



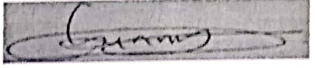
ELIZADE UNIVERSITY, ILARA-MOKIN,
ONDO STATE, NIGERIA

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST SEMESTER EXAMINATION

2019/2020 ACADEMIC SESSION

COURSE: MEE 307 – Fluid Mechanics 1 (2 Units)
CLASS: 300 Level Mechanical & Automotive Engineering
TIME ALLOWED: 2 Hours 15 Minutes
INSTRUCTIONS: Answer any **Four** questions


HOD'S SIGNATURE

Date: February, 2020

Question 1

- (a) Use working principle to differentiate between hydraulic fluid coupling and hydraulic torque converter.
- (b) How are hydraulic turbines classified?
- (c) Briefly explain four point of comparison between impulse and reaction turbine.
- (d) Explain causes of Boundary layer existence and what do you understand by “no-slip condition”.

Question 2

- (a) Differentiate between the following
 - (i) Steady and Unsteady Flow
 - (ii) Compressible and Incompressible Flow
 - (iii) Laminar and Turbulent Flow
 - (iv) Eulerian and Lagrangian methods of representing fluid flow
- (b) Determine whether the continuity equation is satisfied by the following velocity components for an incompressible fluid.

$$u = x^3 - y^3 - z^2x, \quad v = y^3 - z^3, \quad w = -3x^2z - 3y^2z + \frac{z^3}{3}$$

- (c) Check if the following functions represent possible irrotational flow:
 - (i) $\psi = A(x^2 - y^2)$
 - (ii) $\psi = xy$

Question 3

- (a) State Bernoulli's theorem and its mathematical expression. Also state the underlying assumptions of the theorem.
- (b) State four flow measurement equipment that uses the concept of Bernoulli's equation.

- (c) A pipe, 5 m long, is inclined at an angle of 15° with the horizontal. The diameters of pipe at smaller section (at lower level) and larger section are 80 mm and 240 mm respectively. If the pipe is uniformly tapered and velocity of water at the smaller section is 1 m/s, find the difference of pressures between the two sections.

Question 4

- (a) Applying Bernoulli's equation, show that the actual discharge of a Venturimeter is:

$$Q_{act} = C_d \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$$

- (b) A Venturimeter with 150 mm diameter at inlet and 100 mm at throat is laid with its axis horizontal and is used for measuring the flow of oil of specific gravity 0.9. The oil mercury differential manometer shows a gauge difference of 200 mm. Calculate the discharge. Assume the co-efficient of meter as 0.98 and take specific gravity of mercury to be 13.6.

Question 5

- (a) What is dimensional analysis? Also state its uses.
 (b) Explain Model Analysis and Similitude
 (c) Show that the efficiency of fan is given as

$$\eta = \phi \left[\left(\frac{\mu}{\rho \omega D^2} \right), \left(\frac{Q}{\omega D^3} \right) \right]$$

where $\rho = \text{density of fluid}$
 $\mu = \text{viscosity of fluid}$
 $\omega = \text{angular velocity}$
 $D = \text{Diameter of rotor}$
 $Q = \text{Discharge}$

Question 6

- (a) List five dimensionless number in fluid mechanics.
 (b) Differentiate between the Major energy losses and Minor energy losses in pipe flow.
 (c) A horizontal pipe, 150 mm in diameter, is joined by sudden enlargement to a 225 mm diameter pipe water. If water flows through the pipe configuration at the rate of $0.05 \text{ m}^3/\text{s}$, find:
 (i) Loss of head due to abrupt expansion
 (ii) Pressure difference in the two pipes with loss
 (iii) Change in pressure if the change of section is gradual without any loss.