Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING, MUMBAI

DEPARTMENT OF MECHANICAL ENGINEERING

RE-EXAMINATION EXAMINATION, August 2022

(Direct Second Year Admission)

PROGRAM: SY B.Tech. (Mechanical), Semester-IV

COURSE: PE-BTM403 – Fluid Mechanics

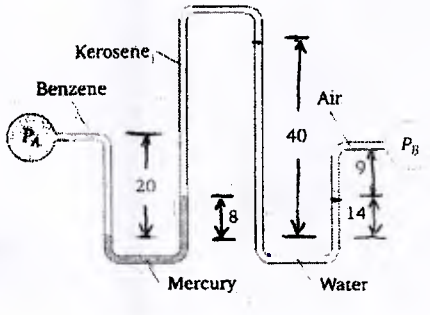
Total points: 100

Duration: 3 HOURS

Note:

- Answer any 5 questions. Each question carries 20 points
- Answer should be question specific and to the point.
- All component of a question must be answered togather.
- Data in the last column represents course outcome and Blooms Taxonomy of respective question

			CO/BT
Q1.	(A) Explain following with illustration: a. Lagrangian and Eulerian motion of fluid particle b. Viscous and Inviscid flows c. Incompressible and compressible flow d. Uniform and non-uniform flows	**10**	1/2
	(B) Listing all assumption made, derive an expression to estimate the force acting on an inclined plane lamina submerged in liquid. Also find an expression for point of application of this resultant force.	**10**	2,3/3
Q2.	(A) Determine the power required to run a 300 mm dia shaft at 400 rpm in journals with uniform oil thickness of 1 mm. Two bearings of 300 mm width are used to support the shaft. The dynamic viscosity of oil is 0.03 Pas. (Pas = (N/m^2) × s).	**10**	1,2/3,4
	(B) A nozzle is attached to a 6-cm-diameter hose but the horizontal nozzle turns the water through an angle of 90°. The nozzle exit is 3 cm in diameter and the flow rate is 500 liter/min. Determine the force components of the water on the nozzle and the magnitude of the resultant force. The pressure in the hose is 400 kPa and the water exits to the atmosphere. Analyze and solve the problem using Reynolds transport theorem.	**10**	2/4
Q3.	(A) Derive an expression for velocity profile of flow between two parallel plates with a small gap 'h' (plates) moving in opposite direction with same velocity. A pressure gradient is maintained in the direction of flow. Use NS equation for derivation.	**10**	1,2/5
	(B) A multi fluid manometer is used for a certain application where it appears as shown below. Length shown is in centimetres. Specific gravity of Benzene and Kerosene is 0.88 and 0.80 respectively. Predict P_B-P_A .	**10**	3/3



Q4.	(A) Differentiate between differential and integral approach of solving a flow	**10**	4/4

problem. Write integral and differential form of mass and momentum equation.

(B) Explain following with reference to compressible flow: **10** 3,4/3,4

a. Mach Number
b. Sonic velocity
c. Stagnation temperature
d. Chocked flow
e. Critical pressure ratio

Q5. (A) What is turbulence? List down its characteristics and explain it with suitable examples. **10** 2/1.2

(B) For a given flow field $\bar{V} = 2x\,\bar{i} - yt\,\bar{j}$ m/s where x and y are in meters and t is in seconds. **10** 4/4,5

(i) What is the dimension of flow?
(ii) Is the flow possible?
(iii) Find the equation of the streamline passing through (2,-1).
(iv) Calculate velocity, acceleration, angular velocity and vorticity of flow at a location (1,1,1) and time t = 2s.

Q6. (A) Derive following basic equation of hydrostatics. **10** 1,2/4

$\nabla p = \rho(\bar{g} - \bar{a})$, all terms carries usual meaning

(B) A wooden cylinder having a specific gravity of 0.6 has a concrete cylinder of the same diameter and 0.2 m length attached to it at one end. The specific gravity of the concrete is 2.5. Determine the length of the wooden cylinder for the composite block to float vertically **10** 2,3/3

Q7. (A) What are minor and major losses in fluid flow. Explain Moody Chart and its use. **10** 1/1,2

(B) The pressure , temperature and Mach number at the entry of a flow passage are 2.45bar, 26.5 °C and 1.4 respectively. If the exit Mach number is 2.5. For the adiabatic flow of a perfect gas with γ=1.3 and R=0.469kJ/kg-K, determine **10** 2,3/3

(i) Stagnation temperature,
(ii) Temperature and velocity of gas at the exit, and
(iii) The flow rate per square meter of the inlet cross -section.