



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING
CERTIFICATE IN BUILDING & CIVIL ENGINEERING (CTI)

AMA 1201: ENGINEERING MATHEMATICS II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2013

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions.

Answer any **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One

a) (i) State any **THREE** laws of friction. **(3 marks)**

(ii) A block of metal with a mass of 30kg requires a horizontal force of 50N to pull it with uniform velocity along a horizontal surface. Calculate the coefficient of friction between the surface and the block.
(Take $g = 10\text{m/s}^2$)

(5 marks)

b) A bus of mass 2000kg travelling at a constant velocity of 72km/hr collides with a stationary car of mass 1000kg. The impact takes 2 seconds before the two move together at a constant velocity for 20 seconds. Calculate:

(i) The common velocity

(ii) The distance moved after the impact

(iii) The impulse force

(iv) The change in kinetic energy

(12 marks)

Question Two

$$P = 2i + j - k \quad q = i - 3j + 2k$$

a) If $p \cdot q$ and $p + q$ find:

(i) $p \cdot q$

(3 marks)

(ii) $p + q$

(2 marks)

(iii) $|p + q|$

(3 marks)

(iv) $|p| + |q|$

(2 marks)

(v) $|p| - |q|$

(2 marks)

$$F_1 = 22$$

b) If $F_1 = 22$ units at 140° , $F_2 = 40$ units at 190° and $F_3 = 15$ units at 290° , calculate the resultant of:

(i) $F_1 - F_2 + F_3$

(ii) $F_2 - F_1 - F_3$

(8 marks)

Question Three

$$X = 5i + j - 2k, \quad Y = 4i - 2j + k \quad Z = 2i - 2k$$

a) If $2x - 2y$ and

Calculate:

(i) $2x - 2y$

(3 marks)

(ii) $2z \times (2x - 3y)$ (5 marks)

(iii) $2x - \frac{1}{2}z$ (2 marks)

b) Determine the angle between vectors Ox and Oy where:

$$Ox = i + 2j - 3k$$

$$Oy = 2i - j + 4k$$

(10 marks)

Question Four

a) (i) Explain the term simple harmonic motion. (2 marks)

(ii) A piston of mass 200g, moves with simple harmonic motion. If the amplitude of the piston is 70mm and its frequency is 10Hz, calculate:

(i) Maximum acceleration

(ii) Maximum velocity

(iii) Maximum kinetic energy (7 marks)

b) (i) State Newton First Law of Motion (1 mark)

(ii) Define the following terms

(i) Impulse

(ii) Momentum

(iii) Inertia (3 marks)

c) A car of mass 1200kg travelling at 45m/s is brought to rest in 9 seconds. Calculate:

(i) Average retardation

(ii) Average force applied by the brakes. (7 marks)

Question Five

Figure 5

For the figure 5 above:

- (i) Calculate the resultant force on the plate
- (ii) The angle made by its line of action with vertical.

(20 marks)