GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI
DEPARTMENT OF MECHANICAL ENGINEERING
Subject: Fluid Mechanics [MEU401]

Class Test: 2 — Max. Marks: 15
Time: 1 Hr. — Date: 5th Mar, 2018

Note: 1. Solve any **three** questions.
2. All questions are carries equal marks.
3. Assume suitable data whenever necessary.
4. Exact and correct answer will be given due credits.

[1] Derive an Euler's equation of motion. Also derive Bernoulli's equation. **[5]**

[2] Explain the principle of venturimeter with neat sketch. Derive the expression for the rate of flow of fluid through it. **[5]**

[3] The water is flowing through a taper pipe of length 50 m having diameters 40 cm at the upper end and 20 cm at lower end, at the rate of 60 litres/s. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the higher end is 24.525 N/cm^2. **[5]**

[4] The velocity components in a two diamensional flow field for an incompressible fluid are as follows:

$$u = \frac{y^3}{3} + 2x - x^2y \quad and \quad v = xy^2 - 2y - \frac{x^3}{3}$$

Obtain an expression for the stream function ψ. **[5]**

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GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI
DEPARTMENT OF MECHANICAL ENGINEERING

Subject: Fluid Mechanics [MEU401]

Class Test: 1 — Max. Marks: 15

Time: 1 Hr. — Date: 16th Mar., 2017

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

Qu.1 Define an Orifice-meter. Prove that the discharge through an orifice-meter is given by the relation

$$Q = Cd.\frac{a_0.a_1}{\sqrt{a_1^2 - a_2^2}} \times \sqrt{2gh}$$

Where, a_1 = area of pipe in which orifice-meter is fitted
a_0= area of orifice **[5]**

Qu.2 A venturimeter of inlet diameter 300 mm and throat diameter 150 mm is fitted in a vertical pipe line. A liquid of sp. Gr. 0.8 is flowing upward through the pipe line. A differential manometer containing mercury gives a reading of 100 mm when connected at inlet and throat. The vertical difference between inlet and throat is 500 mm. If Cd = 0.98, then find: (i) rate of flow of liquid in litres per second and (ii) difference of pressure between inlet and throat in N/m^2. **[5]**

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Qu.3. State Buckingham's π-theorem. Why this theorem is considered superior over the Rayleigh's method. **[5]**

Qu. 4. Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust P depends upon the angular velocity ω, speed of advance V, diameter D, dynamic viscosity μ, mass density ρ, elasticity of fluid medium which can be denoted by the speed of sound in the medium C. **[5]**

D V, μ

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P = ω, V, D, μ, ρ, C

ϕ D V μ $\frac{V}{D\omega} \times \frac{\mu D^5}{V\rho} \times \frac{V}{C}$.

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DEPARTMENT OF MECHANICAL ENGINEERING
Subject: Fluid Mechanics [MEU 401]

Class Test: 2 Max. Marks: 15
Time: 1 Hr. Date: 8th March., 2016

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

Qu.1 Derive an expression for measuring the rate of flow through orifice meter. [5]

Qu.2 In a 45° bend a rectangular air duct of 1 m^2 cross-sectional area is gradually reduced to 0.5 m^2 area. Find the magnitude and direction of the force required to hold the duct in position if the velocity of flow at the 1 m^2 section is 10 m/s, and pressure is 2.94 N/cm^2. Take density of air as 1.16 kg/m^3 [5]

Qu.3. The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. Using Buckingham's π-theorem obtain an expression for Δp. [5]

Qu. 4. Derive the following non-dimensional numbers
a) Reynold's Number
b) Froude's Number
c) Euler's Number
d) Weber's Number
e) Mach's Number [5]

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DEPARTMENT OF MECHANICAL ENGINEERING

Subject: Fluid Mechanics (MEU 401)

Class Test: **2** Max. Marks: 15

Time: 1 Hr. Date: 12th March, 2015

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

1) Derive an expression for rate of flow through venturimeter. **[5]**

2) An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give reading of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co-efficient of discharge for the orifice meter is given as 0.6. Find the discharge of water through pipe. **[5]**

3) State Buckinghum's π-theorum. The efficiency η of a fan depends on the density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter Dof the rotor and the discharge Q. Express η in terms of dimensionless parameters. **[5]**

4) The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. Using Buckinghum's π-theorum, obtained an expression for Δp. **[5]**

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI
DEPARTMENT OF MECHANICAL ENGINEERING

Subject: Fluid Mechanics [MEU401]

Class Test: 2 — Max. Marks: 15

Time: 1 Hr. — Date: 3rd Mar, 2014

Note: 1. Solve any **three** questions.
2. All questions are carries equal marks.
3. Assume suitable data whenever necessary.
4. Exact and correct answer will be given due credits.

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[1] Show that in case of forced vortex flow, the rise of liquid level at the ends is equal to the fall of liquid level at the axis of rotation. **[5]**

[2] Explain uniform flow with source and sink. Derive expression for stream and velocity potential functions. **[5]**

[3] An open circular cylinder of 20 cm diameter and 100 cm long contains water upto a height of 80 cm. it is rotated about its vertical axis. Find the speed of rotation when:

a) No water spills
b) Axial depth is zero. **[5]**

[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]**
