



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ENGINEERING TECHNOLOGY

TVET EXAMINATION

2023/2024 ACADEMIC YEAR

**FIRST YEAR TERM ONE EXAMINATION FOR DIPLOMA IN
MECHANICAL TECHNOLOGY (PRODUCTION) LEVEL 6**

ENG/0S/ME/CC/3/06/A – APPLY MECHANICAL SCIENCE PRINCIPLES

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer ALL questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A - (40 MARKS)

1. Explain the difference between a scalar and a vector quantity giving one example of each. (4 marks)
2. State the following Law of Forces.
 - i. Triangle of Forces
 - ii. Polygon of Forces
 - iii. Parallelogram of Forces (6 marks)
3. State any
 - i. Three engineering applications of friction
 - ii. Two methods of reducing friction in machines. (5 marks)
4. State **three** general conditions of equilibrium. (3 marks)
5. Define the following terms as applied to forces acting on a point.
 - i. Equilibrant.
 - ii. Coplanar forces
 - iii. Resultant
 - iv. Static
 - v. Dynamic (5 marks)
6. State the principles of moments. (2 marks)
7. .
 - a. Define coefficient of friction (1 mark)
 - b. State **four** laws of dry friction (4 marks)

SECTION B (60 MARKS)

Attempt *ALL* questions.

8. .
 - a. Use the Cosine and Sine rules to determine the magnitude and direction of the resultant of a force of 8KN acting at an angle of 50° to the horizontal and a force of 5 KN acting at an angle of -30° to the horizontal. (10 marks)

- b. Find graphically the magnitude and direction of the resultant of four coplanar forces which are acting at a point on a body as follows:
- Force W, 60N acting horizontally to the left.
- Force X, 50N inclined at 45° clockwise to force W.
- Force Y, 30N incline at 105° clockwise to force X.
- Force Z, 40 N inclined at 90° , clockwise to force Y. (10 marks)

9.

- a. A force of 540N acting parallel to a plane inclined at 20° to the horizontal is required to just move a body of mass 61.3kg up the plane. Find
- The coefficient of friction between the surfaces.
 - The force parallel to the plane required to drag the body down the plane at a steady speed. (10 marks)
- b. A uniform beam, 4m long is simply supported at two points A and B, point A being 0.5m from the left hand end and point B, 1.5 from right hand end. The beam carries loads of 600N at the left hand end, 800 N at its centre and 400N at the right hand end. Determine the magnitude of the support reactions at A and B. (10 marks)

10.

- a. State the following Newton's Law of Motion.
- First Law
 - Third Law (4 marks)
- b. Define the following terms as used in Linear motion and state their SI units.
- Displacement
 - Acceleration
 - Velocity (6 marks)
- c. Show that the displacement of a body under linear motion is given by
- $$S=ut+\frac{1}{2}at^2$$
- (5 marks)

- d. A lorry of mass 10Mg reaches a speed of 63km/hr in 20s , starting from rest with uniform acceleration. It travels 2km at this speed and is then brought to rest in a distance of 125m . Determine:
- i. The momentum at 63km/hr .
 - ii. The accelerating and braking forces required. (5 marks)