



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

CRAFT CERTIFICATE IN MECHANICAL ENGINEERING

MECHANICAL SCIENCE I

DATE: 18/4/2019

TIME: 8.30-11.30 AM

INSTRUCTIONS:

This paper contains FIVE questions

Answer all questions.

QUESTION ONE. (20 MARKS)

- a) Define the following terms with reference to angular motion giving their S.I units.
- i. Angular displacement
 - ii. Angular Velocity
 - iii. Angular acceleration (6 marks)
- b) A flywheel of diameter 0.9m revolves 75 times about its axis. If it is uniformly accelerated from rest to 150 rev/min, determine;
- i. The linear acceleration in m/s^2
 - ii. The time taken. (4 marks)
- (Take 1 rev = 2π radians)
- c) A wheel that is initially at rest is subjected to a uniform angular acceleration of 2.5 rad/s^2 for 80 seconds and is then immediately retarded uniformly until it comes to rest 100 seconds later. Using a velocity – Time graph calculate;
- i. Maximum angular velocity in rad/s. (3 marks)

- ii. Total number of complete revolutions. (4 marks)
- iii. Angular retardation in rad/s^2 . (3 marks)

QUESTION TWO (20 MARKS)

- a) A flywheel of diameter 1.2m is accelerated from rest to a speed of 750 rev/min in 15 seconds. It is then maintained at this speed for a further distance of 1250 revolutions. Sketch a velocity-time graph and determine;
 - i. The linear acceleration of the flywheel. (4 marks)
 - ii. Total linear distance travelled by a point on the wheel periphery. (6 marks)
- b) A car of mass 750kg is travelling on a level road at a constant speed of 15 km/h. It is accelerated uniformly to a speed of 85 km/h in 30 seconds. Neglecting frictional resistance or effects, Determine;
 - i. The work done. (6 marks)
 - ii. Power Supplied. (4 marks)

QUESTION THREE (20 MARKS)

- a) Define the following terms:
 - i. Power.
 - ii. Potential Energy
 - iii. Work (6 marks)
- b) A lathe rotates at 60 rev/min while turning a 150mm diameter cylinder. The force on the tool is 2.4 kN and the efficiency of the lathe is 80%. Determine the power required to drive the motor. (7 marks)
- c) A vehicle having a mass of 1600kg increases its speed uniformly from 36 km/h to 72 km/h by the action of an accelerating force of 2.4 kN. Determine the increase in kinetic energy of the vehicle during the acceleration period. (7 marks)

QUESTION FOUR (20 MARKS)

- a) A vehicle hauls a trailer at 72 km/h when exerting a steady pull of 800N at the tow rope. Calculate the work done in 20 minutes and power required to tow the trailer. (9 marks)
- b) An engine has a mass of 150kg and is suspended from a crane by a sling 4m above the ground.

- i. Determine the potential energy of the engine. (3 marks)
- ii. Due to a fault in the sling the engine falls freely to the ground from that*height. Calculate the velocity and kinetic energy of the engine at the point of impact with the ground. (4 marks)
- iii. Determine the kinetic and potential energy of the engine after falling 3m. (4 marks)

QUESTION FIVE (20 MARKS)

- a) State any three laws of dry friction. (3 marks)
- b) A casting of mass 400kg is pulled horizontally by a force of 1177.2N along a horizontal floor.
 - i. Calculate the coefficient of friction between the casting and the floor. (3 marks)
 - ii. Determine the force that would move the same casting if it was a push inclined at 30^0 to the horizontal. (6 marks)
- c) A force of 883N is applied to drag a casting along a horizontal floor. If the casting has a mass of 300kg, Determine the value of a force that would drag the casting if it is
 - i. A pull inclined at 25^0 to the horizontal. (4 marks)
 - ii. A push inclined at 25^0 to the horizontal. (4 marks)