UGANDA MARTYRS UNIVERSITY

FORT PORTAL CAMPUS

FACULTY: ENGINEERING AND APPLIED SCIENCES

DEPARTMENT: DEPARTMENT OF MECHANICAL ENGINEERING

COURSE CODE: **DME1104:** COURSE NAME: **MECHANICAL ENGINEERING SCIENCE I**

FINAL ASSESSMENT

ACADEMIC YEAR 2023/2024 SEMESTER I

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN ELECTRICAL ENGINEERING

Date of Examination: 12TH DECEMBER 2023

Time allowed: 3 hours (9:00Am – 12:00Pm)

Instructions to Candidates:

Read the following before answering the examination questions.

1) This Exam contains **Six (6)** questions.
2) Attempt any **Four (4)** questions of your choice.
3) All Questions carry equal marks.
4) Show all the necessary workings.
5) Start each question on a fresh page.
6) Read other instructions on the answer booklet.
7) Do **NOT** write anything on this question paper.

You should have the following in this Examination.

Answer Booklet, Drawing instruments, graph papers, non-programmable calculator and IEE Tables for the current ratings and voltage drops, 17th edition.

1(a) Enumerate **four** characteristics of a force (4 marks)

(b) State the principle of forces.

(i) Parallelogram of forces (2marks)

(ii) Triangle of forces (2marks)

(iii) Polygon of forces (2marks)

(c)Find graphically the magnitude and direction of the resultant of four coplanar forces which are acting at a point on a body as follows

(i) 25N due North

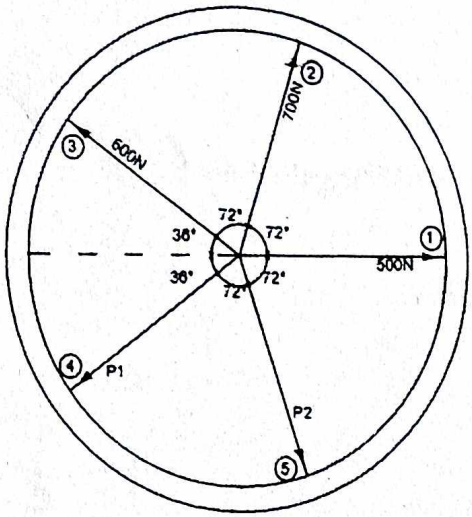
(ii) 15N due East

(iii) 10N North East

(iv) 20N acting S 30^0 E

(v) 30N acting W 60^0 S (7 marks)

(d) A wheel has five equally spaced radial spokes, all in tension. If the tensions of three consecutive spokes are 500N, 700N and 600N respectively, find the tensions in the other two spokes. (8 marks)



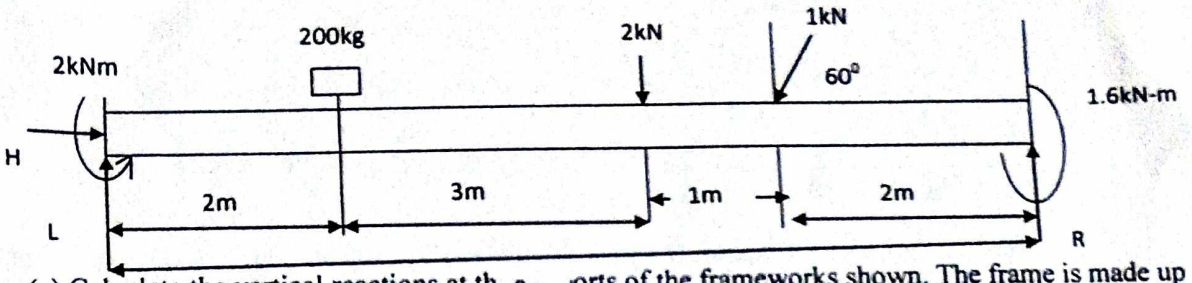
2(a)(i) State the two equilibrium conditions for coplanar forces (4 marks)

(ii) Outline any **four** practical applications of couples in engineering design

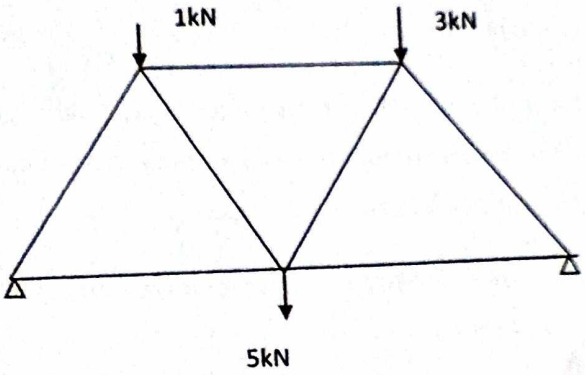
(04 marks)

(b) Abeam carries a dead load of 200kg and is subjected to a vertical force of 2kN and to an inclined force of 1kN acting at the points shown below. The beam is built into a wall at each end

ard due the fixing, there are moments of 2kN-M and 1.6kN-M acting in the direction shown. Find the reactions R, L and H. (10marks)



(c) Calculate the vertical reactions at th 8m orts of the frameworks shown. The frame is made up of equilateral triangle (7marks)



3(a) Define frameworks (02 marks)

(b)Given the framework down analytically determine the

(i) Reactions at the supports (08 marks)

(ii) Magnitude and nature of nature of the forces in each member of the framework (15 marks)

(b) In a simple crank and connecting rod mechanism the crank is 50mm long and the connecting rod is 350mm long. When the crank is 30^0 from the top dead centre position of the piston at 10rev/s, assuming the motion to be simple harmonic find the;

(i) Velocity and acceleration (04 marks)

(ii) Maximum velocity and acceleration (04 marks)

(c) A body performs simple harmonic motion in a straight. Its velocity is 4m/s when the displacement is 50mm and 3m/s when the displacement is 100mm the displacement being measured from the mid-position. Calculate the;

(i) Frequency of the motion (04 marks)

(ii) Amplitude of the motion (04 marks)

(iii) Acceleration when the displacement is 75mm (03 marks)

END