TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATION FOR:

BACHELOR SCIENCE IN MECHANICAL ENGINEERING

EME 2211 : MECHANICAL ENGINEERING

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, pocket calculator, examination pass and student ID

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

Do not write on the question paper.

Question ONE

a) Explain the following terms
   i) Plain Stress and plain strain condition **(4marks)**
   ii) Solid or Hysteretic damping **(4marks)**

b) Derive using diagram and formula the damping constant for parallel plates separated by viscous fluid one plate moving with a velocity *v* relative to the other. **(7marks)**

c) A tensile test is carried out on a bar of mild steel of diameter 2cm. The bar yields under a load of 80kN. It reaches a maximum load of 150kN, and breaks finally at a load of 70kN.
   Estimate:
   i) The tensile stress at the yield point
   ii) The Ultimate stress tensile stress:
   iii) the average stress at the breaking point, if the diameter of the fractured neck is 1cm **(6 marks)**

d) A pipe as shown in figure 1(d) of the given dimensions and parameters has water flowing under pressure from section 1 to 2. Determine the pressure P_1 if the discharge in the pipe is 30 litres/sec and the head loss in the pipe from section to 1 to 2 is given by $0.4(V_2-V_1)^2/2g$. Take the density of water as $1000kg/m^3$. **(9 marks)**

Question TWO

Construct the bending moment and shearing force diagrams for the beam shown in figure 2. **(20 marks)**

Question THREE

Two wooden planks 150 mm x 50 mm each are connected to form a T - section of a beam. If a moment of 3.4 kNm is applied around the horizontal neutral axis, including tension below the neutral axis,
Find;

a) The stresses at the extreme fibres of the cross – section **(17 marks)**
b) The total tensile force on the cross section **(3 marks)**

Refer to Figure 3.

Question FOUR

a) Derive the pure bending formula for a rectangular beam **(8 marks)**

b) The helicopter rotor starts from rest. The moment exerted on it (in Nm) is given as a function of the angle through which it has turned in radians by M=6500-20θ. The rotor's moment of inertia is I=540kgm^2. Determine he rotor's angular velocity (in rpm) when it has turned through 10 revolutions. **(7 marks)**

c) Illustrate by use of diagrams the sign convention of a loaded beam **(5 marks)**

Question FIVE

a) Explain the following terms:
i) Kinematics and kinetics of a body
ii) Steady uniform flow and Unsteady uniform flow **(4marks)**

b) Determine the mass discharge of air through a tube with a smooth circular entrance and a cylindrical part of a diameter 200mm, if the measure of vacuum pressure in the form of a vertical column of water h= 250mm, $\rho_{air} = 1.25 kg/m^3$ and coefficient of loss at the entrance is $\zeta = 0.1$. Refer to figure 5(b)
(8 marks).

c) A piston raises a column of water to a height h_1=4m. Determine the force necessary to retain the piston at a height h_2=3m over the surface in the well given that the diameter of the piston is D=100mm. Diameter of piston load d=30mm. Neglect the weight of the piston rod. Refer to figure 5(c) **(8marks)**

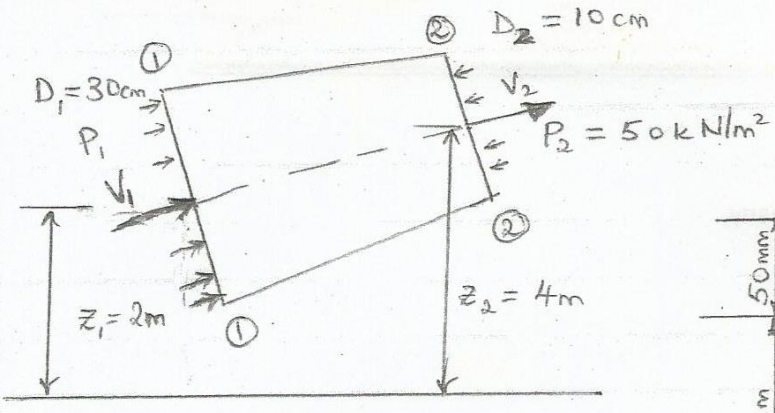

Fig 1(d)

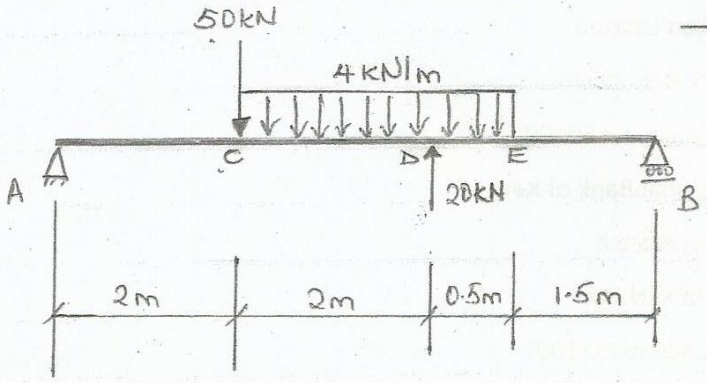

Fig 2

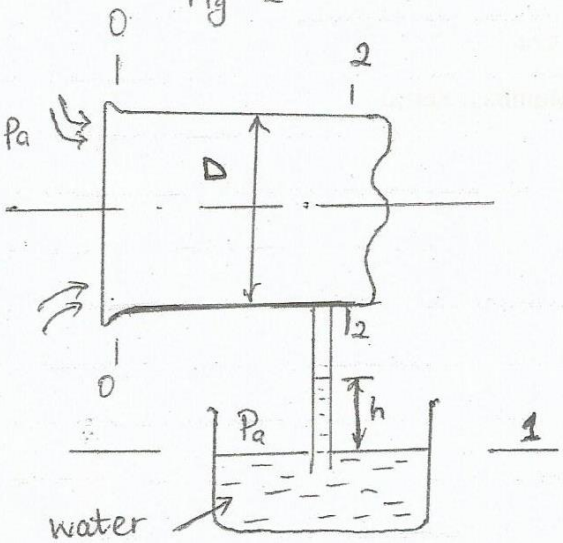

Fig 5(b)

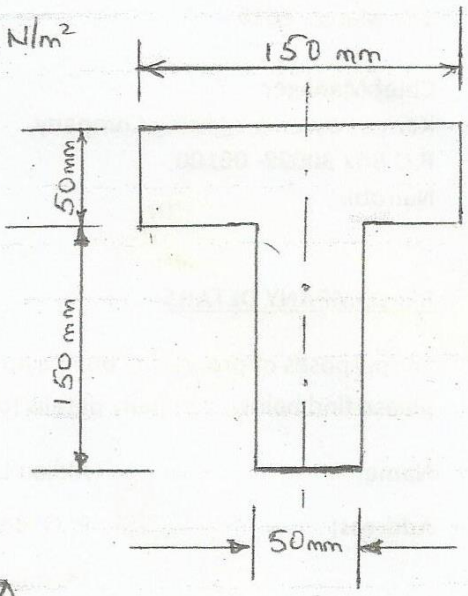

Fig 3

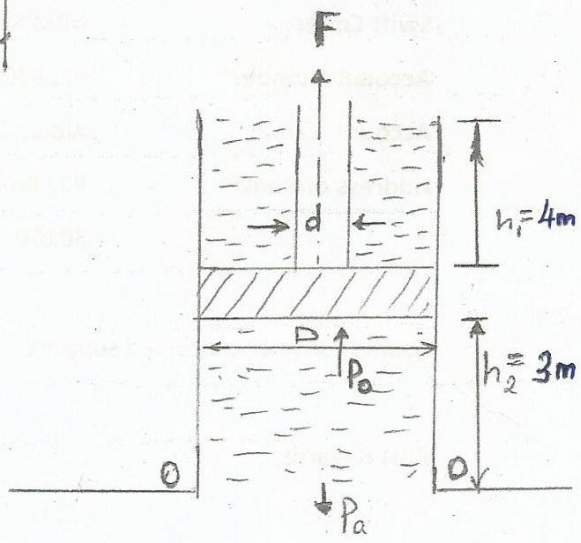

Fig 5(c)