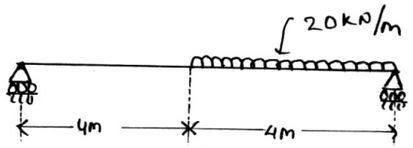
iii. Draw the SFD and BMD for simply supported beam subjected to UDL on right hand half of the span as shown in figure. **5**



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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2019

EN3ES01 Basic Civil Engineering

Programme: B.Tech. 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.

Q.1 i. The minimum crushing strength of third-class brick is: **1**

(a) 3.5 N/mm^2 (b) 7 N/mm^2

(c) 10 N/mm^2 (d) 20 N/mm^2

ii. Which equipment is used to test setting time of cement? **1**

(a) Core cutter

(b) Vibrator

(c) Universal testing machine (UTM)

(d) Vicat apparatus

iii. Forces passing through a common point are known as _____ **1**

(a) Collinear forces (b) Co-planer forces

(c) Concurrent forces (d) None of these

iv. The symbol for Poisson's ratio is **1**

(a) σ (b) η (c) μ (d) None of these

v. Floor in a building **1**

(a) Separates levels (b) Is laid below plinth

(c) Contains R.C.C. (d) Has thickness of 10cm

vi. How many types of foundations are there based on depth? **1**

(a) 3 (b) 4 (c) 5 (d) 2

vii. Least Count of Surveyor compass is: **1**

(a) 30 minute (b) 1 degree (c) 20 second (d) 20 minute

viii. The vertical distance between any two consecutive contours is called **1**

(a) Vertical equivalent (b) Horizontal equivalent

(c) Contour interval (d) Contour gradient

ix. For any part of the beam, between two concentrated load Shear force diagram is a **1**
(a) Horizontal straight line (b) Vertical straight line
(c) Line inclined to x-axis (c) Parabola

x. For any part of a beam between two concentrated load, Bending moment diagram is a **1**
(a) Horizontal straight line (b) Vertical straight line
(c) Line inclined to x-axis (d) Parabola

Q.2 i. List out the Bogue's compound of cement with their chemical formulas. **2**

ii. Define grade of concrete? List out any four different grades of concrete with their proportion. **3**

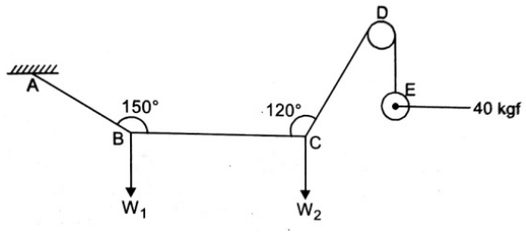
iii. List out the main ingredients of brick with their percentage? Write any three types of bricks with their uses. **5**

OR iv. Write any ten characteristics of good bricks? **5**

Q.3 i. Define force. List out any four various force system. **2**

ii. Write short note on **8**
(a) Stress and strain (b) Hook's law
(c) Modulus of elasticity (d) Poisson's ratio

OR iii. ABCDE is a string whose one end A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small peg at D carrying a weight of 40kg at the free end E as shown in figure. If in the position of equilibrium BC is horizontal and AB and CD makes 150^0 and 120^0 with BC, find: **8**
(a) Tension in the portions AB, BC and DE of the string.
(b) The magnitude of W_1 and W_2.



Q.4 i. Define bearing capacity of soil. List out any four various types of soil with their bearing capacity. **3**

ii. Define foundation. Explain any five types of foundations used in civil engineering with neat sketches? **7**

OR iii. Explain all the building components with neat and labelled sketch. **7**

Q.5 i. Define contours. Explain any three characteristics of contours wit diagram. **4**

ii. A closed compass traverse ABCD was conducted around a lake and the following bearings were obtained. **6**

Line	FB	BB
AB	$74^0\,20'$	256^0
BC	$107^0\,20'$	$286^0\,20'$
CD	$224^0\,50'$	$44^0\,50'$
DA	$306^0\,40'$	126^0

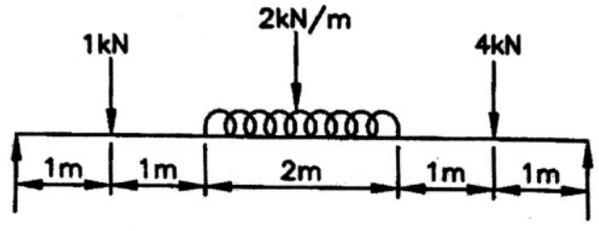
Determine which of the stations are suffering from local attraction and give the values of corrected bearing by included angle method.

OR iii. The following staff reading were observed successively with a level is 0.875, 1.225, 1.285, 1.425, 1.165, 0.785, 0.925, 1.225, 2.825, 0.895, 1.255, 1.685 and 0.915m. The instrument was shifted after 5^{th} and 9^{th} reading. Enter the data in level book and calculate R.L. of all the points if first reading was taken on BM (100m) by H.I. method. **6**

Q.6 Attempt any two:

i. Define beam. Explain any four types of beam with neat sketch. **5**

ii. Define shear force and bending moment and determine the support reactions for the following beam as shown in figure. **5**



P.T.O.

Marking Scheme
EN3ES01 Basic Civil Engineering

Q.1	i.	The minimum crushing strength of third-class brick is: (a) 3.5 N/mm^2		**1**
	ii.	Which equipment is used to test setting time of cement? (d) Vicat apparatus		**1**
	iii.	Forces passing through a common point are known as _____ (c) Concurrent forces		**1**
	iv.	The symbol for Poisson's ratio is (c) μ		**1**
	v.	Floor in a building (a) Separates levels		**1**
	vi.	How many types of foundations are there based on depth? (d) 2		**1**
	vii.	Least Count of Surveyor compass is: (b) 1 degree		**1**
	viii.	The vertical distance between any two consecutive contours is called (c) Contour interval		**1**
	ix.	For any part of the beam, between two concentrated load Shear force diagram is a (a) Horizontal straight line		**1**
	x.	For any part of a beam between two concentrated load, Bending moment diagram is a (c) Line inclined to x-axis		**1**
Q.2	i.	Bogue's compound of cement	1 mark	**2**
		Chemical formulas.	1 mark	
	ii.	Definition of grade of concrete	1 mark	**3**
		List of grades of concrete with their proportion (for 4 grades) 0.5 mark for each grade	2 marks	
	iii.	List of ingredients of brick with their percentage	2 marks	**5**
		Types of bricks and their uses for 3 types with individual use	3 marks	
OR	iv.	Any ten characteristics of good bricks		**5**
		0.5 mark for each characteristic	(0.5 mark * 10)	
Q.3	i.	Definition force	1 mark	**2**
		Any four force system.	1 mark	
	ii.	Write short note on		**8**
		(a) Stress and strain	2 marks	
		(b) Hook's law	2 marks	
		(c) Modulus of elasticity	2 marks	
		(d) Poisson's ratio	2 marks	
OR	iii.			**8**

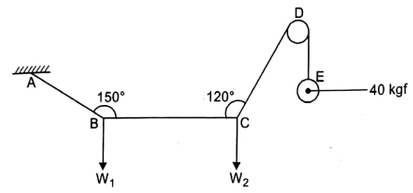


Fig. 3.7.

Solution. Considering the free body diagrams of B and C separately, we get

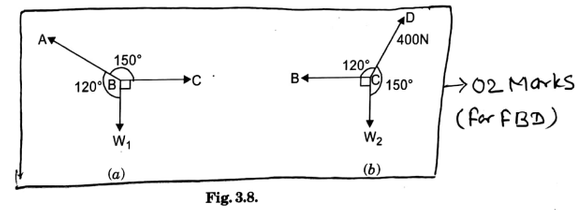


Fig. 3.8.

In Fig. 3.8(b), tension in BC be T_{BC} and tension in CD be 400 N. [$\because$ 1 kgf = 10 N]

$\therefore$ Applying Lami's theorem at C, we get,

$$\frac{400}{\sin 90°} = \frac{W_2}{\sin 120°} = \frac{T_{BC}}{\sin 150°}$$

02 Marks (for W_2 and Tension in BC)

$$\therefore \quad W_2 = 346.4 \text{ N} = 34.64 \text{ kgf}$$

$$T_{BC} = 200 \text{ N} = 20.0 \text{ kgf}$$

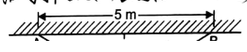
Now, applying Lami's theorem at B we get,

$$\frac{T_{BC}}{\sin 120°} = \frac{W_1}{\sin 150°} = \frac{T_{AB}}{\sin 90°}$$

02 Mark's (for W_1 and Tension in AB)

$$\Rightarrow \quad \frac{200}{\sin 120} = \frac{W_1}{\sin 120} = \frac{T_{AB}}{\sin 90}$$

$\therefore$ $W_1 = 115.5$ N, $T_{AB} = 230.9$ N, $T_{DE} = 400$ N. **Ans.**

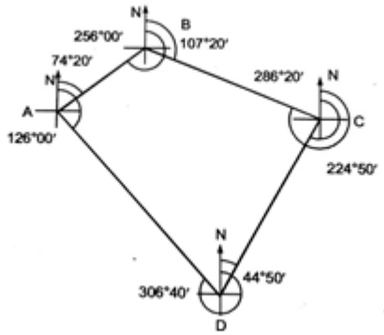


Q.4	i.	Definition of bearing capacity of soil	1 mark	**3**
		Any four types of soil with their bearing capacity 0.5 mark for each (0.5 mark * 4)	2 marks	
	ii.	Definition of foundation	2 marks	**7**
		Any five types of foundations with diagram 1 mark for each (1 mark * 5)	5 marks	
OR	iii.	Building components		**7**
		Any seven 0.5 mark for each (0.5 mark * 7)	3.5 marks	
		Labelled sketch	3.5 marks	
Q.5	i.	Definition of contours	1 mark	**4**
		Any three characteristics of contours with diagram.		

1 mark for each (1 mark * 3) 3 marks

ii. Determine which of the stations are suffering from local attraction and give the values of corrected bearing by included angle method. **6**

Solution : (Refer to Fig. 16.18)



01 mark

Step 1 : Calculation of Included Angles

$\angle A$ = Bearing of line AB – Bearin of line AD
= 74° 20′ – 126° 00′
= 51° 40′ (Anticlockwise) (–ve)

$\angle B$ = Bearing of line BC – Bearing of line BA
= 107° 20′ – 256° 00′
= 148° 40′ (Anticlockwise) (–ve)

$\angle C$ = Bearing of line CD – Bearing of line CB
= 224° 50′ – 286° 20′
= 61° 30′ (Anticlockwise) (–ve)

$\angle D$ = Bearing of line DA – Bearing of line DC
= 306° 40′ – 44° 50′
= 261° 50′ (Clockwise)

∴ Corrected Angle = 360° – 261° 50′
= 98° 10′ (Anticlockwise)

01 mark

Step 2 : Check for Included Angles

The sum of included angles should be equal to
= $(2n - 4)$ 90°
= $(2 \times 4 - 4)$ 90°
= 360°

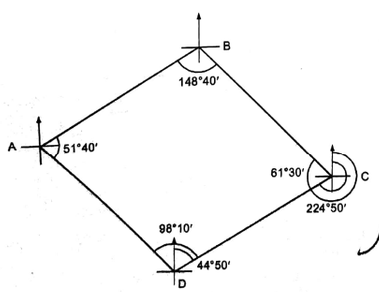
$\angle A + \angle B + \angle C + \angle D$ = 51° 40′ + 148° 40′ + 61° 30′ + 98° 10′
= 360° 00′

01 mark

As sum of included angles is equal to theoretical sum, hence there is no need to apply corrections to included angles.

Step 3 : Find out the Line which is Free from Local Attraction

Here, we find that fore and back bearings of line CD are differ exactly by 180°. Hence, stations C and D are free from local attraction. That means bearings of line CD are the corrected bearings.



01 mark

Fig. 16.19. Traverse with corrected angles

Step 4 : Calculation of Bearings

Corrected fore bearing of line CD = **224° 50′**
Corrected back bearing of line CD = **44° 50′**
Corrected fore bearing of line DA
= Bearing of line DC + $\angle D$
= 44° 50′ + (–) 98° 10′
= – 53° 20′
= 360° – 53° 21′
⇒ = **306° 40′**

Corrected back bearing of line DA
= Fore bearing of DA – 180°
= 306° 40′ – 180°
= **126° 40′**

Corrected fore bearing of line AB
= Bearing of line AD + $\angle A$
= 126° 40′ + (–) 51° 40′
= **75° 00′**

Corrected back bearing of line AB
= Fore bearing of line AB + 180°
= 75° 00′ + 180°
= **255° 00′**

Corrected fore bearing of line BC
= Bearing of line BA + $\angle B$
= 225° + (–) 148° 40′
= **106° 20′**

Corrected back bearing of line BC
= Fore bearing of line BC + 180°
= 106° 20′ + 180°
= **286° 20′**

01 mark

01 mark

Line	*Corrected Fore Bearing*	*Corrected Back Bearing*
AB	75° 00′	255° 00′
BC	106° 20′	286° 20′
CD	224° 50′	44° 50′
DA	306° 40′	126° 40′

OR iii. Enter the data in level book and calculate R.L. of all the points if first reading was taken on BM (100m) by H.I. method. **6**

Solution.

Station	*B.S.*	*I.S.*	*F.S.*	*H.I.*	*R.L.*	*Remark*
A	0.875			100.875	100	BM
B		1.225			99.65	
C		1.285			99.59	
D		1.425			99.45	
E	0.785		1.165	100.495	99.71	CP1
F		0.925			99.57	
G		1.225			99.27	
H	0.895		2.825	917.565	97.67	CP2
I		1.255			97.31	
J		1.685			96.88	
K			0.915		97.65	
	2.555		4.905			

02 marks

02 marks

Arithmetic Check :

ΣBS – ΣFS = Last RL – First RL
2.555 – 4.905 = 97.65 – 100
(–) 2.35 = (–) 2.35 **Hence Checked**

02 marks

Example 17.5 *The following consecutive readings were taken on a ground ...*

	Proper feeding of data in table	3 marks		
	H. I.	1 mark		
	R.L.	1 mark		
	Check	1 mark		
Q.6	Attempt any two:			
i.	Definition of beam	1 mark	**5**	
	Any four types of beam with sketch.			
	1 mark for each (1 mark * 4)	4 marks		
ii.	Definition of shear force	1.5 marks	**5**	
	Definition of bending moment	1.5 marks		

Consider the equilibrium of beam. Apply condition of equilibrium,

$$\Sigma V = 0$$

$$R_A + R_B = 1800 \times 4 = 7200$$

$$\Sigma M = 0$$

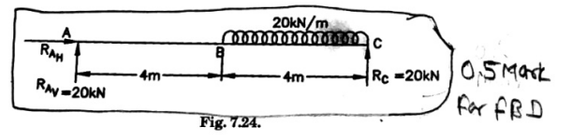
Taking moment about A,

$$(1800 \times 4 \times 4) - R_B \times 9 = 0$$

$$R_B = \frac{1800 \times 4 \times 4}{9} = \mathbf{3200\ N}$$

$$R_A = \mathbf{4000\ N}$$

	Determine the support reactions calculation	2 marks		
iii.	Draw the SFD and BMD for simply supported beam subjected to UDL on right hand half of the span as shown in figure.		**5**	
	Reaction	2 marks		
	S.F.	1 mark		
	SFD	0.5 mark		
	B.M.	1 mark		
	BMD	0.5 mark		



0.5 mark for FBD

Fig. 7.24.

Apply conditions of equilibrium,

$$\Sigma H = 0$$

$$R_{AH} = 0 \quad \ldots(i)$$

$$\Sigma V = 0$$

$$R_{AV} + R_C - 20 \times 4 = 0$$

$$\Rightarrow \quad R_{AV} + R_C = 80 \quad \ldots(ii)$$

$$\Sigma M = 0$$

Taking moment about A,

$$(20 \times 4 \times 6) - R_C \times 8 = 0$$

$$\Rightarrow \quad R_C = \frac{480}{8} = 60\ \text{kN} \quad \ldots(iii)$$

So $\quad R_{A_V} + 60 = 80$

$$\Rightarrow \quad R_{A_V} = 20\ \text{kN}$$

0.5 mark for Reaction calculation

S.F. Calculation

S.F. at C :

$$F_{CR} = 0$$

$$F_{C_L} = -60\ \text{kN}$$

S.F. at B :

$$F_{B_R} = -60 + 20 \times 4 = 20\ \text{kN}$$

$$F_{B_L} = 20\ \text{kN}$$

S.F. at A :

$$F_{A_R} = 20\ \text{kN}$$

$$F_{A_L} = 0$$

01 mark for SF calculation

To Locate Position of M

Consider two similar triangles :

ΔKBM and ΔMCL

$$\frac{x}{4-x} = \frac{20}{60}$$

$$\Rightarrow \quad \frac{x}{4-x} = \frac{1}{3}$$

$$\Rightarrow \quad 3x = 4 - x$$

$$\Rightarrow \quad 4x = 4$$

$$\Rightarrow \quad \boxed{x = 1}$$

01 Mark for B.M. Calculation

B.M. Calculation

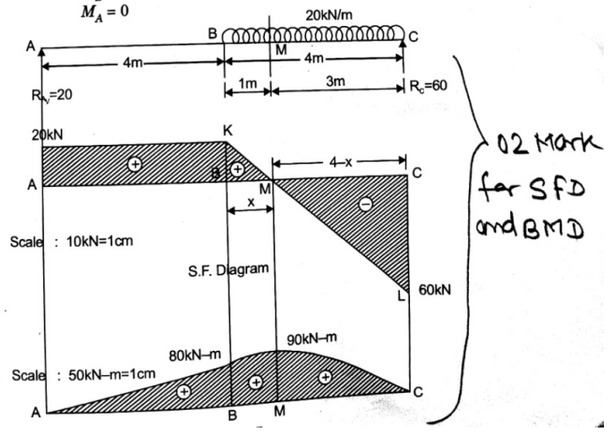
$$M_C = 0,$$

$$M_M = \left(60 \times 3 - 20 \times 3 \times \frac{3}{2}\right)$$

$$= 180 - 90 = 90\ \text{kN-m}$$

$$M_B = 20 \times 4 = 80\ \text{kN-m}$$

$$M_A = 0$$



02 Mark for SFD and BMD

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