



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

EBC 2206: FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** from section **A** and any other **TWO** from section **B**

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY – 30 MARKS)

Question 1

- a) A certain liquid has a mass density of 800kg/m^3 . Determine in SI units:
- Its relative density
 - Its unit weight
 - The volume of 200kg of the liquid
 - The weight of 1.5m^3 of the liquid
- (10 marks)
- b) A differential manometer is fitted between two pipes A & B containing two different liquids as shown in fig.1. Determine the pressure difference between A and B

140mm

- c) A pipe P, 450mm diameter branches into two pipes Q and R of diameters 300mm and 200mm respectively as shown in fig. 2. The velocity in pipe P is 3m/s and velocity in Q is 2.5m/s .

Fig. 2

Determine:

- Discharge in pipe P
 - V_{e0} .
 - locity in pipe R
 - Discharge in pipe R
- (8 marks)
- d) (i) State **TWO** assumptions made in deriving Bernoullis eq
- (ii) Name **FOUR** devices used for measuring velocity of a moving liquid (6 marks)

SECTION B (Attempt any TWO questions from this section – 20 marks each)

Question 2

- a) A rectangular plate 2m wide and 4m deep is immersed in water as shown in fig 3. Determine;

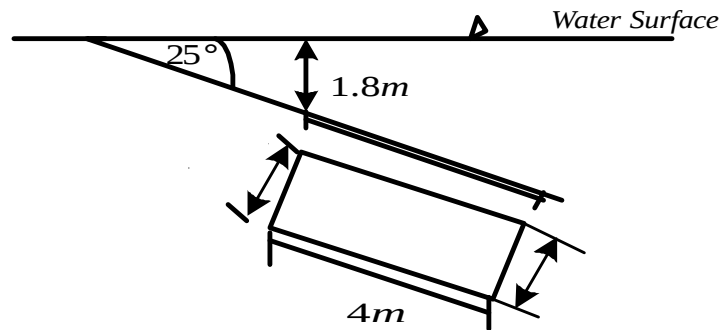


Fig.3

- i) The total pressure on one side of the plate
ii) The position of the centre of pressure (8 marks)
- b) Fig. 4 shows a circular gate AB hinged at C.

A

Fig. 4

Determine:

- i) The resultant pressure on the gate per metre length
ii) The angle at which the resultant acts (8 marks)
- c) Define the following terms
i) Atmospheric pressure
ii) Gauge pressure (4 marks)

Question 3

- a) An oil with a specific gravity of 0.8 is flowing in a pipe at a rate of 2000l/s with a velocity of 3m/s. Determine
- The size of the pipe
 - The mass flow rate of the oil
- (6 marks)
- b) Water is flowing through a horizontal pipe AB 100m long. The pipe tapers uniformly from 300mm dia at A to 200mm dia at B. The pressure head at A is 100 KN/m² and the flow rate is 50l/s. Determine the pressure at B in
- KPa
 - mm of mercury
 - M of water
- (8 marks)
- c) Define the following terms
- Piezometer
 - Siphon
 - Perfect vacuum
- (6 marks)

Question 4

- a) A jet of water 50cm in diameter and having a velocity of 15m/s strikes a plate normally. Calculate the force on the plate, if the plate is
- Stationary
 - Moving with a velocity of 6m/s towards the jet
 - Moving with a velocity of 6m/s away from the jet
- (5 marks)
- b) With the aid of sketches, briefly describe the **THREE** conditions of equilibrium of a solid body
- (9 marks)
- c) Define the following terms
- Buoyancy
 - Metacentric height
 - Centre of buoyancy
- (6 marks)

Question 5

- a) State
- Bernoulli's theorem
 - Archimedes principle
- (6 marks)
- b) Sketch a pitot-static tube and label all the parts
- (4 marks)

- c) A pitot tube was inserted at the centre of a 100mm diameter pipe. The water rose 200mm in the tube. Assuming that the coefficient of the pitot-tube $c = 0.99$ and that the mean velocity in the pipe is $2/3$ of the central velocity, calculate the discharge in the pipe (6 marks)
- d) Differentiate between “total Energy” and “total head” of a moving liquid (4 marks)