



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN MECHANICAL ENGINEERING

EED 106: MECHANICAL SCIENCE

DATE: 2/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

1. a) Define the following terms
 - i Work
 - ii Energy
 - iii Power (3 marks)
- b) a body having a mass of 30kg is supported 50m above earths 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 (6 marks)
- d) A steel specimen 7.98mm diameter was subjected to a tensile test to destruction within the limit of proportionality, a load of 10.8 kN produced an extension of 0.01 mm and a load of 9.9 kN produced an extension of 0.05 mm. The extensions are measured over gauge length of 50 mm. Calculate the value of young modulus. (7 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° 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 (2 marks)
- b) An aluminum 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 65kN,
- Calculate a suitable diameter for the hole
- i If the stress is not to exceed 85N/mm^2
 - ii If the total extension of the bar is not to exceed 0.31mm.
- Take E for aluminum = 80MN/mm^2 (11 marks)
- c) A bar 70 mm diameter has an overall length of 2 m. A quarter of its length is turned to a diameter of 42 mm and an axial tensile load of 44 kN then applied. Taking young modulus of elasticity to be 200 GN/mm^2 . Calculate the extension of the bar due to this load. (7 marks)
4. a) A vehicle of total mass 1600kg increases its speed uniformly from 36km/h to 72km/h by the action of an average accelerating force of 2.4kN. By how much will its kinetic energy have increased during the acceleration shown that this increases in kinetic energy is equal to the work done by the accelerating force. (15 marks)
- b) i State the law of conservation of energy (2 marks)
- ii Distinguish between potential energy and kinetic energy (3 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)

