Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: FLUID MECHANICS [AAE 2159]

REVISED CREDIT SYSTEM (28/11/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.
- 1A. 2 litre of a liquid weighs 14Newton. Find i) Mass density ii) Weight density iii) (02) Specific gravity and iv) Specific volume
- **1B.** Explain the nature of variation of viscosity with temperature in liquids and gases. (03)
- 1C. Velocity profile for a fluid over a stationary plate can be assumed a parabola with an equation $u = ay^2 + by + c$, where u is velocity and y distance from plate. Maximum velocity reaches 120cm/s at a distance of 20 cm from the plate. Calculate the shear stress at a distance of 10cm and 20 cm from the plate. Viscosity is 8.5 poise



For the case (a) and (b) above(Figure 2) derive an expression for the pressure at B in terms of heights h_1 and h_2 .



For the figure 3 shown above, find the pressure of liquid (S = 0.9) inside the pipe. Mercury is manometer liquid.

- Derive an expression for the total pressure and center of pressure for a plane surface 2C. (04)immersed vertically inside a liquid.
- 3A. A solid cylinder of 10cm diameter and 40cm long consists of two parts made up two (04)different materials. Bottom part, 1 cm long, is made up of material with S=9 and top part is made of material with S=0.6. Verify if the cylinder can float in stable condition vertically.
- A wooden block of size 5mX5mX5m size(S=0.8) carries a solid cylinder (S=0.7, **3B.** (03)diameter 4m and height 10m) vertically. Combination is floating in seawater (density 1030kg/m³). Find the depth of immersion
- Classify the fluid flow into steady-unsteady, compressible- incompressible, and 1D, **3C.** (03)2D and 3D flow briefly.
- For a fluid flow, if velocity potential function is given by $\emptyset = x(2y 1)$, determine (04) 4A. the velocity at a point P(4,5) and also find the stream function.
- **4B**. A pipe of diameter 30cm carries water at a velocity of 20m/s. the pressure at the (03)points A and B are 34N/cm² and 29N/cm² respectively. Point B is 3 meter above point A. find the loss of power between point A and B
- Derive Bernoulli's equation for a fluid flow. Define each term (heads) of the 4C. (03)equation.
- 5A. Thrust developed by a propeller depends on angular velocity ω , velocity of the flow (04)V, diameter of the propeller D, dynamic viscosity(μ), mass density(ρ) and Speed of sound C. Show that

$$P = D^2 V^2 \rho \, \phi \left(\frac{D\omega}{V}, \frac{\mu}{DV\rho}, \frac{C}{V} \right)$$

- A pipe of diameter 1.5m is required to transport an oil of specific gravity 0.9, **5B**. (03)viscosity 0.03 poise at a rate of 3000litre/s. What will be the flow rate if tests are conducted on a 15cm diameter pipe with water? Viscosity of water is 0.01poise. (03)
- With a neat sketch explain boundary layer phenomenon 5C.