KISII UNIVERSITY

SCHOO OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARAL SCIENCE

MSC APPLIED MATHEMATICS

MAT 851: FLUID MECHANICS II

DATE: SEPT DEC 2022 FINAL EXAM

INSTRUCTIONS: Answer question one and any other two questions

SECTION A (30 MARKS)

1.

a. Differentiate between lamina and turbulent flows giving examples in each case(5 marks)
b. Explain properties of fluids (5marks)
c. Explain giving the numerical definitions of the following non-dimensional numbers in fluid mechanics
   i. Reynolds number Re (5 marks)
   ii. Vorticity (5 marks)
d. State the difference between Euler and Bernoulli equations (5 marks)
e. The velocity components in a three-dimensional velocity field for an incompressible fluid are expressed as (5 marks)

$$u = \frac{y^3 z}{3} + 2xz - x^2 y$$
$$v = y^2 x - 2zy - \frac{x^3}{3}$$
$$w = z^2 y - 2yz - \frac{x^3}{3}$$

Show that these functions represent a possible case of an irrotational flow. (5 marks)

2.

a. Explain the classifications of fluid flows (10 marks)

b. A pitot tube is pointed into an air stream which has a pressure of 105 kPa. The differential pressure is 20 kPa and the air temperature is 20^0C. Calculate the air speed. (10 marks)

3.

a. Elaborate equations governing fluid flow problems in incompressible forms.(10 marks)
b. Calculate the specific weight, specific mass, specific volume and specific gravity of a liquid having a volume of $6m^3$ and weight of 44kN. (10 marks)

4.

a. A perfect gas is expanded from 5 to 1 bar by the law $pV^{1.2} = C$. The initial temperature is 200^0C. Calculate the change in specific gravity. Take $R = 287\ J/kgK$, $\gamma = 1.4$. (10 marks)

b. Obtain an expression in non-dimensional form for the pressure gradient in a horizontal pipe of circular cross-section. Show how this relates to the familiar expression for frictional head loss. (10 marks)

5.

a. Using forces applied, show the pressure variation in static fluids. (10 marks)

b. A plate of 0.05mm distant from a fixed plate moves at 1.2m/s and requires a force of2.2N/m^2 to maintain the speed. Find the viscosity of the fluid between the plates. (10 marks)