b)	A pipe 300m long has a slope of 1 in 100 and tapers from 1.2 m diameter at high end to 0.6 m diameter at the low end. Water is flowing at a rate of 90 L/s. if the pressure at the high end is 68.67 kPa, estimate the pressure at the lower end. Neglect the losses.	*CO3*	*PO2*	10
			OR			
	4	a)	Derive Bernoulli equation for potential flow of fluids in terms of head stating all assumptions.	*CO2*	*PO1*	**10**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		b)	Estimate the pressure drop when 3 kg/s of sulphuric acid flows through a pipe of 25mm inside diameter and 60 m length. If the pressure drop falls by one-half, what would be the new flow rate? Assume turbulent flow of fluid. Data: Density of acid = 1840 kg/m^3, viscosity of acid = 0.025 (N.s)/m^2	CO3	PO2	**10**
			UNIT - III			
5	a)		Describe the construction and working principle of single acting reciprocating pump with neat labeled diagram.	CO2	PO1	**10**
	b)		A venturimeter is to be installed in a 100mm diameter line to measure the flow of water. The maximum flow is expected to be 73.8 m^3/h. The mercury is to be used as a 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 loss in pressure is 10% of the venture differential pressure. Density of water = 1000 kg/m^3, Density of mercury = 13600 kg/m^3 and coefficient of venturimeter = 0.98	CO3	PO2	**10**
			OR			
6	a)		A single acting reciprocating pump has a stroke of 300mm length and a piston diameter of 150mm. It delivers water through height of 25m. The pump works at 60 rpm. What would be the theoretical discharge and theoretical power required by the pump if the actual discharge is 4.8 L/s. Estimate the percentage slip.	CO3	PO2	**10**
	b)		Illustrate the construction and working principle of venturimeter with a neat labeled diagram.	CO2	PO1	**10**
			UNIT - IV			
7	a)		Derive the relation between time taken for filtration and volume of filtrate (V) under constant pressure (ΔP) filtration conditions.	CO2	PO1	**10**
	b)		State stokes law with suitable equation. What are its limitations? Describe the working principle of batch sedimentation process with a neat diagram.	CO2	PO1	**10**
			OR			

8	a)		For a sludge filtered in a washing plate and frame the filtration equation $V^2 = Kt$ holds good, where V is the volume of the filtrate obtained in time t. When the pressure is constant, 30m^3 of filtrate is obtained in 10h.
			
			   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 one-fourth the final rate of filtration.
				CO3	PO2	**10**

		b)	Explain the process of centrifugal filtration with suitable diagram.	CO2	PO1	**10**
			UNIT - V			
	9	a)	"Mixing is very important in chemical and biochemical processes to maintain homogeneous mixtures. Selection of mixing equipment depends on the types of phases involved in a mixture". Justify the statement by describing the construction and working principle of ribbon blenders for mixing with a suitable sketch. Also mention the phases involved in mixing by ribbon blenders.	CO2	PO1	**10**
		b)	Differentiate axial flow pattern from radial flow patterns of mixing. What are the different methods to prevent or reduce vortex in the reactor vessel?	CO2	PO1	**05**
		c)	Explain the relationship of power with rotational speed and impeller diameter for laminar and turbulent flow, with the help of dimensionless numbers.	CO2	PO1	**05**
			OR			
	10	a)	For a pharmaceutical manufacturing process for an ointment containing solid and semi-solid components, mixing plays a critical role in achieving homogeneous mixtures. Justify the importance of selecting the appropriate mixing equipment based on the phases involved in the mixture. Describe the construction and working principle of a Double Arm Kneader used for mixing such materials. Include a suitable sketch of the equipment.	CO2	PO1	**10**
		b)	Describe the construction and working principle of a muller mixer with neat illustration.	CO2	PO1	**10**

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