Total No. of Questions : 09

B.Tech. (Marine Engg.) (2013 Onwards)   (Sem.–4)
FLUID MECHANICS
Subject Code : BTME-403
M.Code : 72436

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**

a. Express Euler's equation of motion in Cartesian coordinates.

b. How does a fluid differ from a solid?

c. Cite some examples to illustrate the importance of fluid mechanics in the engineering field.

d. Distinguish between vapor and gas.

e. Define rotation.

f. Define Reynold's number.

g. Using Darcy and Hagen-Poiseuille equations, derive expression for friction factor.

h. How is the stability of floating and submerged bodies determined?

i. Define center of buoyancy.

j. Define vorticity

SECTION-B

2. 2 litre of petrol weighs 14 N. Calculate the specific weight, mass density, specific volume and specific gravity of petrol with respect to water.

3. A rectangular pontoon (see Fig. 1) 10 m long, 8 m wide and 3 m deep weighs 6 × 105 N and carries a boiler of 4 m dia on its deck which weighs 4 × 105 N. The centre of gravity of each may be taken to be at the geometric centre. Determine the value of the meta centric height of the combined unit, when it floats in river water. Also Calculate the restoring torque for a tilt of 5° from vertical.
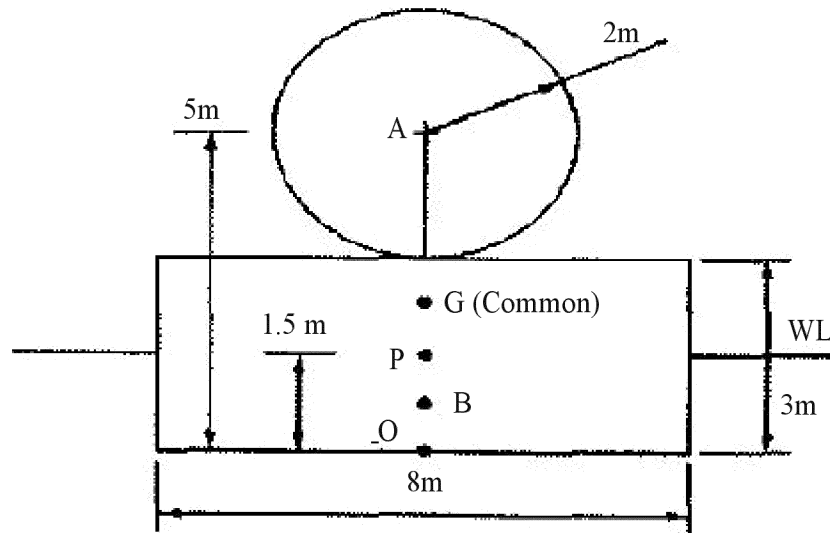

Fig .1

4. In a two dimensional flow the x and y directional velocities u and v are given by :

$$u = -\frac{x}{x^2 + y^2}, \text{ and } v = -\frac{y}{x^2 + y^2}$$

   a. Show that the flow is steady and

   b. Check whether the flow is irrotational.

5. A vertical pipe of diameter of 30 cm carrying water is reduced to a diameter of 15 cm. The transition piece length is 6 m. The pressure at the bottom is 200 kPa and at the top it is 80 kPa. If frictional drop is 2 m of water head, determine the rate of flow.

6. Two identical jets issuing from a touch as shown in Fig. 2 reach the ground at a distance of 10 m. Determine the distances indicated as h and H.
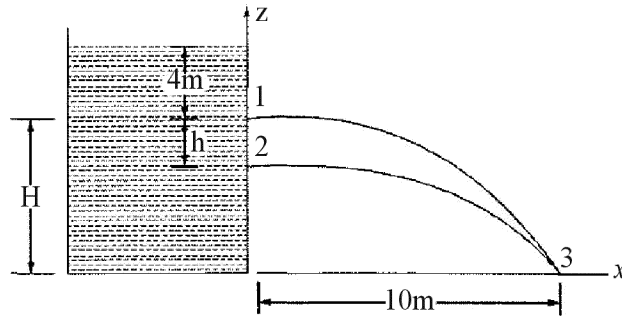
Fig .2

SECTION-C

7. Derive expressions from basics for the pressure inside a droplet and a free jet.

8. Prove that the stream function and potential function lead to orthogonality of stream lines and equipotential flow lines.

9. A pipe inclined at $45°$ to the horizontal converges from 0.2 *m* dia to 0.1 at the top over a length of 2 *m*. At the lower end the average velocity is 2 *m/s*. Oil of specific gravity 0.84 flows through the pipe. Determine the pressure difference between the ends, neglecting losses. If a mercury manometer (specific gravity 13.6) is used to measure the pressure, determine the reading of the manometer difference in *m* of mercury. Oil fills the limbs over mercury in the manometer.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.