TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING (DMEN)

EME 2308
FLUID MECHANICS II

END OF SEMESTER EXAMINATIONS

YEAR 3 SEMESTER 2

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet
   - Scientific Calculator
   - Drawing Instruments

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry equal marks.
5. **This paper consists of THREE printed pages.**

Question ONE

(a) With reference to viscous flow the velocity of a fluid in a circular pipe can be given by:

$$\upsilon = \frac{1}{4\mu}\frac{\partial P}{\partial x}\left[R^2 - r^2\right]$$

Where: $\upsilon =$ Velocity of fluid at any radius r

$\mu =$ Dynamic viscosity

$\partial P / \partial x =$ Pressure gradient

From the above expression deduce expressions for:

(i) Average velocity
(ii) The shear stress

(14 marks)

(b) A fluid of viscosity 0.5Ns/m^2 and specific gravity 1.2 is flowing through a circular pipe of diameter 100mm. The maximum shear stress at the wall is given as 147.15N/m^2. Determine:

(i) Pressure gradient
(ii) Average velocity
(iii) Reynods number of the flow

(6 marks)

Question TWO

The flow rate per unit time 'Q' drained by an orifice of diameter 'd' from a circular tank of diameter 'D' , when the head is 'h' depends on the density $'\rho'$ and viscosity $'\mu'$ of the fluid and acceleration due to gravity $'g'$ by choosing $\rho,\ d\ and\ \mu$ as reaping variable determine:

(i) Number of dimensionless groups
(ii) An equation relating/correlating Q with other variables

(20 marks)

Question THREE

(a) Briefly describe **THREE** sources of losses in centrifugal pumps. **(6 marks)**

(b) The following data refer to a typical centrifugal pump:

Impeller diameter external	=	500mm
Width at exit	=	25mm
Pump speed	=	1200rpm
Suction head	=	6m
Delivery head	=	40m
Friction in suction side	=	2m
Friction in delivery side	=	8m
Blade angle at inlet	=	30^o
Manometric off	=	80%
Overall off	=	75%

From the above data:

Determine:

(i) Power required to drive pump
(ii) Pressure at suction and delivery side of the pump

(14 marks)

Question FOUR

The drag on a ship on sea water with $2135m^2$ wetted areas is to be estimated a model 1/33 scale towed at 1.3m/s through fresh water had a total drag resistance of 15.3N. The skin resistance of the model follows the law $F = CU_m^{1.9}$, and was $14.33N/m^2$ at 3m/s. The ship skin resistance per unit area follows the law $F = 5.76U_s^{1.85}(N/m^2)$. Determine; (stating any formulae used).

(i) Corresponding speed of the ship
(ii) Power needed to proper the ship

Take density of sea water = $1025kg/m^3$

(20 marks)

Question FIVE

The resistance due to surface friction of a flat plate $1m^2$ in area when moving in its own plane in water was found to be 34.5N at 3m/s and 124.5N at 6m/s. Determine the power absorbed by a thin disc 500mm in diameter having a similar surface when rotated in water (both sides wet) at 1500rev/min. The disc is attached to a shaft of 25mm dia which extends through it. (Proove any formulae used). **(20 marks)**