University Examinations 2012/2013

SECOND YEAR, FIRST SEMESTER, EXAMINATION FOR THE DIPLOMA IN
MECHATRONICS ENGINNERING

EMC 0222: FLUID MECHANICS I

DATE: DECEMBER 2012   **TIME: 1 ½ HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE – 30 MARKS

a. A liquid has a specific gravity of 0.7, calculate its density, specific weight and the weight of one litre of the liquid.   (5 Marks)
b. The pressure intensity at a point in a given liquid is $4.9 N/cm^2$, find the corresponding height of the fluid when its water.   (3 Marks)
c. State and prove the principles of Archimedes.   (4 Marks)
d. State two conditions for equilibrium of a floating body.   (2 Marks)
e. Distinguish between laminar and turbulent flow.   (2 Marks)
f. State the Bernoulli's theorem for steady flow of an incompressible fluid.   (2 Marks)
g. Sketch a picot tube and explain how its used to measure the velocity of a flowing fluid.   (4 Marks)
h. Give the dimensions of power and kinematic viscosity.   (2 Marks)
i. A liquid of specific gravity 0.85 flows through a pipe 5cm diameter at rate of $3000 cm^3/s$, determine the type of flow if the velocity is $0.38 Ns/M^2$.   (6 Marks)

QUESTION TWO – 15 MARKS

a. A square plate of sides 6cm hangs in water from one of its corners, the centre of gravity of the plate is at 10cm from the water surface, calculate the total pressure on the plate and the position of the centre of pressure.   (7 Marks)
b. The diameter of a pipe at the sections 1 and 2 are 15cm and 20cm respectively, find the discharge through the pipe if the velocity of water at section 1 is 4m/s, determine the velocity at section 2.
                                                                                        (6 Marks)
c. State the Newton's law of viscosity.   (2 Marks)

QUESTION THREE – 15 MARKS

a. State and prove Pascal's principle. (5 Marks)
b. The diameter of a pipe changes gradually from 150mm at a point A 6m above the datum to 75mm at B 3m above the datum. The pressure at A is 103KN/M^2 and the velocity of flow is 3.6m/s, assuming there are no losses, calculate the measure at B. (6 Marks)
c. A spherical balloon 6m diameter is filled with gas weighing 5.60N/M^3, in standard air weighs 12.066N/M^3, what is the maximum load including its own weight that the balloon can lift? (4 Marks)

QUESTION FOUR – 15 MARKS

a. By using Buckigham's II theorem develop an expression for the power P of the pump which depends on the head **H**, specific weight $\propto$ and discharge **Q** of the fluid. (6 Marks)
b. A venturi meter is installed in a pipe carrying air the meter has a diameter of 60cm at the inlet and 45cm at the throat. The differential pressure gauge containing water indicates a difference of 10cm, determine the discharge per minute, neglect friction and assume weight of air as 12.56N/M^3. (6 Marks)
c. Oil flows through a pipe of diameter 50mm at a velocity of 1.5m/s, determine the type of flow if its kinematic viscosity is 4.47 x 10-4m^2/s. (3 Marks)