UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : CIVIL*
SUBJECT	:	**HYDRAULICS 2A**
CODE	:	**CEW2A11**
DATE	:	WINTER EXAMINATION 12 JUNE, 2018
DURATION	:	16:30 - 18:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	75

EXAMINER	:	MR LF SHIRLEY
MODERATOR	:	DR AM CASSA
NUMBER OF PAGES	:	3 PAGES AND 1 FORMULAE SHEET

INSTRUCTIONS	:	ANY TYPE OF POCKET CALCULATOR PERMITTED.
REQUIREMENTS	:	NONE

INSTRUCTIONS TO CANDIDATES:

ANSWER ALL THE QUESTIONS.

QUESTION 1

1.1 Convert a pressure head of 10m of water to that of oil of specific gravity 0,850. (3)

1.2 Convert a pressure intensity of 100kN/m^2 to a pressure head of mercury. Take the specific gravity of mercury as 13,60. (4)

1.3 Determine the intensity of pressure exerted by a glycerine column 5 m high. Take the specific gravity of glycerine as 1,260. (3)

[10]

QUESTION 2

A force P of 850 N is applied to the smaller cylinder of a hydraulic press. The area a of the small piston is 15 cm^2 and the area A of the larger piston is 150 cm^2.

2.1 What load W can be lifted on the larger piston if the pistons are at the same level? (8)

2.2 What is the mechanical advantage of the press expressed as a ratio? (2)

[10]

QUESTION 3

A triangular surface having a base width of 2 m and height of 3 m is submerged vertically in water. The vertex of the triangular surface is above the base and just touches the free water surface.

3.1 Calculate the hydrostatic pressure (force) acting on one side the submerged surface. (4)

3.2 Calculate the depth to the centre of pressure of the above force. (6)

[10]

QUESTION 4

A circular plate of 2 m diameter is immersed in water such that its greatest and least depth below the water surface is 4 m and 3 m respectively.

4.1 Calculate the hydrostatic pressure (force) acting on one side of the surface. (4)

4.2 Calculate the depth to the centre of pressure of the above force. (8)
[12]

QUESTION 5

A rectangular concrete open channel conveying water is 2 m wide. The depth of flow in the channel is 1 m. The channel has a longitudinal slope of 1 in 750.

5.1 Calculate the flow in the channel in m^3/s using Manning's formula taking n = 0,0150.

[10]

QUESTION 6

A horizontal pipeline with centerline 10 m above datum conveys water at a mean velocity of 2 m/s. The water in the pipeline is under a pressure of 100kPa.

6.1 Calculate the potential head relative to datum, the velocity head, the pressure head and total head of any point lying on the centerline of the pipeline.

[8]

QUESTION 7

The jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, what will be the diameter of the jet at a point 4,50 m above the nozzle if the velocity with which the jet leaves the nozzle is 12 m/s?

[15]

[TOTAL = 75]

Formulae

$$p = \rho g h = \gamma h$$

$$p = \frac{F}{A}$$

$$\gamma = \rho g$$

$$\tau = \frac{F}{A} = \mu \frac{dv}{dy}$$

$$\nu = \frac{\mu}{\rho}$$

$$I_{rect} = \frac{1}{12} b d^3$$

$$I_{circle} = \frac{\pi d^4}{64}$$

$$I_{triangle} = \frac{b h^3}{36}$$

$$P = wA\bar{x} = \gamma \bar{y} A$$

$$\bar{h} = \frac{I_g \sin^2 \theta}{A\bar{x}} + \bar{x} = \frac{k^2 \sin^2 \Theta}{\bar{y}} + \bar{y}$$

$$P_h = wA_p \bar{x} = \gamma \bar{y} A_p$$

$$P_v = \rho g V = \gamma V$$

$$R = \sqrt{P_h^{\,2} + P_v^{\,2}}$$

$$\tan^{-1} \Theta = \frac{P_v}{P_h}$$

$$BM = \frac{I}{V}$$

$$I = Ak^2$$

$$z_1 + \frac{p_1}{\rho g} + \frac{v_1^2}{2g} + h_p = z_2 + \frac{p_2}{\rho g} + \frac{v_2^2}{2g} + h_l$$

$$v = \frac{1}{n} m^{\frac{2}{3}} i^{\frac{1}{2}}$$

$$F = \rho Q (v_2 - v_1)$$

$$f_1 ; f_2 = \pm \frac{F}{A} \pm \frac{My}{I}$$

$$P = \rho g Q H$$

$$Q = av$$