MACHAKOS UNIVERSITY

DIPLOMA IN ELECTRICAL ENGINEERING

TVET

MECHANICAL SCIENCE

TIME 3HRS

Instructions

- This paper consists of FIVE questions
- Answer all questions

.

1.a)With an aid of a load-extension graph describe the tensile test to destruction of a mild steel specimen. (8mks)

b. A steel specimen of diameter 11.5 mm is subjected to a tensile load of 10 kN which causes a length of 100 mm to increase to 100.75 mm. Calculate:-

i) The stress induced
ii) The strain in the steel
iii) Young's modulus of elasticity

(12mks)

2(a). A ship is dragged through a lock by means of capstan which has a diameter of 500 mm, turns at 30 rpm. The rope makes 3 complete turns around the capstan, μ being 0.25 and at the free end of the rope a pull of 100 N is applied. Find the pull on the ship and the power required to drive the capstan (10 marks)

b) The tension in a pulley belt is 110 N when stationary. Calculate the tension in each side and power transmitted when the belt is on the point of slipping on the smaller wheel. The wheel diameter is 240 mm and the coefficient of friction is 0.32. The angle of lap is 165^0. The wheel speed is 1500 rev/min. (10 marks)

3(a).A ball bearing is dropped on a rigid hard surface from height, h. It rebounds to height , h_1. Find the co-efficient of restitution if, h= 800mm and h_1 = 650mm (7 marks)

(b) The two buffers at one end of a truck each require a force of 0.7 MN/m of compression and engage with similar buffers on the truck which it overtakes on a straight horizontal track. The truck has a mass of 10 tonnes and its initial speed is 1.8 m/s, while the second truck has a mass of 15 tonnes with initial speed 0.6 m/s, in the same direction.

i. Find the common speed when moving together during impact
ii. The kinetic energy lost to the system and the compression of each buffer spring to store this
iii. The velocity of each truck on separation if only half of the energy stored in the springs is returned. (13 mks)

4.a) Define the following terms

i) Stress
ii) Strain
iii) Shear stress (6 mks)

b) A steel brake rod is 1.2 m long and is subjected to a maximum load of 4.5 kN. If the extension of the rod is not to exceed 0.384 mm, determine

i) The maximum stress produced in the rod

ii) A suitable diameter for the rod. (14 mks)

5 A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kw at 1250 rpm. The outer diameter of the contact surfaces is to be 300mm. The coefficient of friction is 0.4.

i) Assuming a uniform pressure of 0.17 N/mm^2, determine the inner diameter of the friction surfaces

ii) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached. (20 mks)