MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION FOR CRAFT CERIFICATE IN

MECHANICAL ENGINEERING (PRODUCION) MODULE I

1501/102/MS: MECHANICAL SCIENCE

DATE: TIME:


INSTRUCTIONS: ANSWER ALL QUESTIONS

1   (a)   Define the following terms;

        I)   Force
        II)   Scalar quantity
        III)   Vector quantity

                                                    (3 marks)

(b)   Four forces of magnitudes 10KN,15KN,20KN and 40KN are acting outwards at a point O. The angles made by the forces with X-axis in an anticlockwise direction are $30^0, 60^0, 90^0$ and 120^0 respectively. Using analytical method, find the magnitude and direction of the resultant force.   (17 marks)

2.   (a)   I)   State the principle of moments

        II)   State the condition for a body to be in equilibrium

        III)   Differentiate between moment of a force and a couple   (6 marks)

(b)   A bus chassis 5.4m long consists of two side members and a number of cross members. Each side member can be considered as a beam, simply supported at two points A and B,3.6m apart, A being positioned 0.9m from the front end of the frame and subjected to the following concentrated loads;

    Engine support (front) 2KN, engine support(rear) 2.5KN, gear box support 0.5KN and body W KN. The distances of these loads are respectively 0.6m,1.8m,2.4m and 3m. If the reaction at A is 8.5KN, determine the magnitude of the;

        I)   Load W due to the vehicle body

II)   Support reaction at B

(14 marks)

3.   (a) I) Differentiate between coplanar forces and concurrent forces

II) State the parallelogram of force's rule

III) State the triangle of force's rule   (8 marks)

(b) A load of 2000N is suspended in the air by two ropes. If the inclination of the
ropes to the vertical are 45^0 and 60^0 respectively, draw the space and force
diagram and determine tension in each rope.   (12 marks)

4.   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 1.5m from the right-hand end. The beam carries loads
of 600N at the left-hand end ,800N at its Centre and 400N at the right-hand end,
determine the;

(a) Magnitude of the support reactions at A and B   (12 marks)

(b) Point at which a load of 800N should be applied to make the support reaction equal
(8 marks)

5. (a) Four coplanar forces act at a point as shown. The angle between 4N force and 8N
force is 90^0, between 8N force and 7N force is 60^0 and that between 5N force and the
horizontal is 30^0.Determine graphically their resultant in magnitude and direction.
(10 marks)
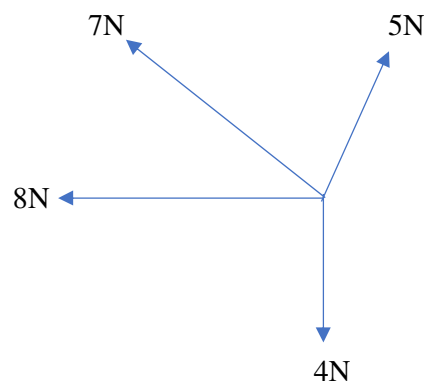
(b) A uniform horizontal lever is supported on a pivot and loaded as shown. Neglect the
mass of the lever and calculate the magnitude of the;

I)   Load F required to maintain equilibrium

II)   Reaction R at the support.

(10 marks)

200N   300N   F   100N

0.1m   0.25m

0.3m   0.4m

R