



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, $d=30\text{mm}$
Tensile load, $p = 54\text{kN}$
Gauge length $l = 300\text{mm}$
Extension of the bar $\delta l = 0.112\text{mm}$
Change in diameter $\delta d = 0.00366\text{mm}$

Calculate ;

- (i) Poisson's ratio
 - (ii) The values of the three moduli (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 $\theta = 0^\circ$. If the slider block at B is acted upon by a horizontal force $p = 50\text{N}$, Determine the angular velocity of the rod at the instant. $\theta = 45^\circ$. 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 $\omega_d = 6 \text{ rad / s}$. At the time instant shown, determine the velocity of point A.
- Relative to the secondary reference frame.
 - 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:
- Darcy – Weisbach formula.
 - Chezy's formula for which $C=65$.
- Assume kinematic viscosity of water as 0.0012 stoke or $0.012 \times 10^{-4} \text{ m}^2/\text{s}$. **(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 $\theta=30^\circ$ 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 $\theta=0^\circ$. 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
- pipe flow
 - Major & minor losses in pipes. **(8 marks)**

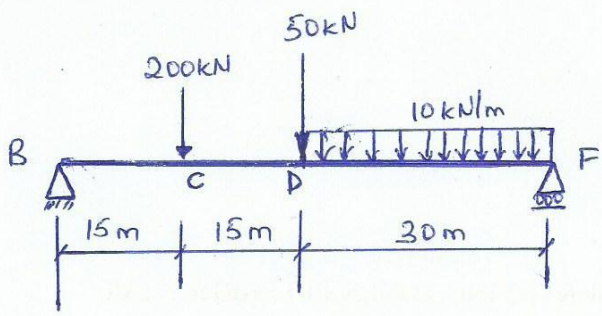


Fig. 2

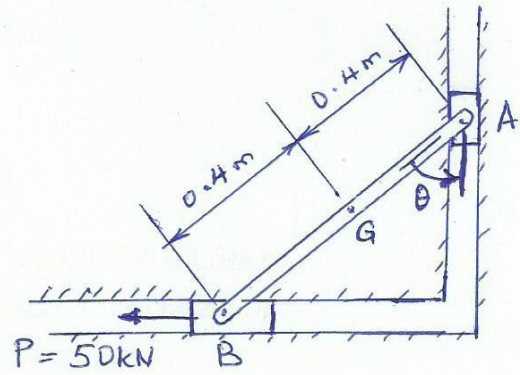


Fig 3(a).

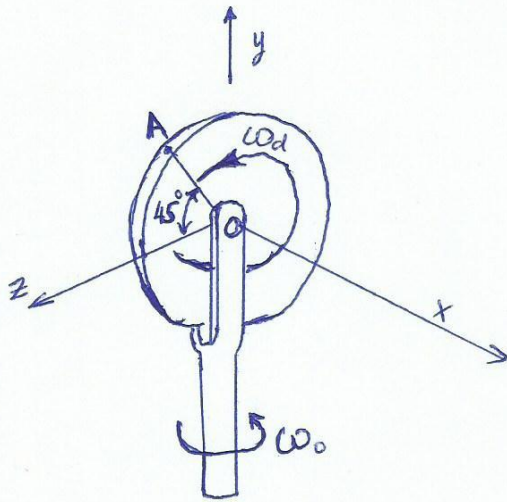


Fig 3(b)

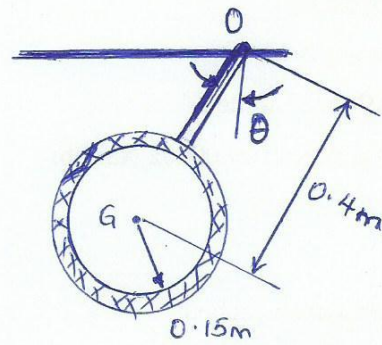


Fig 5(a)