MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN MECHANICAL ENGINEERING

FLUID MECHANICS II

DATE: 4/8/2016 **TIME:**

INSTRUCTIONS:

Question 1 is compulsory
Attempt any TWO other questions from section

1. a) Explain the following terms as used in fluid mechanics

   (i) Uniform flow

   (ii) Steady flow

   (iii) Mass flow rate

   (iv) Discharge (3 marks)

   b) Stating the assumptions made, show from basic principles that Frictional head loss h_f of a fluid flowing at a mean velocity, $\bar{v}$, in an Inclined Pipe of length L and diameter D is given by;

   $$h_f = 4f\frac{L\bar{v}^2}{D2g}.$$

   Where g is gravitational acceleration and f is the friction coefficient.

   (15 marks)

   c) Using Rayleigh's method find an expression for the drag force F on smooth sphere of diameter D, moving with a uniform velocity V in a fluid of density ρ and dynamic viscosity μ. (12 marks)

2 A" three throw" pump has a cylinder of 250 mm diameter and a stroke of 500 mm each. The pump is required to deliver 0.1 m^3/s, at a head of 100 m. The friction losses are estimated to be 1 m in the suction pipe and 19 m in the delivery pipe. Velocity of water in the delivery pipe is 1 m/s, overall efficiency is 85% percentage slip 3%. Determine speed of pump in rev/min and actual power required to drive the pump.

(20 marks)

3 Show that when a fluid flows between two parallel plates at a distance h, and length L, the velocity V, of the flow of an elemental strip at a distance y, from the axis of the plates is given by;

$$V = \frac{P}{2\mu L}\left\{\frac{h^2}{4} - y^2\right\}$$

Where P is the pressure difference between the ends of the plates and μ is the dynamic viscosity. (20 marks)

4. The pressure ΔP in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ, and density ρ. Using Buckingham's π-theorem, obtain an expression for ΔP. (20 marks)

5. From basic principles, show that the loss of head, h, when a pipe undergoes a sudden enlargement is given by,

$$H = \frac{(V_1 - V_2)^2}{2g}$$

Where V_1 and V_2 are velocities at sections. (20 marks)