(*Knowledge for Development*)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER

SPECIAL/SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND

BACHELOR OF SCIENCE

COURSE CODE: **MAA 313**

COURSE TITLE: **FLUID MECHANICS 1**

DATE: 14/11/2022   **TIME: 2 PM -4 PM**

INSTRUCTIONS TO CANDIDATES
Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) (a) State Bernoulli's equation for incompressible fluid. (2marks)
b) (c) Show that φ is constant a long a streamline (5marks)
c) A ball initially at rest at $x = 0$ in a viscous is pulled in a straight line by a string. A time in depended force at Fax is applied to the string. At time t the ball comes to rest at $x = 1$ and the force is moved. As the ball moves through the fluid it experiences a dragging force preposition to its speed which depends on its speed flow. How much work is done by the applied force to move the ball from $x = 0$ to $x = n = 0$ (7marks)
d) Water flows through 0.4m pipe at a rate of 3000l per minute, at another section the pipe diameter reduces to 0.16m. What are the average velocities of the flow at the two sections? (6marks)

(e) Examine whether the velocity component is given by $u = xy, v = 2yz$ represents 2D OR 3D incompressible fluid then determine its stream function. (10marks)

QUESTION TWO (20 MARKS)
(a) Explain the following types of fluid flow. (6marks)
    i.   Steady flow and Unsteady flow
    ii.   Compressible flow and Incompressible flow
    iii.   Rotational flow and Irrotational flow
(b) State the possible ways how displacement of a particle can occur (3marks)
(c) Sate the two conditions for the existence foe stream functions. (2marks)
(d) Using a diagram, state the continuity equation for compressible and incompressible fluid. (3marks)

(e) The velocity a long a streamline is given by $v = 2s + t + 1)m/s$. Find the acceleration and velocity at s=2m after 1 second. (3marks)
(a) Explain the following properties of fluids. (3marks)
    i.   Specific gravity
    ii.   Mass density
    iii.   Surface tension

QUESTION THREE (20 MARKS)

A velocity field is given by $q = \frac{-yi+xj}{x^2+y^2}$.
Determine whether the flow is irrotational and calculate the circulation
Around
    i.   Square with its corners (1,0)(2,0)(2,1)(1,1) . (10marks)
    ii.   Unit cycle with center at the origin. (10marks)

QUESTION FOUR (20 MARKS)

a) Liquid of specific gravity of 1.3 flows in a pipe at a rate of 800 l/s from point A to point B, which is 1m above point A. The diameters at section A and B are 0.6m and 0.3m respectively. If the pressure at section A is 10 bar. Determine the pressure of section B.

(10marks)

(10 marks)

b) A 2D flow field is given by $\emptyset = 3xy$.
   i. Determine the stream function
   ii. Determine velocity at A(1,3) and B(3,3)
   iii. What is the discharge between the streamlines passing through these points?

QUESTION FIVE (20 MARKS)

Show that for a frictionless fluid if once irrotational will always remain irrotational. So, throughout the flow of the channel when each particle is acted by verifying resistance as the velocity.

(20marks)