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 150rev/min, determine;

i. The linear acceleration in m/s^2

ii. The time taken. (4 marks)

(Take I rev=2π radians

c) A wheel that is initially at rest is subjected to a uniform angular acceleration of $2.5rad/s^2$ 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 of750rev/min in 15 seconds.It is the 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 15km/h.It is accelerated uniformly to a speed of 85km/h in 30 seconds.Neglecting frictional resistance or effects, Determine;

i. The workdone. (6 marks)

ii. Power Supplied. (4 marks)

QUESTION THREE (20 MARKS)

a) Define the following terms terms.

i. Power.

ii. Potential Energy

iii. Work (6 marks)

b) A lathe rotates at 60rev/min while turning a 150mm diameter cylinder. The force on the tool is 2.4KN 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 36km/h to 72km/h by the action of an accelerating force of 2.4KN. 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 72km/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 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)