



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE 14M)

ECE 2203: FLUID MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Pocket Calculator*

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

Maximum marks for each part of a question are as shown

Use neat, large and well labeled diagrams where required

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Define the following terms as used in fluid mechanics:

- (i) Mass density (2 marks)
- (ii) specific density (2 marks)
- (iii) Specific gravity (2 marks)
- (iv) Specific volume (2 marks)
- (v) Viscosity (2 marks)

b) Using a well labeled diagram show the forces on a liquid droplets (3 marks)

c) (i) Define pressure (2 marks)

(ii) State the hydrostatic law (2 marks)

- d) Using a well labeled diagram, state the mechanical gauges that are used to measure pressure **(6 marks)**
- e) A force of 900N is applied to the smaller cylinder of a hydraulic jack. The diameter of the smaller piston is 5mm while that of the larger piston is 15mm. Determine the load W which can be lifted on the larger piston if:
- The piston are at the same level
 - The larger piston is 0.8m below the smaller piston

The liquid in the jack is water of specific weight 9810N/m^3 **(7 marks)**

Question Two

- a) (i) A U-tube differential manometer is connected to two pipes A and B as shown below. Pipe A contains a liquid of sp.gr 1.5 while pipe B contains a liquid of sp.gr 0.9. The pressures at A and B are 98.1KN/m^2 and 176.58KN/m^2 . Determine the difference in mercury level in the differential manometer **(10 marks)**

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- (ii) Differentiate between total pressure and centre of pressure and hence state Pascal's Law for pressure at a point **(6 marks)**

- (iii) A block of wood 4m long x2m wide x 1m deep is floating horizontally in water. If the density of wood is 700kg/m^3 . Determine the volume of water displaced and the position of centre of buoyancy **(4 marks)**

Question Three

- a) State and briefly explain the conditions of equilibrium of a floating body. Use illustrations appropriately 1-a-swering and hence define "equilibrium" **(8 marks)**
- b) A cylinder 360mm long, 80mm, In diameter has its base 10mm thick and of specific gravity 7. The remaining part is of specific gravity 0.7. Determine if it can float vertically in water **(12 marks)**

Question Four

- a) Using a well labeled diagram define the types of the flow lines **(12 marks)**
- b) The diameters of a pipe at entrance and exit sections are 100mm and 150mm respectively. If the velocity of water at the pipe entrance is 5mm/s, determine:
- The discharge at the entrance
 - The velocity at the exit **(8 marks)**

Question Five

- a) A conical pipe diverges uniformly from 100 to 200mm in diameter over a length of 1m. Determine the local and convective accelerations at the mid-section assuming:
- (i) A constant flow rate of $0.1\text{m}^3/\text{s}$
 - (ii) The rate of flow varies uniformly from $0.1 - 0.2\text{m}^3/\text{s}$ in 5 seconds at 2 sec **(12 marks)**
- b) Differentiate between:
- (i) Laminar and turbulent flows
 - (ii) Steady and unsteady flow **(8 marks)**