



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING DIPLOMA IN ELECTRICAL ENGINEERING (DEE 2)

EME 2130 MECHANICAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATIONS

YEAR 1 SEMESTER 2

SERIES: MARCH, 2014

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
 - Answer Booklet
 - Scientific Calculator
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) (i) State the first law of thermodynamics.
- (ii) State the non-flow energy equation and explain the terms used.

(5 marks)

$$W = P_1 V_1 \ln \frac{V_2}{V_1}$$

- (b) (i) Show that for an isothermal process the work done is given by :

Where: P_1 is the initial pressure
 V_2 is the final volume
 V_1 is the initial volume

- (ii) A gas of volume of 0.02m^3 is cooled until its volume is halved, while its pressure remains constant. If the initial temperature is 50°C , calculate the final temperature.

(15 marks)

Question TWO

Water flows through a pipe AB 1.2m diameter at 3m/sec and then passes through a pipe BC 1.5m diameter. At C, the pipe branches branch CD is 0.8m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5m/sec. Calculate:

- (i) The flow rate in AB
(ii) The velocity in BC
(iii) The velocity in CD
(iv) The diameter of CE

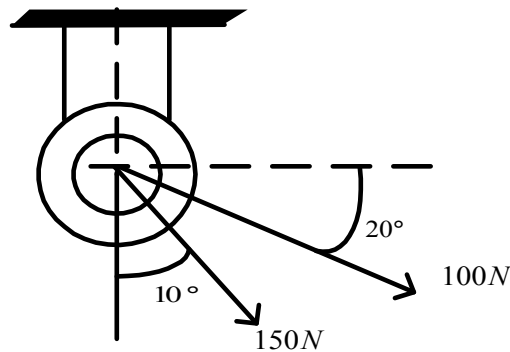
Ignore losses

Question THREE

- (a) A farm tractor has an engine with a power output of 90kw. The tractor travels at a maximum speed to the top of a 600m hill in a time of 4min 20secs. If the mass of the tractor is 2.4 tonnes. Calculate the efficiency of the tractors drive system. **(10 marks)**
- (b) A loaded railway truck of total mass 8600kg is travelling along a level track at a velocity of 5m/sec and is struck from behind by an empty truck of mass 3500kg travelling at 8m/sec. The two trucks become coupled together during the collision. Calculate the velocity of the trucks after impact. **(10 marks)**

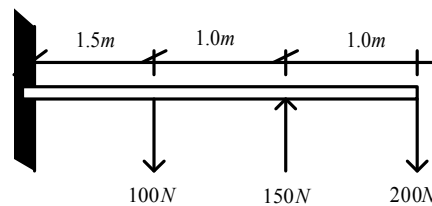
Question FOUR

- (a) A screw eye is subjected to two forces of 150N and 100N as shown in the figure below. Calculate resultant force and its direction:



(10 marks)

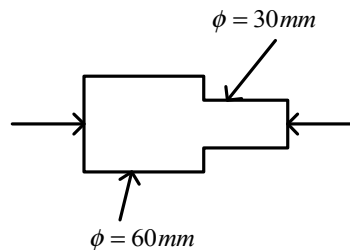
- (b) Replace the system of forces shown in the diagram below with an equivalent single force and calculate its distance of application.



(10 marks)

Question FIVE

- (a) Calculate the maximum diameter hole that can be punched in an aluminum plate thickness 10mm if the punching force is limited to 20kN. The shear strength of the aluminum is 90MN/m².
- (b) A rod is formed with one part of it having a diameter of 60mm and the other part a diameter of 30mm and is subject to an axial force of 20kN. Calculate the stresses on the two parts of the rod.



(20 marks)