U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH3DCFME **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 and prove Pascal's Law and state the assumptions made.	CO1	PO1	10
	b)	A differential "U"-tube manometer containing mercury of density 13000 kg/m^3 is used to measure the pressure drop along a horizontal pipe. If the fluid in the pipe is water and the manometer reading is 0.65m, what is the pressure difference between the two tapping points?	CO2	PO3	04
	c)	Provide a brief explanation of any four fluid properties	CO1	PO1	06
		OR			
2	a)	Enlist the different types of fluid flow. Explain any two in detail with the help of their governing equation.	CO1	PO1	08
	b)	With the help of the relevant derivation, explain the working of a U-tube differential manometer.	CO2	PO3	08
	c)	An inclined tube manometer consists of a vertical cylinder 35mm diameter. At the bottom of this is connected a tube 5mm in diameter inclined upward at an angle of 15 to the horizontal, the top of this tube is connected to an air duct. The vertical cylinder is open to the air. The manometric fluid has relative density 0.785. Determine the pressure in the air duct if the manometric fluid moved 50mm along the inclined tube.	CO2	PO3	04
		UNIT - II			
3	a)	Derive Euler's equation of motion	CO3	PO3	10
	b)	A pipeline carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a point A to 500 mm diameter at point B, which is 4 m from a higher level. If the pressure at A & B, are 9.81 N/cm^2 and 5.886 N/cm^2 respectively, and the discharge is 200 liter/s. Determine the loss of head & the direction of flow.	CO3	PO3	10
		OR			
4	a)	Derive Bernoulli's equation starting from Euler's equation, Mention the assumption made	CO3	PO3	10

		b)	Determine the cost of pumping 3 Lakh liter/h of an oil having specific gravity 0.9, Viscosity 30 cP through a pipeline 25 cm in diameter & 50 km long. It may be assumed that the $\boldsymbol{\eta}$ of the pump together with the motor is 50 % & the power cost 40 Paise/kWh. The pipe line is horizontal, f = 0.046 (NRe)-0.2	***CO4***	***PO2***	**10**
			UNIT - III			
	5	a)	Derive the Bernoulli's equation for compressible adiabatic flow process.	***CO3***	***PO3***	**10**
		b)	Air has a velocity of 1000 km/h at a pressure of 9.81 kN/m^2 in vacuum and a temperature of 47°C. Compute its stagnation properties and the local Mach number. Take atmospheric pressure = 98.1 kN/m^2, R = 287 J/kg K and γ = 1.4. What would be the compressibility correction factor for a pitot-static tube to measure the velocity at a Mach number of 0.8.	***CO4***	***PO2***	**10**
			UNIT - IV			
	6	a)	With the help of a block diagram, discuss in detail about classification of pumps	***CO2***	***PO3***	**10**
		b)	Determine the power required to drive a centrifugal pump to deliver 0.035 m3/s of water against a head of 25 m through a 16 cm diameter pipe and 150 m long. The overall efficiency of the pump is 75%. Use the formula $h_f = 4fL\,V^2/\,2gd$ to determine the frictional losses in the pipe having co-efficient of friction 'f' as 0.15.	***CO4***	***PO2***	**10**
			UNIT - V			
	7	a)	Discuss in detail about similitude.	***CO2***	***PO3***	**10**
		b)	Using π-theorem, derive the expression for specific speed of a pump as $N_S = \boldsymbol{N\ \sqrt{Q}\ /H^{3/4}}$, Where, variable parameters are as discharge Q, speed N, head H, Impeller diameter D of the pump, density ρ of the fluid and acceleration due to gravity g	***CO3***	***PO3***	**10**

******