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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 19BT3DCUO1 **Max Marks: 100**
Course: Unit Operations - 1 **Date: 25.09.2023**

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

1 a) The efficiency of a fan depends on the density ρ, dynamic viscosity μ, angular velocity ω, diameter D, discharge Q. Express efficiency in terms of dimensionless parameters using Rayleigh's method. **10**

b) Differentiate Fundamental and derived Quantities. Give examples for each with their S.I units. **04**

c) A pressure gauge on a tank reads 50 psig on a day when the barometer reads a pressure of 28 inch Hg. Find the absolute pressure in the tank in psi. **06**

UNIT - II

2 a) Derive Hagen Poiseulle equation for laminar flow through circular pipe. **10**

b) Water with density 1000kg/m^3 flows through a piping system of 3 pipes connected, pipe A, pipe B and pipe C. Pipe C has two branches such that an equal quantity of water flows through each of the two pipes. The flow through pipe A is 10 m^3/h. Calculate (i) mass flow rate in each pipe. (ii) Average velocity in each pipe and (iii) mass velocity in pipe A and B. Diameter of pipe A is 50 mm, of pipe B is 75 mm and that of pipe C is 40 mm. **10**

UNIT - III

3 a) A rotameter tube is 0.3 m long with an internal diameter of 25 mm at the top and 20 mm at the bottom. The diameter of float is 20 mm. Find the float position when metering water at the rate of 100 cm^3/s. Specific gravity of float = 4.8, volume of float = 6 cm^3, coefficient of discharge of meter = 0.72 and density of water = 1000 kg/m^3 **10**

b) Describe the construction and working principle of orifice meter with a neat labeled diagram. **10**

OR

4 a) The flow of water through a 50 mm pipe is measured by means of an orifice meter having an aperture of 40 mm. The pressure drop recorded across the meter is 150 mm on a mercury manometer. If the coefficient of discharge of the orifice meter is 0.60, what is the Reynolds number in the pipe and what will be the pressure drop over 30 m length of the pipe? **10**
Data: Density of mercury=13600 kg/m^3, Density of water=1000 kg/m^3,

viscosity of water=1 (mN.s)/m^2

b) Illustrate the construction and working principle of centrifugal pump with a neat labeled diagram. **10**

UNIT - IV

5 a) With a schematic representation, demonstrate the construction and working of cyclone separator. **10**

b) A dolomite mixture having the following screen analysis is screened through a standard 100 mesh screen. Calculate the effectiveness of the screen and the mass ratios of overflow and underflow to feed. **10**

Screen analysis:

Mesh	Feed	Oversize	Undersize (Weight %)
35	7.07	13.67	0.00
48	16.60	32.09	0.00
65	14.02	27.12	0.00
100	11.82	20.70	2.32
150	9.07	4.35	14.32
200	7.62	2.07	13.34
-200	33.80	0.00	70.02
	100	100	100

UNIT - V

6 a) Illustrate the principle of batch sedimentation with neat representation. Define Stoke's law and describe its importance. **10**

b) Derive the relation between time taken for filtration, specific cake resistance and filter medium resistance under constant pressure (ΔP) filtration. Assume that V is the total volume of filtrate collected in time t, A is the filter area and c is the mass of particles deposited on the filter per unit volume of filtrate. **10**

OR

7 a) What is the significance of using filter aids? Derive the equation for constant rate filtration. **10**

b) With a neat representation, describe the construction and working of plate and frame press filter. **10**

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