GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI
DEPARTMENT OF MECHANICAL ENGINEERING

Subject: Fluid Mechanics [MEU401]

Class Test: 1 — Max. Marks: 15

Time: 1 Hr. — Date: 22nd Jan., 2018

Note: 1. Solve any **Three** questions.
2. All questions carry equal marks.
3. Assume suitable data whenever necessary.

Qu.1 Derive an expression for continuity equation in cylindrical polar co-ordinates. **[5]**

Qu.2. A fluid flow is given by:

$$V = xy^2 i - 2yz^2 j - \left(zy^2 - \frac{2z^3}{3}\right) k$$

Prove that it is a case of possible steady incompressible fluid flow. Also calculate the velocity and acceleration at the point [1, 2, 3]. **[5]**

Qu.3. **a)** Explain the different types of fluids with examples. Also represent graphically on shear stress verses velocity gradient ranging from ideal fluid to ideal solid. **[3]**

b) Explain the concept of Vapour pressure and cavitation. **[2]**

Qu.4 a) Elaborate the concept of Langrangian Method and Eulerian Method in context of fluid motion. **[3]**

b) Distinction between Solid and Fluid. **[2]**

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Qu.1 Derive an expression for continuity equation in cylindrical polar co-ordinates. **[5]**

Qu.2. Define velocity potential function and stream function. What are the conditions for flow to be irrotational. **[5]**

Qu.3. A single column vertical manometer is connected to a pipe containing oil of specific gravity 0.9. The area of the reservoir is 80 times the area of the manometer tube. The reservoir contains mercury of specific gravity 13.6. The level of the mercury in the reservoir is at a height of 30 cm below the centre of the pipe and difference of mercury levels in the reservoir and right limb is 50 cm. Find the pressure in the pipe. **[5]**

Qu.4. A fluid flow is given by:

$$V = xy^2 i - 2yz^2 j - \left(zy^2 - \frac{2z^3}{3}\right)k$$

Prove that it is a case of possible steady incompressible fluid flow. Also calculate the velocity and acceleration at the point [1, 2, 3]. **[5]**

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4. Exact and correct answer will be given due credits.

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1. State and prove:
   a) Pascal's law, and
   b) Hydro-static law. [5]

2. If the velocity profile of a fluid over a plate is a parabolic with the vertex 20 cm from the plate, where the velocity is 120 cm/sec. calculate the velocity gradients and shear stresses at a distance of 0, 10 and 20 cm from the plate, if the viscosity of the fluid is 8.5 poise. [5]

3. A circular opening, 3 m diameter, in a vertical side of a tank is closed by a disc of 3 m diameter which can rotate about a horizontal diameter. Calculate
   i. The force on the disc, and
   ii. The torque required to maintain the disc in the vertical position when the head of water above the horizontal diameter is 4 m. [5]

4. Derive an expression for continuity equation in cylindrical polar Co-ordinate. [5]
