UNIVERSITY OF GHANA

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B.Sc. (ENGINEERING) SECOND SEMESTER EXAMINATIONS : 2013/2014

FAEN 204: FLUID MECHANICS (3 CREDITS)

INSTRUCTION: ***ANSWER ALL QUESTIONS***

TIME ALLOWED: TWO (2) HOURS

QUESTIONS

1) Choose the correct answer

a) The viscosity of any fluid has the dimension

i. $FL^{-2}T$ ii. $FL^{-1}T^{-1}$ iii. FLT^{-2} iv. $FL^{2}T$

b) The pressure at a point in a static liquid depends on
   i. The shape and size of the container
   ii. The depth below the free liquid surface
   iii. The specific weight of the liquid and depth below the surface
   iv. The specific weight of the liquid, depth below the surface and shape and size of the container.

c) A simple equation which relates the two pressure measuring systems is
   i. Absolute Pressure = Gauge Pressure – Atmospheric Pressure
   ii. Gauge Pressure = Absolute Pressure – Atmospheric Pressure
   iii. Absolute Pressure = Atmospheric Pressure + Vacuum Pressure
   iv. Gauge Pressure = Atmospheric Pressure + Vacuum Pressure

d) Uniform flow occurs
   i. Whenever the flow is steady
   ii. When $(^{dv}/_{dt})$ is everywhere equal to zero
   iii. Only when the velocity at any point remains constant
   iv. When $(^{dv}/_{ds})$ is equal to zero

e) In Laminar flow through a pipe, the discharge varies
   i. Linearly as the viscosity
   ii. Inversely as the pressure drop
   iii. Directly as the square of the diameter
   iv. Inversely as the viscosity

f) In open channel flow, the critical depth occurs when
   i. The specific energy is maximum for a given discharge
   ii. The normal depth and critical depth coincide

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iii. The velocity is equal $\sqrt{2gy}$ (y =hydraulic depth)

iv. Any change of depth requires more specific energy

g) Flow in an open channel with Froude Number less than one(1) and Reynolds number less than 500 is described as

i. Subcritical-laminar

ii. Subcritical-turbulent

iii. Supercritical-laminar

iv. Supercritical-turbulent

h) Provide the appropriate word(s) to complete each statement

i. In a fluid confined by solid boundary, Pressure acts .....to the boundary

ii. The specific weight of a liquid is the product of.....and.....

iii. A flowing fluid in which the shearing stress is directly proportional to the velocity gradient is called.....

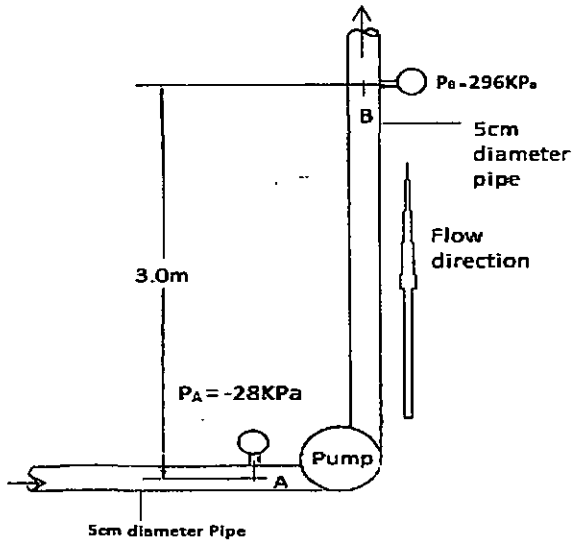
(20 Marks)

2)

a) State the general Energy Equation and define all terms.

(5 Marks)

b) The figure below shows a system used to spray polluted water into the air to increase the waters' oxygen content. The pressure at point A (the pump inlet) is -28KPa. The Pressure at point B just ahead of the nozzle must be 296KPa for proper nozzle performance. The volume flow rate is 14lit per min. The specific gravity of the polluted water is 1.026. Compute the power delivered by the pump to the fluid. Neglect friction energy loss in the discharge line



(25 Marks)

3)

a) What factors influence the velocity of flow of liquid in an open channel? (5 Marks)

b) Design a rectangular storm drainage channel to be made of formed unfinished concrete to carry $5.75m^3$/sec of water when laid on a slope of 12m per 1KM. The normal depth of flow should be ONE HALF the WIDTH of the channel bottom. (Assume n=0.017) (20 Marks)

4)

a) Briefly distinguish between Laminar Flow and Turbulent Flow. (6 Marks)

b) State three (3) important reasons for creating Turbulent Flow (9 Marks)

c) The table below gives Laboratory results for computing Reynolds Number for SAE 10 oil. Complete the table and comment on the results.

Pipe Diameter = 52.5mm
Pipe Area = 0.0233sq.m
Viscosity of Fluid = 100.55×10^{-3}PaS
Density = $891.6Kg/m^3$

VOLUME (Lit)	TIME (sec)	Volume Flow Rate, M^3/Sec	VELOCITY OF FLOW (M/Sec)	REYNOLDS NO.
820	10			
1050	5			

(10 Marks)