U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

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

Branch: Chemical Engineering **Duration: 3 hrs.**

Course Code: 23CH3PCFME / 22CH3PCFME **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.

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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	State Pascal Law and prove that $P_x = P_y = P_z$.	*CO1*	*PO1*	**10**
	b)	Derive the expression for pressure difference measured by a differential U- tube manometer attached to pipe across two sections i) at different elevation ii) at same elevation	*CO1*	*PO1*	**10**
		OR			
2	a)	State Newton's law of viscosity and define different types of fluids based on Newton's law.	*CO1*	*PO1*	**08**
	b)	Define Reynold's number. Discuss its significance in fluid flow.	*CO1*	*PO1*	**05**
	c)	Explain the concept of boundary layer separation and wake formation.	*CO1*	*PO1*	**07**
		UNIT - II			
3	a)	Derive Bernoulli's equation stating all assumptions. What are the corrections applied to the equation and why?	*CO2*	*PO3*	**14**
	b)	Calculate the pressure drop due to friction in a 300 m long pipe 150mm i.d. through which water is flowing at a rate of 0.05 m^3/s. Data: Density of water =1000 kg/m^3, Viscosity of water =10×10^{-3} $(N.s)/m^2$	*CO3*	*PO3*	**06**
		OR			
4	a)	Prove that the average velocity is one half the maximum velocity for an incompressible fluid flowing in a pipe.	*CO2*	*PO3*	**10**
	b)	A 15 kW pump with 80% efficiency is discharging oil of specific gravity 0.85 to an overhead tank from storage tank. The surface of the oil in the storage tank from a datum line is 5m and that in	*CO3*	*PO3*	**10**

			the overhead tank from the datum line is 25m.Both the tanks are open to atmosphere. If the losses in the piping system are 1.75 m of flowing fluid, Calculate the volumetric flowrate of oil.			
			UNIT - III			
	5	a)	What is a compressible fluid? Discuss the continuity equation for compressible fluid.	*CO3*	*PO3*	**08**
		b)	A gas is flowing through a horizontal pipe at a temperature of 4^0C. The diameter of the pipe is 8cm at section 1 of the pipe and pressure is 30.3N/cm^2 (gauge). The diameter of the pipe changes to 4cm at section 2 where pressure is 20.3N/cm^2 (gauge). Find the velocities of the gas at these sections assuming an isothermal process. Take atmospheric pressure=10N/cm^2 and R= 287.14 N-m/kg-K.	*CO3*	*PO3*	**12**
			OR			
	6	a)	Calculate the stagnation pressure, temperature and density on the nose of a plane which is flying at 800km/hour through still air having a pressure 8N/cm^2 (absolute) and temperature -10°C. Take R=287 J/kg-K and γ = 1.4. Assume adiabatic condition.	*CO3*	*PO3*	**10**
		b)	Derive an expression for mass flowrate of compressible fluid flowing through a venturimeter under adiabatic condition.	*CO3*	*PO3*	**10**
			UNIT - IV			
	7	a)	What is a pump? Give the classification of pump. Explain the construction and working of centrifugal pump.	*CO2*	*PO3*	**14**
		b)	Discuss the following i) Cavitation ii) NPSH	*CO1*	*PO1*	**06**
			OR			
	8	a)	Calculate the discharge of water flowing through a pipe 30cm diameter placed in an inclined position where a venturi meter is inserted having a throat diameter 15cm.The difference of pressure as measured by an inverted U-tube manometer is 30cm.The manometer fluid has a density of 0.6. The loss of head between pipe and throat is 0.2 times the kinetic head in the pipe.	*CO3*	*PO3*	**10**
		b)	Explain the characteristics of centrifugal pump.	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Using Buckingham π-method of dimensional analysis establish a correlation between the thrust developed by the propeller P which depends on the angular velocity ω,speed of advance V, diameter D, dynamic viscosity μ,mass density ρ, elasticity of fluid medium which can be denoted by the speed of sound in the medium C	*CO3*	*PO3*	**12**
		b)	Explain the significance of different dimensionless numbers.	*CO3*	*PO3*	**08**
			OR			

	10	a)	For an agitation process, the power requirement of agitator is P, which is dependent on propeller diameter D, rotational speed N, density (ρ), viscosity (μ) and acceleration due to gravity. Using dimensionless analysis find the correct representation for the power requirement in terms of dimensionless groups.	*CO3*	*PO3*	**10**
		b)	Explain the following i) Derived quantities ii) Buckingham's Pi theorem	*CO3*	*PO3*	**10**

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