ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

HIGHER EDUCATION EXAMINATIONS COUNCIL (HEXCO)

NATIONAL DIPLOMA

IN

QUANTITY SURVEYING

SUBJECT: Soils and Structures

PAPER NO: 575/22/S13
575/15/S13

DURATION: 3 hours

MARCH/APRIL 2025 EXAMINATION

REQUIREMENTS

1. Scientific calculator
2. Particle size distribution chart
3. Casasrade plasticity chart

INSTRUCTIONS TO CANDIDATE

Answer any four (4) questions.

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QUESTION 1

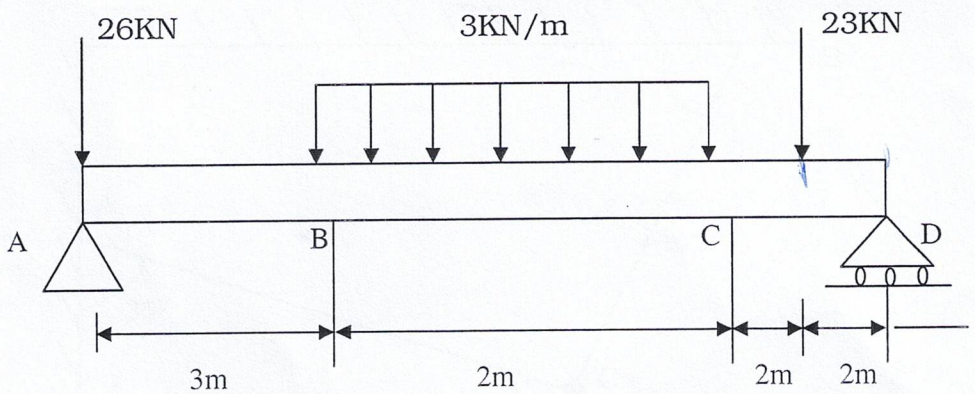
a) Explain what you understand by the following terms
   i) Liquid limit (2 marks)
   ii) Plastic limit (2 marks)
   iii) Plasticity index (2 marks)

b) In its natural condition a soil sample has a mass of 2290g and a volume of $1.15 \times 10^{-3} m^3$. After being completely dried out in an oven the mass of the sampe is 2035g. The specific gravity Gs = 2.68. Determine:
   i) Bulk density (3 marks)
   ii) Unit weight (3 marks)
   iii) Moisture content (3 marks)
   iv) Void ratio (3 marks)
   v) Porosity (3 marks)
   vi) Degree of saturation (2 marks)
   v) Air content (2 marks)

QUESTION 2

a) Describe the following terms, use diagrams to illustrate your answer.
   i) Equilibrium (4 marks)
   ii) Uniformly Distributed load (4 marks)
   iii) Simply supported Beam (4 marks)
   iv) Hinge support (4 marks)
   v) Concurrent coplanner forces (4 marks)

b) Calculate the reactions at A and D in the beam



(5 marks)

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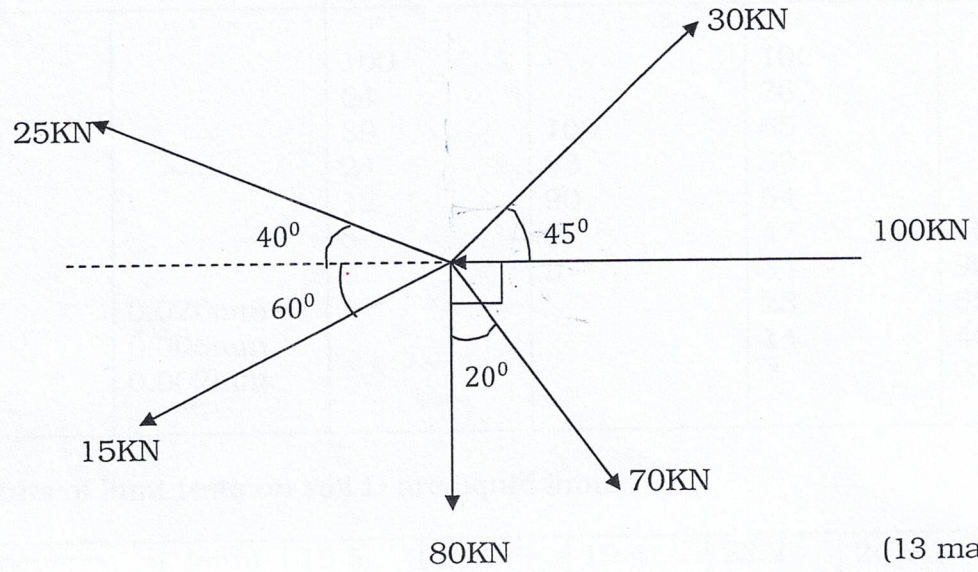
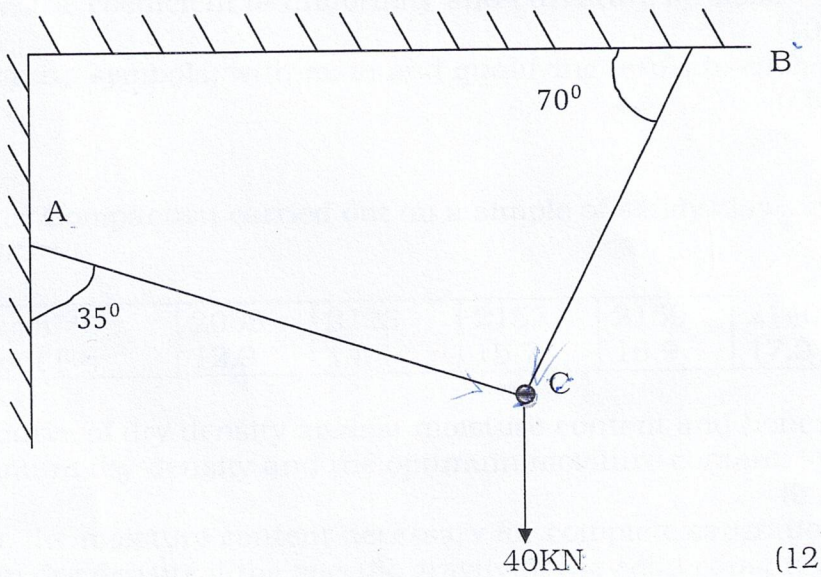
QUESTION 3

a) Calculate the magnitude and direction of the resultant force for the system of forces shown in the diagram below.



(13 marks)

b) An electric fixture shown below weighs 40KN and hangs from point C. It is supported by two strings AC and BC. Determine the tensions in the string AC and BC.



(12 marks)

QUESTION 4

The results of particle size analysis of four soils A; B; C and D are shown below:

B.S. Size	Particle Size	Percentage Smaller			
		Soil A	Soil B	Soil C	Soil D
63mm		100		100	
20mm		64		76	
6.3mm		39	100	65	
2mm		24	98	59	
600μm		12	90	54	
212μm		5	9	47	100
63μm		0	3	34	95
	0.020mm			23	69
	0.006mm			14	46
	0.002mm			7	31

The results of limit tests on soil D are liquid limit.

Cone penetration (mm)	15.5	18.0	19.4	22.2	24.9
Water content (%)	39.3	40.8	42.1	44.6	45.6

Plastic limit

Water content %	23.9	24.3

a) Determine the coefficient of uniformity and curvature for soils (10 marks)

b) Allocate group symbols, with main and qualifying terms to each soil. (15 marks)

QUESTION 5

Standard Proctor Compaction carried out on a simple of sandy clay yielded the following results.

Bulk density kgm^{-3}	2058	2125	2152	2159	2140
Moisture content (%)	12.9	14.3	15.7	16.9	17.9

a) Plot the curve of dry density against moisture content and hence find the maximum dry density and the optimum moisture content. (9 marks)

b) Calculate the moisture content necessary for complete saturation at the maximum dry density if the specific gravity of the solid constituents is 2.73. (9 marks)

c) Plot the "zero air voids" line and 5 percent air voids line. (7 marks)

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