

**Faculty of Engineering**  
**Department of Mechanical Engineering**

**Mechanics First Quiz**

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**Problem 1 ( 10 points ) :**

The brake horsepower bhp of a pump is a function of the pump diameter, the density of the fluid, and the rotational speed of the impellers.

Express this relation as a dimensionless group and name the coefficient.

Xuhanna (1211224) Quiz 1

1/17/2024

Musleh

Fluid Mechanics

$$p = f(\rho, n, b)$$

$$L: \rho^a n^b b^c p^1 = M^0 L^0 T^0$$

$$(M^{-3})^a (T^{-1})^b (L^0) M L^2 T^{-3} = M^0 L^0 T^0$$

$$L: -3a + c + 2 = 0$$

$$M: a + 1 = 0 \Rightarrow a = -1$$

$$\Rightarrow 3 + c + 2 = 0 \Rightarrow c = -5$$

$$T: -b - 3 = 0 \Rightarrow b = -3$$

$$\Pi_1 = \rho^{-1} n^{-3} b^{-5} p^1$$

$$\Pi_1 = \frac{p}{\rho n^3 b^5}$$