



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY (DSL T 10S)

**APS 2201: PHYSICS TECHNIQUES I – MECHANICS, FLUIDS,
FUELS & COMBUSTION**

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 2HOURS

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** questions from **SECTION B**

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION A (Compulsory)

Question One (30 marks)

- a) Explain **FOUR** sources of energy (4 marks)
- b) Discuss the various energy changes involved to have water in a dam produce electricity (2 marks)
- c) State the law of conservation of momentum (2 marks)
- d) When is work said to have been done? Give a formula of determining work done (3 marks)
- e) Define the terms
- (i) Viscosity (1 mark)
 - (ii) Fluidity (1 mark)
- f) Distinguish between viscosity in liquids and gases (4 marks)
- g) Define hydrostatic pressure and derive a formula to calculate it. (3 marks)
- h) The radius of the effort piston of a hydraulic lift is 1.4cm while that of the load piston is 7.0 cm. This machine is used to raise a load of 120kg, at a constant velocity through a height of 2.5m. Given that the machine is 80% efficient, calculate;
- (i) The effort needed (5 marks)
 - (ii) The energy wasted in using this machine. (5 marks)

SECTION B (Attempt any TWO questions)

Question Two (20 marks)

- a) The boy pulls a toy car by a string which makes an angle of 30° with the horizontal. If the boy applies force of 4.8N and the toy moves through a horizontal distance of 8m, calculate the work done by the boy. (5 marks)
- b) A body of mass 50kg is raised to a height of 2m above the ground.
- (i) What is its potential energy? (3 marks)
 - (ii) If the body is allowed to fall, find its kinetic energy
 - (I) When halfway down (4 marks)
 - (II) Just before impact with the ground (Take 'g' as 10N/kg)(4 marks)
- c) State the **TWO** laws of thermodynamics (4 marks)

Question Three (20 marks)

- a) Distinguish between Newtonian and Non-Newtonian fluids (4 marks)

- b) Discuss thermodynamic reversibility (3 marks)
- c) Discuss **FIVE** different types of combustion (5 marks)
- d) Distinguish giving examples combustion with oxygen as the oxidizing element and combustion with air as the oxidizing element (4 marks)
- e) A block and tackle system is used to lift a mass of 200kg. If this machine has a velocity ratio of 5, and an efficiency of 80%, calculate the effort E applied. (Take $g = 10\text{N/Kg}$) (4 marks)

Question Four (20 marks)

- a) Derive a relationship between Mechanical Advantage, Velocity Ratio and Efficiency (6 marks)
- b) Describe the working principle of a simple power plant (6 marks)
- c) A man uses the inclined plane to lift a 50kg load through a vertical height of 4m. The inclined plane makes an angle of 30° with the horizontal. If the efficiency of the inclined plane is 72%, calculate:
 - (i) The effort needed to move the load up the inclined plane at a constant velocity (4 marks)
 - (ii) The work done against friction in raising the load through a vertical height of 4m. (Take 'g' as 10N/kg) (4 marks)

Question Five (20 marks)

- a) Outline the factors that determine the adiabatic combustion temperature. (4 marks)
- b) A car traveling at a speed of 72km/h is uniformly stopped after 8 seconds by applying brakes. If the car and its occupants have a mass of 1250kg, calculate
 - (i) The braking force (3 marks)
 - (ii) The work done by the braking force to stop the car (3 marks)
- c) Draw a steam power plant cycle (5 marks)
- d) Differentiate between a superheated steam boiler and a supercritical steam generator. (5 marks)