MURANG'A UNIVERSITY COLLEGE

(A constitute college of Jomo Kenyatta university of Agriculture & Technology)

SCHOOL OF ENGINEERING AND TECHNOLOGY

MECHANICAL ENGINEERING

 CODE: SEM 1110

YEAR II SEMESTER I

COURSE: MECHANICAL ENGINEERING SCIENCE

CLASS: ME /14DS

DATE: 27ᵀᴴ APRIL 2015   TIME: 2HRS

INSTRUCTIONS

QUESTION ONE IS COMPULSORY AND ATTEMPT ANY OTHER TWO QUESTIONS

QUESTION ONE

a. Define
   i.   stress
   ii. strain   [4mks]

b. A rubber pad for a machinemounting is to carry a load of 20KN and to compress 12mm under this load. If the stress in the rubber is not to exceed 350KN/m^2 determine the diameter and thickness of a pad of circular cross-section

   Take E for rubber as 1MN/m^2 [6mks]

c. The following results were obtained during a tensile test to destruction on a specimen on low carbon steel
   ➢ Diameter of specimen=11.28mm
   ➢ Gauge length=50mm
   ➢ Load at yield point=26KN
   ➢ Maximum load on specimen=47.5KN
   ➢ Final length at fracture=67mm
   ➢ Diameter of specimen at fracture=8.2mm

From these results determine the yield stress, tensile strength, percentage elongation and percentage reduction in area [10mks]

d. A force of 540N acting parallel to a plane inclined at 20° to the horizontal is required to just move a body of mass 61.3kg up the plane. Find
    i. the coefficient of friction between the surfaces
    ii. The force parallel to the plane required to drag the body down the plane at a steady speed. [10mks]

QUESTION TWO

a. state Hooke's law [2mks]
b. A brake rod 1.25m long is made from steel which has a modulus of elasticity of 200Gpa.using a factor of safety of 6 calculate the minimum diameter of rod required to transmit a pull of 4000N,the tensile strength of the material being 480Mpa. Determine also the extension of the rod when subjected to this pull [10mks]
c. A handbrake has a leverage of 8:1.the handbrake cable has an initial length of 2m and a cross-sectional area of $20mm^2$ determine
    i. The stress in the cable when the driver applies a force of 100N to the handbrake
    ii. The strain in the cable when it is extended by 0.4mm
    iii. The modulus of elasticity for the material of the brake [8mks]

QUESTION THREE

3(a) state three laws of friction [6mks]

3b) A single- plate clutch of 0.15m effective diameter is lined with material of coefficient of friction 0.35.if the total spring force is 25KN

Calculate

i. The torque transmitted
ii. The power transmitted at 300rev/min [7mks]

3c) A load of 10 tonnes is pulled along a horizontal track by a force of 30° to and above the track. If the coefficient of sliding friction is 0.2 find the friction force [7mks]

QUESTION FOUR

4. a)Define the terms statics and dynamics [2mks]

4.b) A vehicle is accelerated uniformly at 1.5m/s^2 from a speed of 27km/h. calculate

i. Time required for it to attain a speed of 81km/h
ii. The distance travelled in this time [5mks]

4c)A cyclist accelerates with a constant acceleration of $0.2\text{m}/s^2$ from rest for a period of 7s and continues at this speed for 30s before coming to rest in 5s.The deceleration is constant. Sketch the v-t diagram and determine the taken to travel the first 15m and the total distance travelled.   [7mks]

4.d) Find the deceleration of a car which is brought to rest in 60m from a speed of 45km/h. what is the time taken.   [6mks]