UNIVERSITY OF LAGOS
DEPARTMENT OF MECHANICAL ENGINEERING
B.Sc. (Hons.) MECHANICAL ENGINEERING
SECOND SEMESTER EXAMINATIONS, 2013/2014 SESSION
MEG 202: FLUID MECHANICS

ANSWER THREE (3) QUESTIONS TIME ALLOWED: 2 HRS

Good sketches and labelling where necessary, as well as orderly presentation of facts will earn you more mark.

Question 1(Compulsory)

Define the following terms:

a. Lagrangian methods of fluid flow analysis
b. Eularian methods of fluid flow analysis
c. Steady and Unsteady Flow
d. Compressible flow
e. Incompressible flow
f. Steady uniform flow
g. Steady non uniform flow
h. Unsteady uniform flow
i. Unsteady non uniform flow
j. System and control volume
k. Streamlines
l. Pathlines

Question 2 (Compulsory)

a. Explain the meaning of Non- Newtonian fluids and ideal fluids with examples.
b. Briefly discuss the term viscosity.
c. Do you think that the study of fluid mechanics is relevant to the society? Justify.
d. If $u=ay + by^2$ represents the velocity of fluid in the boundary layer of a surface, a and b being constants and y the perpendicular distance from the surface, calculate the shear stress acting on the surface when the speed of the fluid relative to surface is 7.2km/hr at a distance of 1.5mm from the surface and 10.08km/hr when 3mm from the surface. [$v=1.2x10^{-3}Ns/m^2$, $s.g=0.79$]. Assume linear velocity profile.

Question 3

a. State Pascal's law. Show that the pressure variation in a compressible fluid is given by $\frac{P}{P_0} = exp\left(-\frac{gz}{RT}\right)$ with necessary assumptions.

b. Compute the pressure difference between pipes A and B for the differential manometer shown in **Fig. Q3**

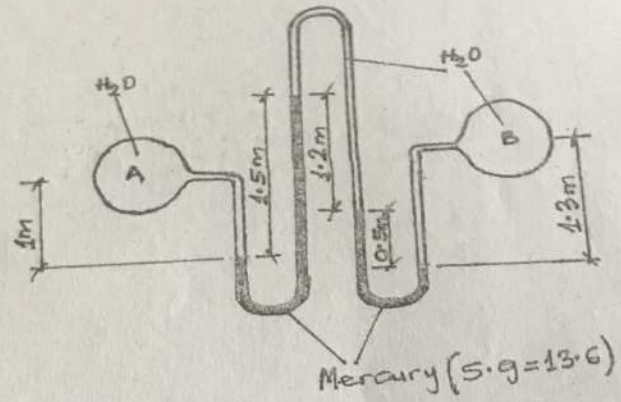

Fig. Q3.

Question 4

a. A uniform wooden circular cylinder of 200mm diameter and of specific gravity 0.7 is required to float in an oil of specific gravity 0.9. Determine the maximum length of the cylinder, in order that the cylinder may float vertically in water.

b. A 50mm diameter siphon drawing oil (R.D of 0.82) from an oil reservoir as shown in **Fig. Q4.** The head loss from point 1 to point 2 is 1.5m and from point 2 to 3 is 2.4m. Calculate:

i. the discharge of oil from the siphon;

ii. the oil pressure at point 2.

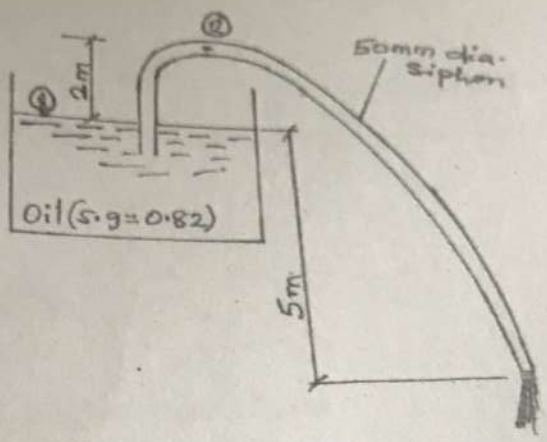

Fig. Q4.

Question 5

a. Using the concept of metacentric height state the condition under which a floating body will be in stable, neutral and unstable condition.

b. Derive the expression for the ratio of base diameter to the height of a cone to float in a fluid in a stable condition given the relative density between the solid and the fluid as S.

c. A conical wooden block of 0.5 m diameter and 0.7 m high has a relative density of 0.7 for a fluid in which it floats. Determine whether it can float in a stable condition.

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