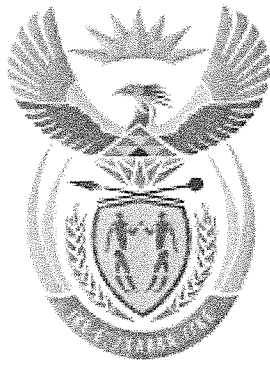
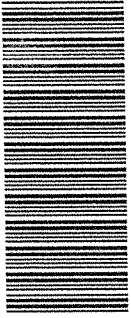


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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

**T190(E)(N19)T
NOVEMBER EXAMINATION**

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

**19 November 2014 (Y-Paper)
13:00–16:00**

Calculators may be used.

This question paper consists of 6 pages, 1 formula sheet and 2 diagram sheets.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
BUILDING SCIENCE N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Read ALL the questions carefully.
 3. Number the answers according to the numbering system used in this question paper.
 4. ALL sketches and/or diagrams must be done in pencil.
 5. The sketches and/or diagrams must be reasonably large and fully labelled.
 6. Assume that 1 kg of mass exerts a force of 10 N.
 7. Write down the formula BEFORE you start your calculations.
 8. Write neatly and legibly.
-

QUESTION 1

The following definitions of terms are found in building science. Study each definition and state what it describes.

- 1.1 A form of energy: It is the transfer of energy from one substance to another due to the difference in temperature.
- 1.2 It is the quantity of energy required to raise the temperature of any body by 1 °C or 1 K.
- 1.3 It indicates whether one substance is warmer or colder than another.
- 1.4 The transmission of heat through space without the aid of a material medium.
- 1.5 The transfer of heat from particle to particle. It occurs mostly in solids.
- 1.6 It is the increase in length per unit length per degree rise in temperature.
- 1.7 It is the quantity of heat required to raise the temperature of 1 kg of that material by 1 °C or 1 K.
- 1.8 The transfer of heat through the movement of heated particles which convey heat to cooler particles. This occurs in fluids and gasses with circulating currents.

(8 × 1) [8]

QUESTION 2

- 2.1 Briefly describe the meaning of *efflorescence* on plaster. (2)
- 2.2 2.2.1 What type of force does capillary action depend on? (1)
- 2.2.2 Briefly describe how this *force* helps to let water be drawn up a narrow tube. (4)
- 2.3 2.3.1 What are the characteristics of a material that would make it porous? (2)
- 2.3.2 Name TWO materials that would absorb large amounts of water. (2)
- 2.3.3 Name TWO materials that would absorb no water. (2)
- 2.4 Briefly describe the difference between *absorption* and *permeability*. (2)

[15]

QUESTION 3

- 3.1 Briefly describe the difference between density of a material and the relative density of a material. (2)
- 3.2 Determine the relative density of wrought iron, given the density of iron = 7 800 kg/m³. (3)
- [5]

QUESTION 4

Copy the following table in the ANSWER BOOK and complete it by writing YES; NO; or FAIR in the spaces provided.

ROOF COVERING	HEAVY	DURABLE	ECONOMICAL
Corrugated iron			
Glass-fibre sheets			
Cement-fibre sheets			
Copper sheets			
Lead plates			
Melthoid sheeting strips			

(18 × ½)

[9]

QUESTION 5

- 5.1 Define or describe **any TEN** of the following terms as used with coplanar-concurrent forces:
- 5.1.1 Resultant
 - 5.1.2 Equilibrant
 - 5.1.3 Equilibrium
 - 5.1.4 Force
 - 5.1.5 Coplanar forces
 - 5.1.6 Concurrent forces
 - 5.1.7 Parallelogram of forces

5.1.8 Space diagram

5.1.9 Force diagram

5.1.10 Triangle of forces

5.1.11 Polygon of forces

5.1.12 Bow's notation

(10 × 1) (10)

5.2 FIGURE 1 on the attached DIAGRAM SHEET shows a system of coplanar, concurrent forces that are in equilibrium. Use a graphical method to determine the magnitude of force "P" and the direction of the 45 N force.

(8)
[18]

QUESTION 6

6.1 The simply supported beam as seen in FIGURE 2 on DIAGRAM SHEET (attached) supports four point loads.

6.1.1 Use the link-polygon projection method to find the magnitudes of the supports on the left and on the right sides of this beam. (10)

6.1.2 Prove your answers with the aid of Newton's third law. (3)

6.2 6.2.1 What is a *centroid* of a body? (2)

6.2.2 What type of object would you determine the centroid of? (1)

6.3 Give TWO practical examples of a couple. (2)
[18]

QUESTION 7

- 7.1 FIGURE 3 (DIAGRAM SHEET) shows a JIB crane frame. Determine graphically the magnitude of the forces in all the members. Show the nature of each member on the space diagram. Use the following scales: Space diagram: 1 : 50
Force diagram: 1 mm = 100 N (12)

- 7.2 Neatly tabulate your answers in the ANSWER BOOK according to the following table:

Member	Magnitude (N)	Nature	
		Tie	Strut
1.			
2.			
3.			
4.			
5.			
6.			

(18 x ½) (9)

- 7.3 The same figure also shows an equilibrant force "P". Determine the magnitude of the equilibrant with the aid of a sketch by using a scale of 1 mm = 100 N.

(6)
[27]**TOTAL: 100**

BUILDING SCIENCE N2

(15070012)

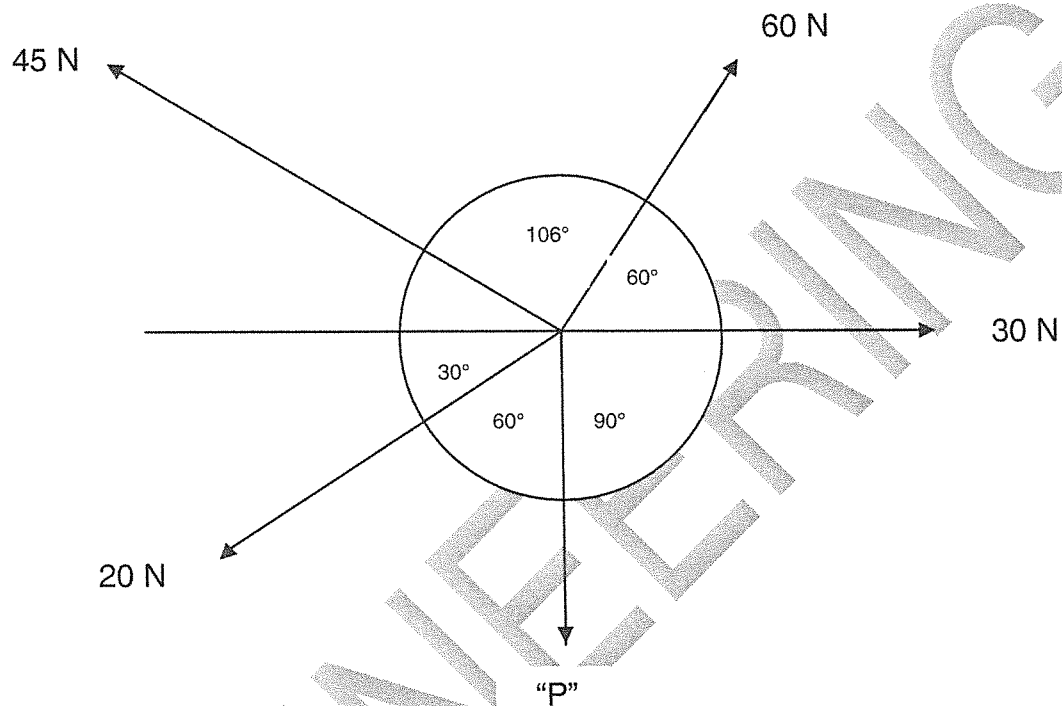
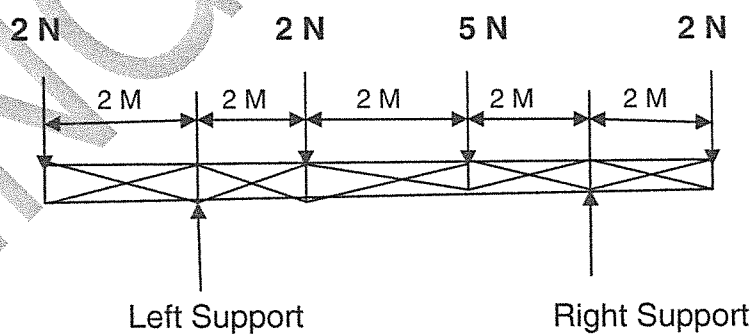
FORMULA SHEET

Any applicable formula may be used.

1. $F = m \times g$
2. $\sin \theta = O/H$
3. $\cos \theta = A/H$
4. $\tan \theta = O/A$
5. $A = \pi \frac{D^2}{4} = \pi r^2$
6. $A = \frac{1}{2}(B \times H)$
7. $V = \pi \frac{D^2}{4} \times H$
8. $\sum CM = \sum ACM$
9. $\sum \uparrow F = \sum \downarrow F$
10. $V = L \times B \times H$
11. $M = F \times s$
12. $K = C + 273$
13. Moment of area = area \times distance from axis
14. $VC = W. \sin \theta$ $VK = W. \sin \theta$
15. $HC = W. \cos \theta$ $HK = W. \cos \theta$
16. $y = \frac{\sum My}{\sum A}$
17. $D = \frac{M}{V}$
18. $RD = \frac{D \times S}{D \times W} = RD = \frac{M \times S}{M \times W}$
19. $\Delta L = L_o \times \Delta T \times \alpha$
20. Heat required = $m \times \Delta t \times SHC$
21. $\% \text{ porosity} = \frac{\text{Bulk volume} - \text{Solid volume}}{\text{Bulk volume}} \times 100\%$
22. $\text{saturation coefficient} = \frac{\text{volume of water absorbed}}{\text{bulk volume} - \text{solid volume}}$
23. Heat lost = heat gained

BUILDING SCIENCE N2

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DIAGRAM SHEET**FIG 1****FIG 2**

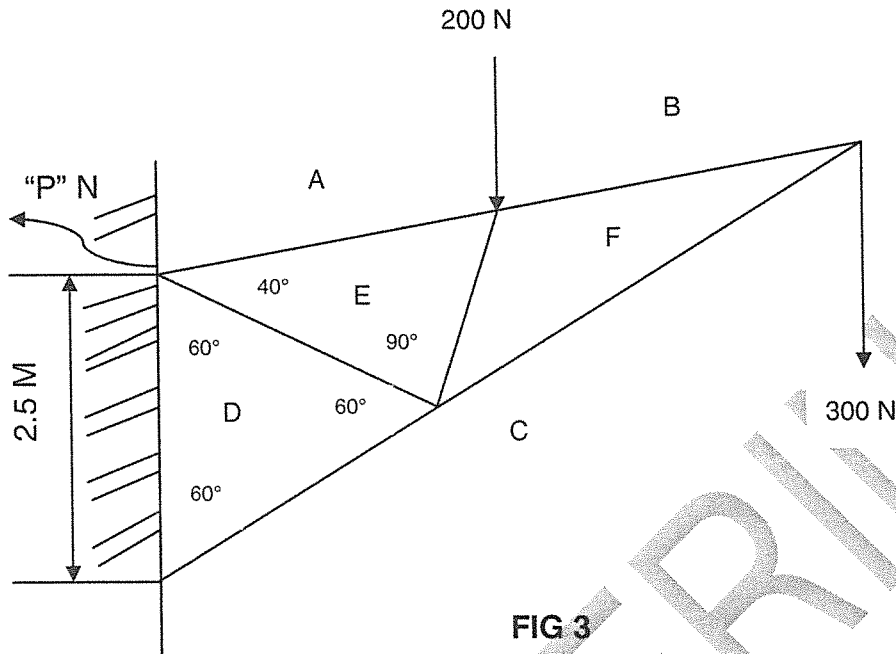
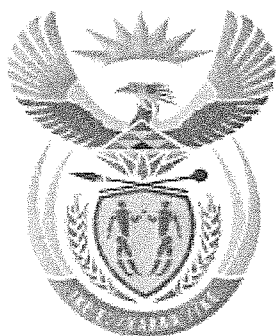


FIG 3

DRAWINGS NOT TO SCALE



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MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

BUILDING SCIENCE N2

19 NOVEMBER 2014

This marking guideline consists of 8 pages.

QUESTION 1

- 1.1 Heat ✓
- 1.2 Heat capacity ✓
- 1.3 Temperature ✓
- 1.4 Radiation ✓
- 1.5 Conduction ✓
- 1.6 Coefficient of linear expansion ✓
- 1.7 Specific heat capacity ✓ or (SHC)
- 1.8 Convection ✓

(8 x 1) [8]

QUESTION 2

- 2.1 Efflorescence is a term used to describe crystallisation ✓
of soluble salts ✓ on building materials (2)
- 2.2 Surface tension ✓ (1)
If the liquid wets ✓ the tube, a film of liquid will form on the tube's inner ✓
surface.
This surface tension will make it contract ✓ and so the liquid will be drawn up ✓
the tube. (4)
- 2.3 2.3.1 The particles that make up this material have small ✓ open spaces
in it ✓ (2)
- 2.3.2 Bricks, concrete blocks, limestone, wood, etc. ✓ ✓
Glass, plastics, bitumen, slate, etc ✓ ✓ (Any 2 x 2) (4)
- 2.4 Absorption is the ability to fill and hold the pores with water. ✓
Permeability is the ability to allow water to move through the pores (capillary
action). ✓ (2)

[15]

QUESTION 3

- 3.1 Density is the mass per unit volume. ✓
Relative density is *its density compared to the density of water*. ✓ (2)

- 3.2 $RD = \frac{D_{\text{MS}}}{D_{\text{MW}}}$ ✓

RD = 7 800/1 000 ✓

= 7,8 ✓ **NB: No units** (3)
[5]

QUESTION 4

Roof covering	Heavy	Durable	Economical
Corrugated iron	Fair ✓	Yes ✓	Yes ✓
Glass-fibre sheets	No ✓	Fair ✓	No ✓
Cement-fibre sheet	Yes ✓	Yes ✓	Fair ✓
Copper sheets	Fair ✓	Yes ✓	No ✓
Lead plates	Yes ✓	Yes ✓	No ✓
Melthoid sheeting strips	No ✓	Fair ✓	Yes ✓

(18 x ½) [9]

QUESTION 5

- 5.1 5.1.1 Resultant = that single force that can replace the combined force action on a body ✓

5.1.2 Equilibrant = that single force that can balance the action of the resultant force ✓

5.1.3 Equilibrium = when all forces combined will not result in movement of a body ✓

5.1.4 Force = is that influence which changes or tends to change the state of rest or uniform motion of a body ✓

5.1.5 Coplanar forces = forces lying in the same plane of action ✓

5.1.6 Concurrent forces = forces acting to or from the same point ✓

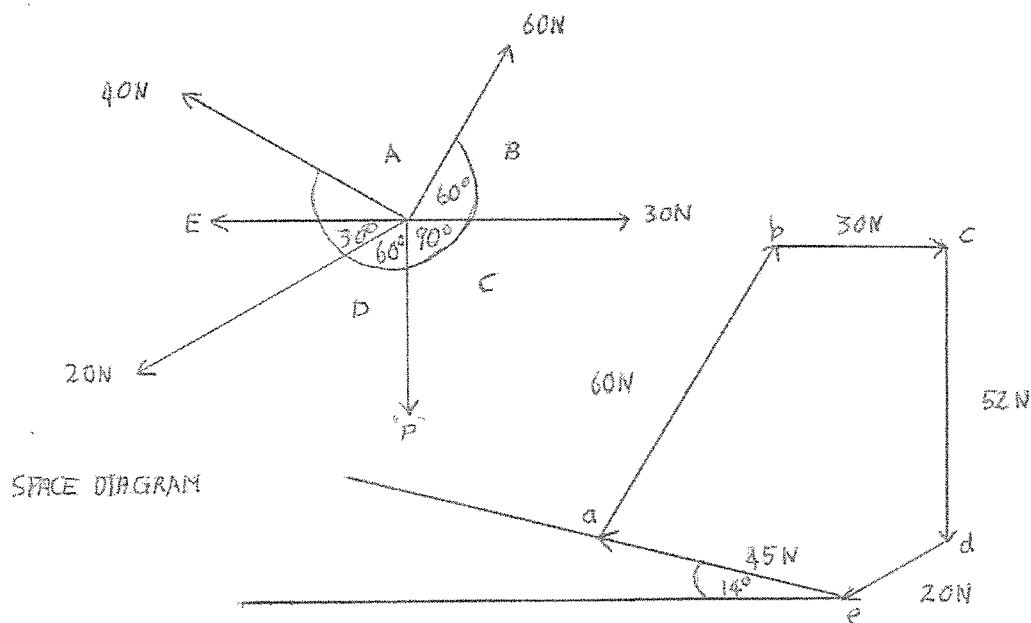
5.1.7 Parallelogram of forces = when two forces acting on a point is drawn as a parallelogram to determine the resultant ✓

- 5.1.8 Space diagram = graphical representation of coplanar forces to demonstrate magnitude and direction of a system of forces acting on a single point ✓
- 5.1.9 Force diagram = graphical representation of a system of forces ✓
- 5.1.10 Triangle of forces = when three forces acting on a point is drawn as a triangle to determine equilibrium ✓
- 5.1.11 Polygon of forces = when more than three forces acting on a point is drawn as the sides of a polygon to determine equilibrium ✓
- 5.1.12 Bow's notation = a convention where capital letters are used to number the spaces between forces. Acting on a point is drawn as a triangle to determine equilibrium ✓ OR

A method of lettering the cells and outside spaces formed by the direction of the stresses in and loads on a framed structure that these stresses and loads can be traced by similar letters in the reciprocal diagram.

(Any 10 x 1) (10)

- 5.2 Space diagram sketch = 1 Vector diagram sketch correctness = 2
 Space diagram labelling = 1 Vector diagram sketch labelling = 2
 Scale = 1 Magnitude "P" = 1
 Direction of 40 N = 1



VECTOR DIAGRAM

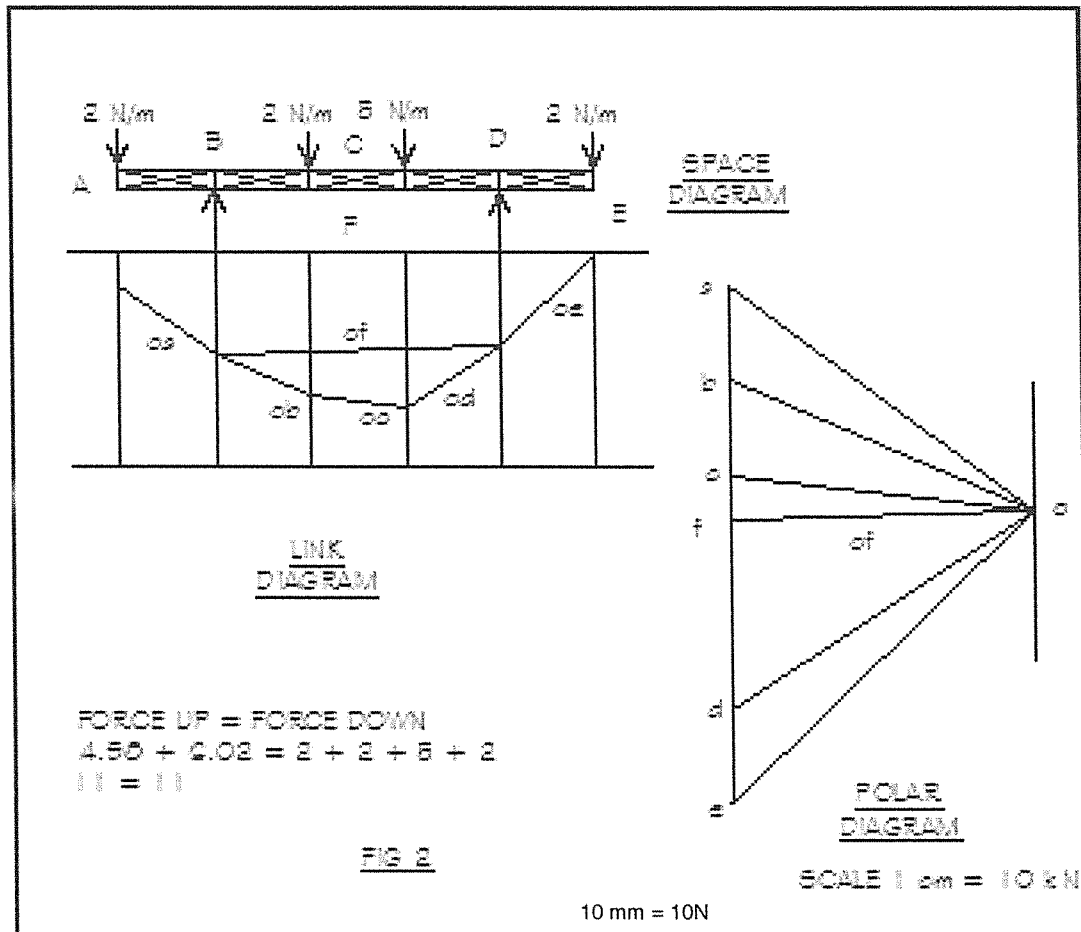
SCALE: 1mm = 1N

EQUILIBRANT "P" = 52N

a-e → 45N @ 14° NORTH OF WEST

(8)
[18]

QUESTION 6



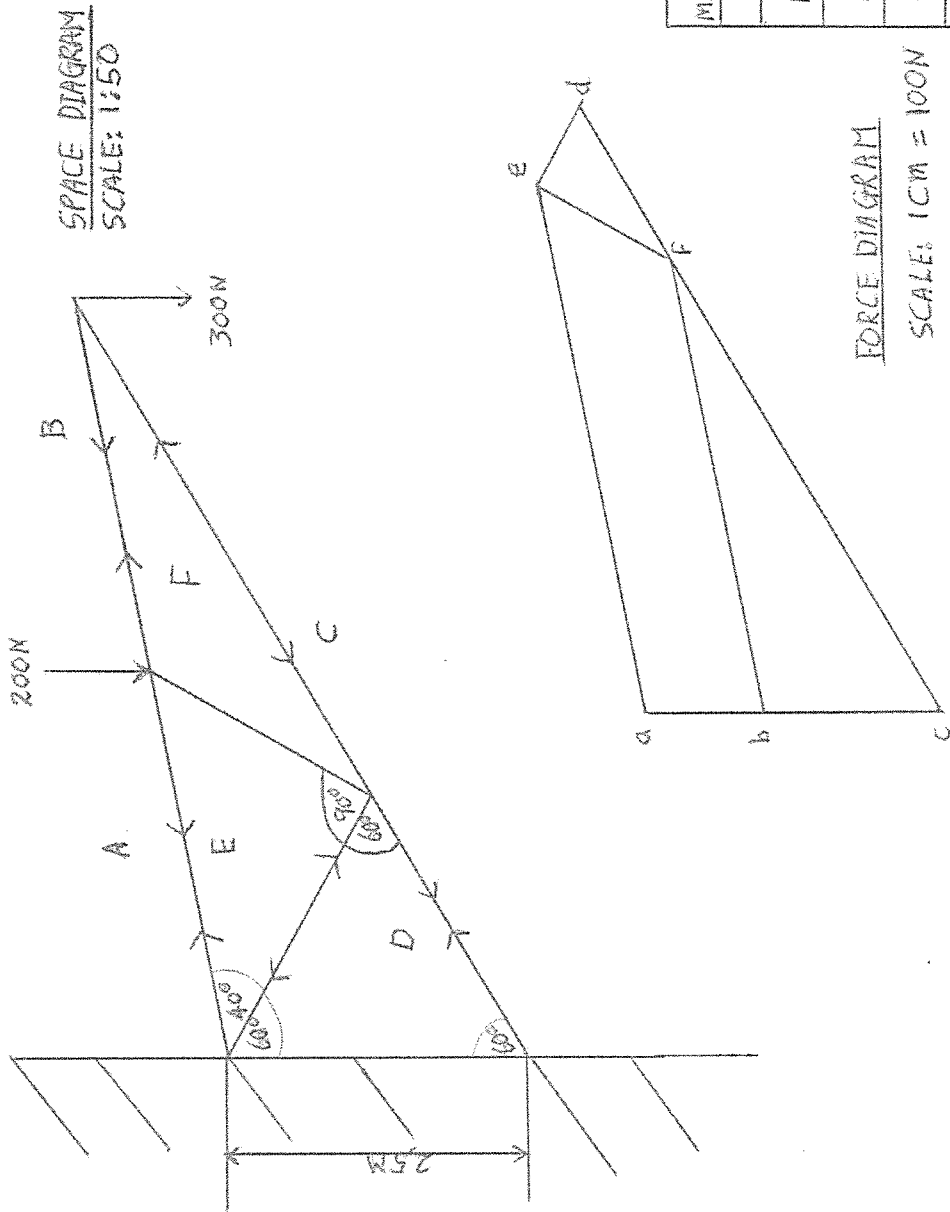
- 6.1 6.1.1 Draw space diagram accurately in proportion ✓
 Project link polygon in line with space diagram ✓
 Use an appropriate scale e.g 1 cm = 10 kN
 Draw and measure – graphical drawing accurate to 5% of memo values will be acceptable.
 Polar diagram: draw correctness ✓✓
 Draw accuracy ✓✓
 Logical labelling ✓✓
 Accuracy of scale conversion to force magnitude ✓✓ (10)
- 6.1.2 $\sum \uparrow F = \sum \downarrow F$ ✓
 $ef + fa = ab + bc + cd + de$
 $4.98 + 6.02 = 2 + 2 + 5 + 2$ ✓
 $11 = 11$ ✓ (3)

- 6.2 CENTROID of a body is the exact centre around a specific axes of rotation ✓✓
Very thin plane (single area) figures called LAMINAS ✓ (3)
- 6.3 Examples of a couple = Wing nut
Cross-wheel spanner,
Stocks and dies,
Large gate-valve handle or any suitable alternative (Any 2 x 1) (2)
[18]

QUESTION 7

- 7.1 Use a scale of 1 mm = 100 N Draw and measure – graphical drawing accurate to 5% of memo values will be acceptable.
Force diagram: draw correctness ✓✓✓
Draw accuracy ✓✓✓
Logical labelling ✓✓✓
Head to tail vectors indicated ✓✓✓ (12)
- 7.2 Copy table and populate – point loads net required in table (18 x ½) (9)

QUESTION 7.1 and 7.2



MEMBER	MAGNITUDE N	NATURE	
		TIE	STRUT
AE	890N	X	
BF	770N		X
CF	870N		X
CD	1170N	X	
DE	150N		X
EF	250N	X	

FIGURE 3

- 7.3 Use a scale of 1 mm = 100 N Draw and measure – graphical drawing accurate to 5% of memo values will be acceptable.

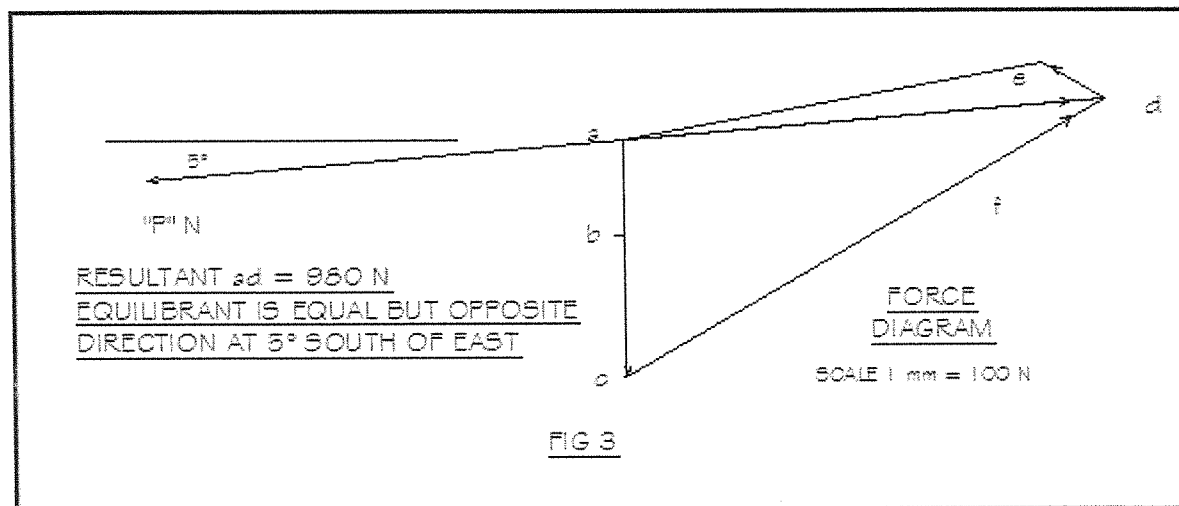
Force diagram: draw correctness ✓✓

Draw accuracy ✓

Head to tail vectors indicated ✓

Answer correctly tabulated ✓✓

(6)



[27]

TOTAL: 100