



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST SEMESTER EXAMINATION FOR

CRAFT CERTIFICATE IN MECHANICAL NGINEERING (PRODUCION)

MODULE I

1501/102/MS: MECHANICAL SCIENCE

DATE: 8/9/2019

TIME: 11:30 – 2:30 AM

INSTRUCTIONS:

ATTEMPT ALL QUESTIONS.

1. A car at rest attains a speed of 10m/s in 5 seconds. The gear is then changed and in the next 5 seconds, the car reaches a speed of 30m/s. The brakes are then applied and the car is brought to rest in a distance of 75m, determine the;
 - (a) Uniform acceleration of the car in each of the two gears (8 marks)
 - (b) Retardation of the car (7 marks)
 - (c) Total time taken (2 marks)
 - (d) Total distance travelled. (3 marks)

2. (a) Define each of the following terms;
 - (i) Angular acceleration
 - (ii) Angular velocity
 - (iii) Angular displacement (3 marks)

- (b) (i) Show that $\omega_2^2 = \omega_1^2 + 2 \bar{\alpha} \theta$

Where ω_1 = initial angular velocity

ω_2 = final angular velocity

$\bar{\alpha}$ = angular acceleration

θ = angular displacement

(ii) A vehicle fitted with tyres of radius 380mm is brought to rest in a distance of 70m from a speed of 45km/h. Determine;

- I. Retardation of the vehicle;
- II. Initial angular velocity of the wheels
- III. Angular retardation of the wheels (17 marks)

3 (a) Define the following terms:

- (i) Acceleration.
- (ii) Velocity.
- (iii) Speed. (3 marks)

(b) State Newton's second law of motion (2 marks)

(c) A car travels at uniform speed of 100Km/h for 4minutes. It is uniformly accelerated to 120Km/h in 2minutes. It is then retarded and brought to rest after a total travelling time of 20 minutes. If the braking effort is uniform, draw the velocity-time graph and from it, determine:

- (i) Distance covered during acceleration.
- (ii) Distance covered during retardation.
- (iii) Total distance covered. (15 marks)

4 (a) A disc rotating about a fixed axis at 20 rev/min is uniformly accelerated for 70 seconds, during which it makes 50 revolutions, determine the;

- (i) Angular velocity at the end of this interval
- (ii) Time required for the speed to reach 100rev/min (10 marks)

(b) The wheels of a vehicle 0.7m diameter increase their speed uniformly from 50 rev/min to 1100 rev/min in 40 seconds. Determine the;

- (i) Angular acceleration of the wheels
- (ii) Linear acceleration of a point on the tyre tread (10 marks)

- 5 (a) A force of 200N acts on a body having a mass of 300kg for 90 seconds. If the initial velocity of the body is 20 m/s, determine the final velocity of the body when the force acts in the;
- (i) Direction of motion
 - (ii) Opposite direction of the motion
- (10 marks)
- (b) A flywheel is rotating at 200 rev/min and after 10 seconds it is rotating at 160 rev/min.
- If the retardation is uniform, determine the;
- (i) number of revolutions and
 - (ii) Time taken by the flywheel before it comes to rest
- (10 marks)