



# MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)

University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL

ENGINEERING

MECHANICAL SCIENCE

DATE: 4/8/2016

TIME: 2 HOURS

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## INSTRUCTIONS:

*ATTEMPT QUESTION ONE AND ANY OTHER TWO QUESTIONS.*

1.     a)     Define the following terms
  - i.     Work
  - ii.    Energy
  - iii.   Power (6 marks)
- b)     A body having a mass of 30kg is supported 50m above earth's surface.
  - i)     Calculate the potential energy of the body
  - ii)    If the body is allowed to fall freely, calculate its potential and kinetic energies when the body is 20 m above the ground and just before it touches the ground. (14 marks)
- c)     A wagon of mass 4 tonnes is pulled on a horizontal frictionless track. After five minutes it is observed that the amount of power used is 8.2 kW, calculate:-
  - i)     The average work done
  - ii)    The distance travelled (10 marks)
2.     a)     Define the following terms
  - i)     Polygon of forces
  - ii)    Resultant of force
  - iii)   Equilibrium

- b) The following horizontal forces act at a point:-  
 50N in direction due east  
 80N in direction due south  
 30N in direction  $20^\circ$  north of west.

Calculate the values and direction of the fourth force necessary to maintain equilibrium. (14 marks)

3. a) define the following terms  
 i) Stress  
 ii) Strain
- b) An aluminium alloy tie bar is 42mm diameter and 500mm long. A flat bottomed hole 100mm deep is to be drilled from one end of the bar. When the maximum axial tensile load is 65kW, Calculate a suitable diameter for the hole  
 i) If the stress is not to exceed  $85\text{N/m}^2$   
 ii) If the total extension of the bar is not to exceed 0.31mm.  
 Take  $E$  for aluminium =  $80\text{MN/m}^2$
4. Three perfectly elastic balls A, B and C of masses 2 kg, 4 kg and 8 kg move in the same direction with velocities of 4 m/s, 1 m/s and 0.75 m/s respectively. If the ball A impinges with the ball B, which in turn impinges with the ball C, prove that the balls A and B will be brought to rest by the impacts. (20 marks)
5. a) i) State THREE effects of force  
 ii) Name THREE factors which characterize a force
- b) Three forces of magnitude 200N, 145N, and 180N respectively act at a point as shown. Determine by drawing a triangle of forces measured in a clockwise direction from force 200N, at which the other two forces must act in order that the three forces shall be in equilibrium. (20 marks)

