Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering / Science

End Sem Examination May-2024

EN3ES30 / BC3ES12

Basic Civil Engineering & Mechanics

Programme: B.Tech./B.Sc. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. The initial setting time of Ordinary Portland Cement is: **1**

(a) 10 minutes (b) 20 minutes

(c) 30 minutes (d) 60 minutes

ii. Which of the following is not a part of superstructure of a building? **1**

(a) Beam (b) Wall (c) Lintel (d) Foundation

iii. The least count of prismatic compass is: **1**

(a) 10 minutes (b) 30 degrees

(c) 30 minutes (d) 1 degree

iv. The benchmark is at a height of 200 m. and the first staff reading is 1.505 m, the instrument will be at a height of: **1**

(a) 198.495 m (b) 201.505 m

(c) 205.505 m (d) 195.505 m

v. The vertical distance between two successive contour lines is: **1**

(a) Contour interval (b) Contour gradient

(c) Horizontal equivalent (d) None of these

vi. Contour drawn at small distance have ……. slope. **1**

(a) Gentle (b) Steep (c) Uniform (d) Zero

vii. Which of the following relation stand true for a perfect truss? **1**

(a) m+3=2j (b) m+3>2j (c) m+3<2j (d) m=2(3j)

viii. The standard unit of force is: **1**

(a) Newton (b) Joules (c) Watt (d) None of these

ix. Shear force diagram in case of point load will be: **1**

(a) Vertical straight line (b) Inclined line

(c) 2 deg. parabola (d) 3 deg. parabola

P.T.O.

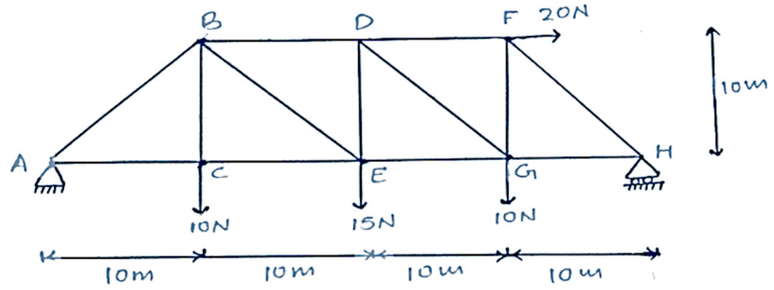
x. One end of a beam is fixed, and another is free, the beam is: **1**
(a) Cantilever (b) Simply supported
(c) Overhanging (d) Fixed

Q.2 i. Write two characteristics of first-class bricks. **2**
ii. Draw a flow diagram explaining load transfer mechanism in a building and specify the role of foundation. **3**
iii. Write the role of bogues compound in cement. Also define initial and final setting time of cement. **5**
OR iv. Explain flooring with all its types in detail. **5**

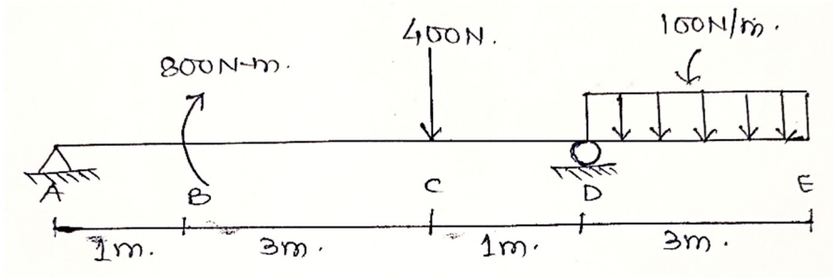
Q.3 i. Write two fundamental principles of survey. **2**
ii. Write three points of difference between whole circle and reduced bearing system. **3**
iii. Write about chain survey (principle, instrument used and procedure of how the area of field is calculated). **5**
OR iv. The following staff readings were taken during a levelling practice: 2.405, 2.385, 2.650, 2.430, 1.580, 1.690, 1.325 (m) **5**
Calculate the reduced levels of all the stations if the instrument was shifted after 4th staff reading and the benchmark is at a height of 434 metres. Solve by height of instrument method and apply suitable check.

Q.4 i. Write a short note on remote sensing and its applications. **3**
ii. Derive the formulae for computation of area by trapezoidal and Simpson's rule. **7**
OR iii. The perpendicular offsets taken at 10m interval from a survey line to an irregular boundary are 2.19m, 3.2m, 4.36m, 6.1m, 5.5m, 7.6m, 8.4m, 8.8m, 5.4m. Calculate the area enclosed and compare the results by trapezoidal rule and Simpson's rule. **7**

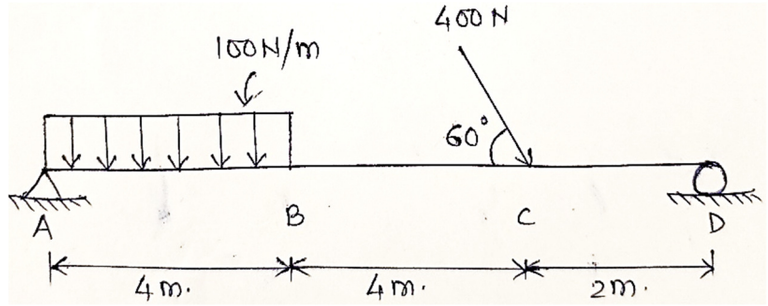
Q.5 Attempt any two:
i. Write the statement and derive a relation to determine the resultant of two forces by parallelogram law of forces. **5**
ii. State and prove Lami's theorem. **5**
iii. Use method of section to calculate the forces in the members DF, DG, EG. **5**



Q.6 i. Define point of contraflexure. **2**
ii. Draw shear force and bending moment diagram for the given beam: **8**



OR iii. Draw shear force and bending moment diagram for the given beam: **8**



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Scheme of Marking

Faculty of Engineering

End Sem Examination Dec-2023

EN3ES30 Basic Civil Engineering and Mechanics

Programme: B.Tech. | | Branch/Specialisation:

Q.1	i)	c) 30 minutes	**1**
	ii)	d) Foundation	**1**
	iii)	c) 30 minutes	**1**
	iv)	b) 201.505 m	**1**
	v)	a) Contour interval	**1**
	vi)	b) Steep	**1**
	vii)	a) m+3=2j	**1**
	viii)	a) Newton	**1**
	ix)	a) Straight line	**1**
	x)	a) Cantilever	**1**
Q.2	i.	2 marks for two characteristics (one mark each)	**2**
	ii.	1 mark for flow chart and 2 marks for role of foundation	**3**
	iii.	3 marks for role of bogues compound and 2 marks for initial and final setting time definition	**5**
OR	iv.	2 marks for flooring and 3 marks for its types	**5**
Q.3	i.	2 marks for two principles (one mark each)	**2**
	ii.	3 marks for 3 point of differences (one mark each)	**3**
	iii.	1 mark for principle, 1 mark for instruments and 3 marks for explanation	**5**
OR	iv.	2 marks for table filling, 2 marks for RL calculation and 1 mark for check	**5**
Q.4	i.	3 marks for remote sensing and applications	**3**
	ii.	3 marks for trapezoidal rule and 4 marks for Simpson's rule	**7**
OR	iii.	3 marks for area by trapezoidal rule, 3 marks for area by Simpson's rule and 1 mark for result comparison	**7**
Q.5	i.	1 mark for statement and 4 marks for derivation	**5**
	ii.	1 mark for statement and 4 marks for proof	**5**
OR	iii.	2 marks for calculation of unknown reactions and 3 marks for calculation of forces in the members	**5**
Q.6	i.	2 marks for correct definition	**2**
	ii.	1 mark for FBD, 2 marks for unknown reactions, 2 marks for shear force and SFD, 3 marks for bending moment and BMD	**8**
	iii.	1 mark for FBD, 2 marks for unknown reactions, 2 marks for shear force and SFD, 3 marks for bending moment and BMD	**8**

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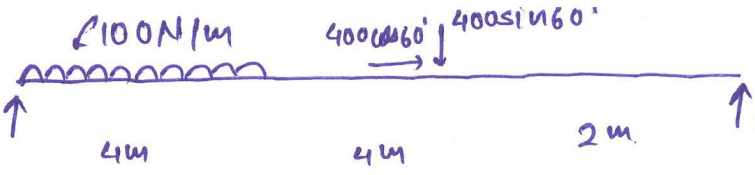
Q6(iii)



$\Sigma H = 0 \quad HA + 400\cos 60^\circ = 0 \longrightarrow HA = -200N.$

$\Sigma V = 0 \quad RA - 100(4) - 400\sin 60^\circ + RD = 0 \longrightarrow RA + RD = 746.41N.$

$\Sigma M_D = 0 \quad 10RA - 100\times4\times8 - 400\sin 60^\circ * 2 + 0RD = 0 \longrightarrow RA = 389.28N.$

$RD = 357.13N.$

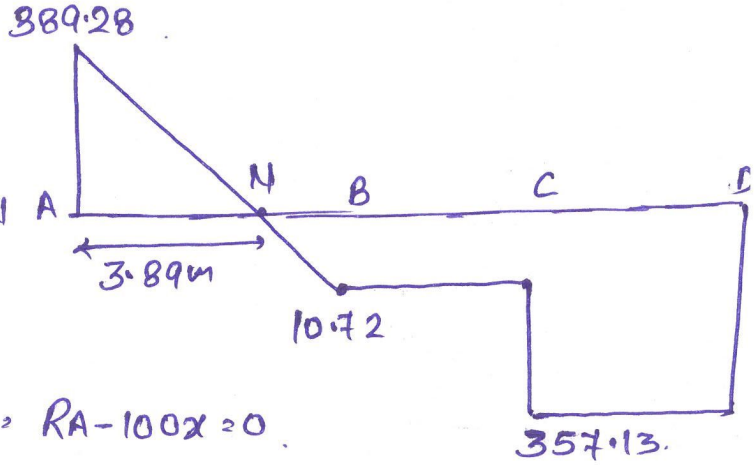
Shear force

$SF(A) = RA = 389.28N.$

$SF(B) = RA - 100\times4 = -10.72N.$

$SF(C) = RA - 400 - 400\sin 60^\circ = -357.13N$

$SF(D) = RA - 400 - 400\sin 60^\circ + RD = 0.$



Consider xx' btw^ A & B @ x from A $\rightarrow SF(x) = RA - 100x = 0$

$389.28 = 100x$

$x = 3.89^m$ from A

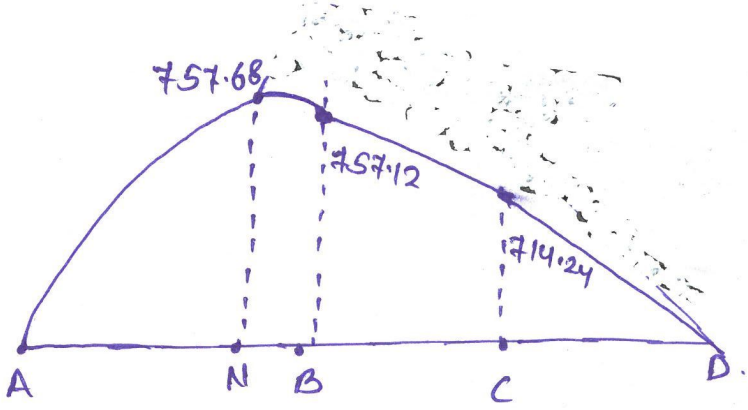
$BM(A) = 0RA = 0N\text{-}m.$

$BM(N) = 3.89RA - 100 * 3.89 * 3.89/2 = 1514.29 - 756.605 = 757.685Nm$

$BM(B) = 4RA - 100\times4\times2 = 757.12\ N\text{-}m.$

$BM\ C = 8RA - 100\times4\times6 - 400\sin 60^\circ(0) = 714.24\ N\text{-}m.$

$BM(D) = 0Nm.$



Q3 (iv) 2.405 , 2.385 , 2.650 , 2.430 , 1.580 , 1.690 , 1.325

Stan	BS (m)	IS (m)	FS (m)	HI (m)	RL (m)	Remark
A	2.405			436.405	434	FRL
		2.385			434.020	
		2.650			433.755	
			2.430		433.975	
B	1.580			435.555		Stan change
		1.690			433.865	
			1.325		434.23	LRL

Calculations -

$HI = RL + BS = 434 + 2.405 = 436.405$ m

New RL = $HI - IS/FS = 436.405 - 2.385 = 434.02$ m

Check -

$\Sigma BS - \Sigma FS = LRL - FRL$

$(2.405 + 1.580) - (2.430 + 1.325) = 434.23 - 434$

$3.985 - 3.755 = 0.23$

$0.23 = 0.23$

→ (7 marks)

Q.4

(iii) $d = 10\ m$

$n = 8$ segments

number of ordinates = 9

Length of survey line = $8 \times 10 = 80\ m$.

(a) Area by trapezoidal rule

$$A = \left(\frac{O_0 + O_8}{2} + O_1 + O_2 \ldots + O_7 \right) d$$

$$= \left(\frac{2.19 + 5.4}{2} + 3.2 + 4.36 + 6.1 + 5.5 + 7.6 + 8.4 + 8.8 \right) \times 10$$

$$= 477.55\ m^2$$ — (3) marks

(b) Area by simpson's method

$$= \frac{d}{3}\left[(O_0 + O_8) + 4(O_1 + O_3 + O_5 + O_7) + 2(O_2 + O_4 + O_6) \right]$$

$$= \frac{10}{3}\left[(2.19 + 5.4) + 4(3.2 + 6.1 + 7.6 + 8.8) + 2(4.36 + 5.5 + 8.4) \right]$$

$$= \frac{10}{3}\left[(7.59) + 102.8 + 36.52 \right]$$

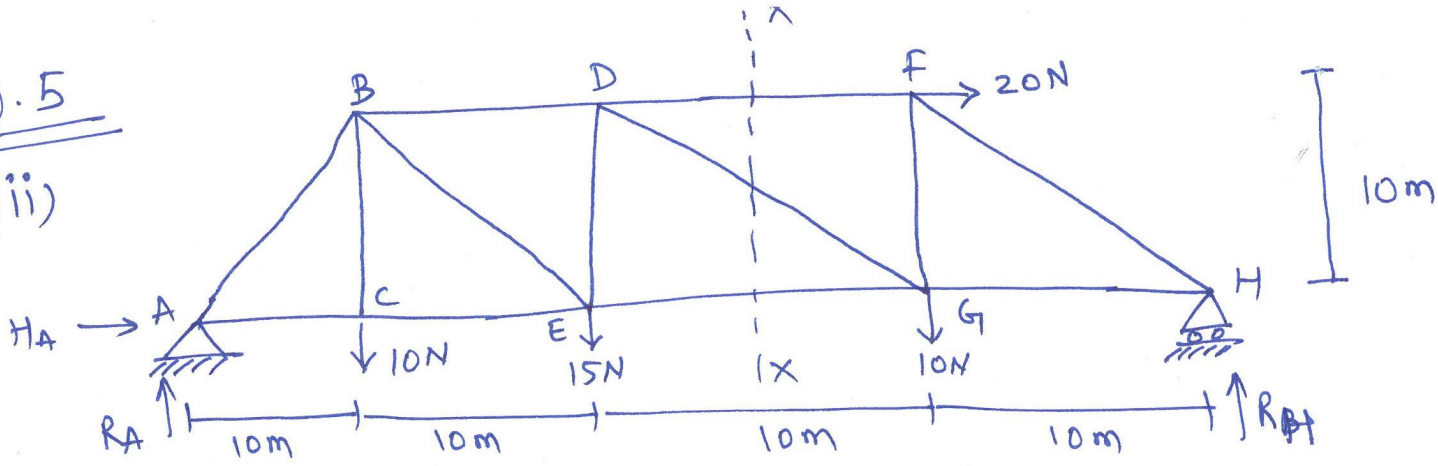
$$= 489.7\ m^2$$ — (3) marks

Difference in areas, $\Delta = 489.7 - 477.55$

$= 12.15\ m^2$ — (1) mark.

Q.5

(iii)



Reactions R_A & R_B

$\Sigma f_x = 0$, $H_A = 20\ N$

$\Sigma f_y = 0$, $R_A + R_B = 10 + 15 + 10$

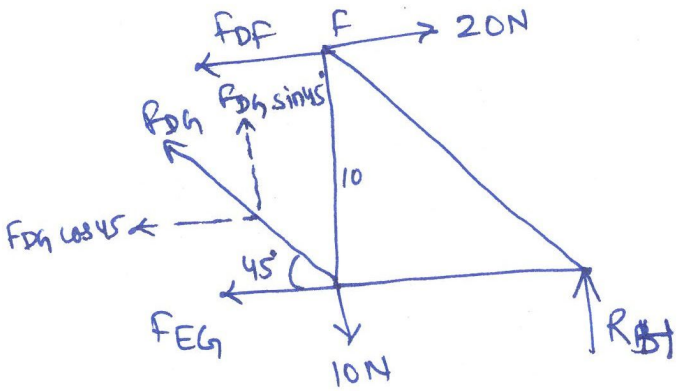
$R_A + R_B = 35$

$\Sigma M_A = 0$ $R_B \times 40 - 10 \times 30 - 15 \times 20 - 10 \times 10 - 20 \times 10 = 0$

$R_B = 22.5\ N$

$R_A = 12.5\ N$ — 2 marks

FBD of RHS part of Section X–X.



$f_{DG} = -17.677\ N$ (C)

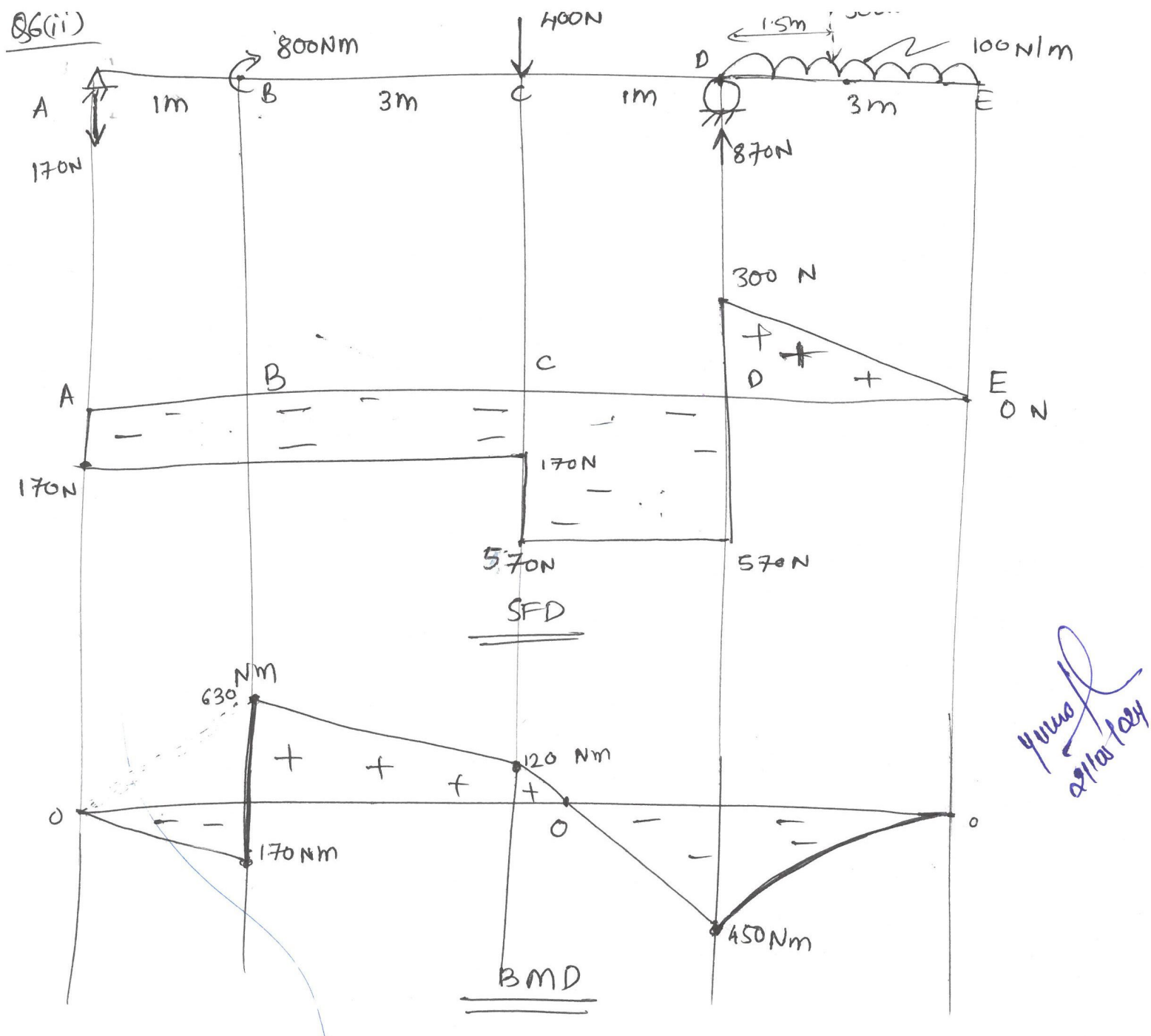
$f_{DF} = -2.5\ N$ (C)

$f_{EG} = 35\ N$ (T)

S.NO	force in member	Magnitude	Nature
1.	f_{DF}	2.5N	Compression
2.	f_{DG}	17.677N	Compression
3.	f_{EG}	35N	Tension

— (3 marks)

Q6(ii)



1) Reaction calculations ⇒ $\Sigma F_y = 0$, $+R_A + R_D - 400 - 300 = 0$

$R_A + R_D = 700N$

$\Sigma M_A = 0$

$+800 + (400 \times 4) - (R_D \times 5) + (300 \times 6.5) = 0$

$\boxed{R_D = 870\,N,\ R_A = -170N}$

2) Shear force calculations –

$SF_A = -170\,N$

$(SF_C)_L = -170N$

$(SF_C)_R = -170 - 400 = -570\,N$

$(SF_D)_L = -570N$

$(SF_D)_R = -570 + 870 = +300N$

$(SF_E) = +300 - 300 = 0N$

3) Bending moment calculations.

$BM_A = BM_E = 0\,N\,m$

$(BM_B)_L = (-170 \times 1) = -170\,Nm$

$(BM_B)_R = (-170 \times 1) + 800 = 630\,Nm$

$(BM_C) = (-170 \times 4) + 800 = 120\,Nm$

$(BM_D) = (-170 \times 5) + 800 + (-400 \times 1)$

$= -450\,Nm$