TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

UNIVERSITY EXAMINATION FOR:

Bachelor of Science in Electrical and Electronic 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) Discuss the following :
   i) Theory of parallel axis
   ii) Theory of perpendicular axis
   iii) Number of degrees of freedom of a system
   iv) Deterministic and Random vibrations **(8 marks)**

b) Discuss Pascal's theory of pressure at a point. **(8 marks)**

c) Explain 5 advantages of chain drives over belt or rope drives. **(5 marks)**

d) The following data relates to a bar subjected to a tensile test:
   Diameter of the bar, d=30mm
   Tensile load, p = 54kN
   Gauge length l = 300mm
   Extension of the bar $\delta l = 0.112mm$
   Change in diameter $\delta d = 0.00366mm$
   Calculate ;
   (i) Poisson's ratio
   (ii) The values of the three modulii (E,G and K) **(9 marks)**

Question TWO

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

Question THREE

a) A 10 kg rod as shown in Fig 3(a) is constrained so that its ends move along the grooved slots. The rod is initially at rest when $\theta = 0°$. If the slider block at B is acted upon by a horizontal force p= 50N, Determine the angular velocity of the rod at the instant. $\theta = 45°$. Neglect friction and the mass of blocks A and B.
(14 marks)

b) Relative to an earth- fixed reference frame, (figure 3b), the vertical shaft rotates about its axis with angular velocity $\omega_0 = 4 \text{ rad/sec}$. The secondary xyz coordinate system is fixed with respect to the shaft and its origin is stationary, Relative to the secondary coordinate system, the disk (radius = 8cm) rotates with constant angular velocity $\omega_d = 6rad/s$. At the time instant shown, determine the velocity of point A.
(i) Relative to the secondary reference frame.
(ii) Relative to the earth – fixed reference. **(6 marks)**

Question FOUR

a) The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at sections 1 and 2 respectively. The discharge through the pipe is 40 litres/ sec. The section 1 is 10m above datum and section 2 is 6m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2
(12 marks)

b) In a pipe of diameter 500 mm and length 50m water is flowing at a velocity of 3m/s. Find the head lost due to friction using:
i) Darcy – Weisbach formula.
ii) Chezy's formula for which C=65.
Assume kinematic viscosity of water as 0.0012 stoke or 0.012 x 10^{-4} m^2/s. **(8 marks)**

Question FIVE

a) The 700kg pipe is equally suspended from the two tines of the fork lift shown in the photo. It is undergoing a swinging motion such that when θ=30° it is momentarily at rest. Determine the normal and frictional forces acting on each tine which are needed to support the pipe at the instant θ=0°. Measurements of the pipe and the suspender are shown in Fig. (5a). Neglect the mass of the suspender and the thickness of the pipe.
(12marks)

b) Explain the terms
i) pipe flow
ii) Major & minor losses in pipes. **(8 marks)**

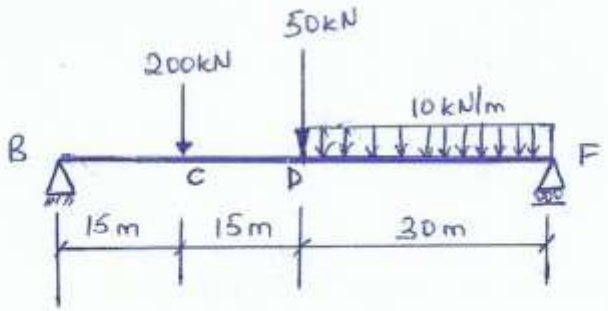

Fig. 2

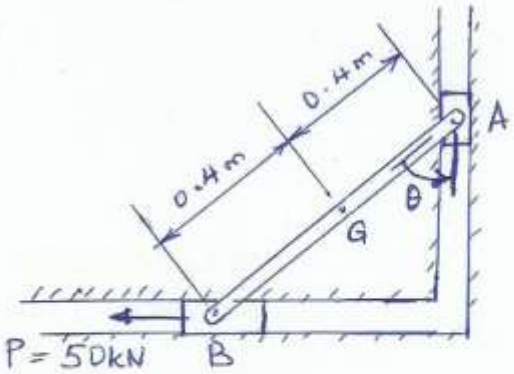

Fig 3(a)

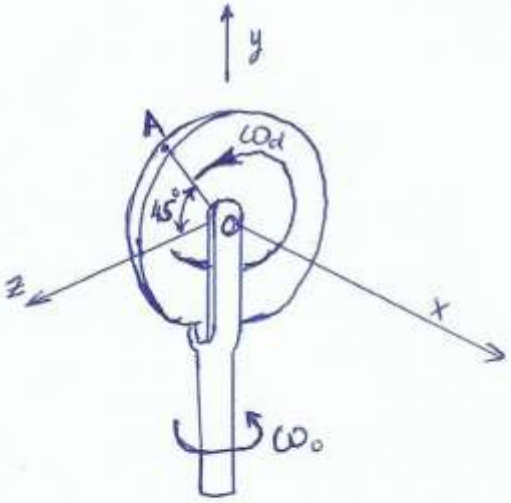

Fig 3(b)

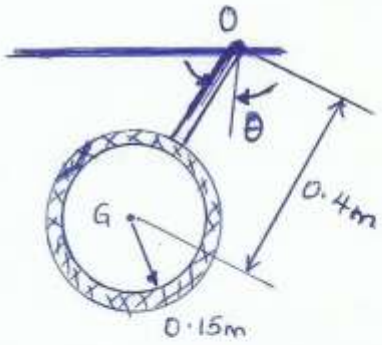

Fig 5(a)