

Time: 3Hours

Max Marks:80

- Note: 1) Question 1 is compulsory  
 2) Attempt any three from remaining  
 3) Assume suitable data wherever necessary and mention it clearly.  
 4) Figures to the write indicate full marks.

**Q1**  
(20 Marks)

Attempt any four of the following

5 marks each

- A Note on different uses of theodolite.
- B Note on Characteristics of contour
- C Describe applications of total station
- D Explain radiation method of plane table surveying with neat sketch .
- E A 20 m chain was found to be 6 cm too long after chaining 1600m. It was 8 cm too long at the end of day work after chaining a total distance of 2650m. If the chain was correct before commencement of the work, find the true distance.

**Q2**  
(20 Marks)

10 marks each

Following is the page of a level book. Fill in the missing data. And calculate RL of all the points

Station	B.S.	I.S.	F.S.	rise	fall	RL	Remarks
1	3.250					249.260	BM
2	1.755		?		0.750		CP
3		1.950					
4	?		1.920				CP
5		2.340		1.500			
6		?		1.000			
7	1.850		2.185				CP
8		1.575					
9		?					CP
10	?		1.895	1.650			
			1.350	0.750			

A

The following bearings was taken while conducting a close traverse with a compass in a place where local attraction was suspected. At what stations do you suspect local attraction? Find the corrected bearings for local attraction and for declination of 1°30'W calculate true bearings.

Line	FB	BB
AB	80°45'	260°
BC	130°30'	311°35'
CD	240°15'	60°15'
DA	290°30'	110°10'

B

**Q3**  
**(20 Marks)**

**A**  
**i.**  
**ii.**  
**B**

**Attempt the following questions**

**5 marks each**

Explain use of planimeter.  
Explain profile levelling

**10 marks**

Calculate latitudes, departures and closing error for the following traverse and adjust using Bowditch rule

Line	length	W.C.B.
AB	89.31	45°10'
BC	219.76	72°05'
CD	151.18	161°52'
DE	159.10	228°43'
EA	232.26	300°42'

**Q4 A**

**i**

**Attempt the following questions**

**5 marks each**

Enlist various application of GPS in surveying

**ii**

Write short note on fundamental lines of a theodolite and relation between them

**B**

Two tangents intersect at the chainage 1190m, the deflection angle being 36°. Calculate all the data necessary for setting out a curve with a radius of 300 by deflection angle method. The peg interval is 30m.

**10 marks**

**Q 5**

**A**

**Attempt the following questions**

**10 marks each**

Determine the gradient from a point A to a point B from the following observations made with a tacheometer fitted with an analytic lens. The constant of the instrument was 100m and the staff was held vertically.

Inst.St.	Staff station	BEARING	Vertical angle	Staff readings
P	A	134°	+10° 32'	1.360, 1.915, 2.470
	B	224°	+5° 6'	1.065, 1.885, 2.705

**B**

The offsets (in m) taken from a chain line to a curved boundary are given below

Ch.	0	5	10	15	20	25	35	45	55	65
Offsets	2.5	3.8	8.4	7.5	10.5	9.3	5.8	7.8	6.9	8.4

Find the area between chain line, the first and last coordinate and the boundary by

1) Trapezoidal rule 2) Simpsons rule

**Q 6**

**A**

**Attempt the following questions**

**10marks each**

Explain in detail radial contouring project.

**B**

Describe the field procedure of setting out a simple circular curve by offset from long chord method?

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(3 Hours)

[Total Marks: 80]

N.B. : 1) Question No. 1 is Compulsory.

2) Answer any THREE questions from Q.2 to Q.6.

3) Figures to the right indicate full marks.

**Q.1** (a) The mean life time of a sample of 25 bulbs is found as 1550 hours with standard deviation of 120 hours. The company of manufacturing bulbs claims that the average life of their bulbs is 1600 hours. Is the claim acceptable at 5% LOS ? (5)

(b) Find k and mean of following distribution (5)

X	8	12	16	20	24
P(X=x)	1/8	k	3/8	1/4	1/12

(c) Evaluate  $\int_c z dz$  where c is unit circle  $|z| = 1$  (5)

(d) Show that  $\underline{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$  is both solenoidal and irrotational. (5)

**Q.2** (a) Evaluate  $\int_c \frac{z+3}{(2z^2+3z-2)} dz$ , where c is the circle  $|z-i|=2$ . (6)

(b) Fit a straight line for following data (6)

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(c) Given  $\underline{F} = (2xy + z)i + (x^2 + 2yz^3)j + (3y^2z^2 + x)k$ , (8)

(a) Prove that  $\underline{F}$  is conservative.

(b) Find Scalar potential function  $\phi$  such that  $\underline{F} = \nabla\phi$ .

(c) Find the work done by  $\underline{F}$  in moving a particle from  $A(1, 2, 0)$  to  $B(2, 2, 1)$  along the straight line AB.

**Q.3** (a) Two different processes A and B are used to manufacture tubes. Samples were drawn from these two populations and following results were obtained (6)

Population	A	B
Sample Size	25	17
Sample SD	4	3

Test the hypothesis that variance of A lesser than variance of B.

Given  $(F_{(24,16)}(0.05) = 2.24)$

(b) An I.Q. test was administered to 5 persons and after they were trained. The results are given below. Test whether there is any change in I.Q. after the training program, use 1% LOS. (6)

	I	II	III	IV	V
I.Q. Before training	110	120	123	132	125
I.Q. after training	120	118	125	136	121

(c) Find the Laurent's series for  $f(z) = \frac{2z-3}{(z-1)(z-3)}$  about  $z = 0$ . (8)

- Q.4** (a) Using Green's Theorem evaluate  $\int_c (xy + y^2)dx + x^2dy$  and  $c$  is closed curve of the region bounded by  $y = x$  and  $y = x^2$ . (6)
- (b) Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs if it is known that 2% of the bulbs are defective. (6)
- (c) The following table gives the number of accidents in a district during a week. Apply  $\chi^2$  test to find whether the accidents are uniformly distributed over the week. (8)

Day	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
No. of days	13	12	11	9	15	10	14

- Q.5** (a) Three factories A, B, C produce 30%, 50% and 20% of the total production of an item. Out of their production 80%, 50% and 10% are defective respectively. An item is chosen at random and found to be defective. Find the probability that it was produced by the factory A. (6)
- (b) A continuous random variable has pdf  $f(x) = k(x - x^2), 0 \leq x \leq 1$ . Determine k, mean,  $P(0.5 \leq x \leq 3)$ . (6)
- (c) The mean height of 500 students is 68 inches and the standard deviation is 4 inches. Assuming that the heights are normally distributed, find the number of students whose heights i) between 65 and 71 inches, ii) less than 62 inches, iii) greater than 72 inches. (8)

- Q.6** (a) Calculate Karl Pearson's coefficient of correlation from the following data. (6)

Price (in \$)	5	6	3	4	3
Demand (in units)	10	10	12	11	12

- (b) Use Divergence theorem to evaluate  $\int \int_s \vec{F} \cdot \vec{ds}$  where  $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$  and  $s$  is the surface of the region  $x^2 + y^2 = 4, z = 3$  above  $xy$  plane. (6)
- (c) The regression line of samples are  $6y - 5x = 90$  &  $15x - 8y = 130, \sigma_x = 4$  find i) Sample mean  $\bar{x}, \bar{y}$  ii) Coefficient of correlation between  $x$  &  $y$  iii)  $\sigma_y$  iv) Also estimate  $y$  at  $x=10$ . (8)

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Duration-3 Hours

Total Marks: 80

- N.B. 1) Question No.1 is Compulsory.  
 2) Attempt any three questions from remaining questions.  
 3) Assume suitable data where required and clearly state the same.  
 4) Figures to the right indicate full marks.

Q.1 Attempt any four

20

- Write a short note on Major and minor losses in pipes.
- Explain Mach number with its applications.
- Discuss the phenomenon of boundary layer separation in diverging flow.
- Explain Dash-Pot mechanism in laminar flow.
- Compare hydrodynamically smooth and rough pipes.
- Explain moment of momentum equation.

Q.2a) The difference in water level, between two tanks which are connected by three pipes in series is 15m. Length and diameter of these pipes are 300m, 150m, 200m and 30cm, 20cm, 30cm, Respectively. Find the discharge through the pipeline and tabulate all losses if  $f$  for the three pipes To be taken as 0.02, 0.025 and 0.03. 10

b) What is meant by water hammer? Obtain an expression for the rise in pressure in a thin elastic pipe of circular section in which the flow of water is stopped by sudden closure of valve. 10

Q.3a) Calculate discharge in each pipe of network as shown in fig. The pipe network consists of 5 pipes. The head loss  $h_f$  in pipe is given by,  $h_f = rQ^2$ . The values of  $r$  for various pipes and also inflow or outflow at nodes are shown in fig. 1 10

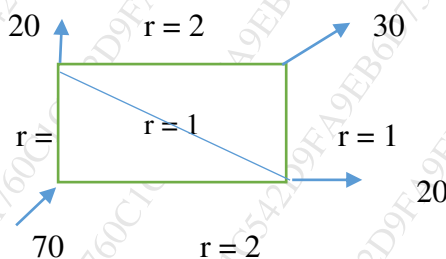


Fig.1

b) Prove that the maximum velocity in a circular pipe for a viscous flow is equal to two times the average velocity of the flow. 10

Q.4a) for the following types of velocity distribution obtain the values of  $(\delta^*/\delta)$  and  $(\Theta/\delta)$  **10**

i)  $\frac{v}{V} = 2\eta - \eta^2$  ii)  $\frac{v}{V} = 2\eta - 2\eta^2 + \eta^4$  where  $\eta = (y/\delta)$

- b) Experiments were conducted a wind tunnel with a wind speed of 70 km/hr on a flat plate of size 2m long and 1m wide. The density of air is 1.15 Kg/m<sup>3</sup>. The coefficient of lift and drag 0.75 and 0.15 Respectively. Determine i) Lift force ii) Drag force iii) Resultant force iv) direction of resultant force. v) Power exerted by air on plate. **10**

Q.5 a) Lawn sprinkler has two nozzles of diameters 3mm each is connected across a tap of water. The nozzles are at distance of 40 cm and 30 cm from the centre of tap. The rate of water through The tap is 120cm<sup>3</sup>/s. The nozzle discharge water in the downward direction. Determine the angular Speed at which the sprinkler will rotate free. **10**

- b) Derive Prandtl's Universal velocity distribution equation for turbulent flow in pipes what do you understand velocity defects **10**

Q.6a) The pressure drop in an aeroplane model of size 1/10 of its prototype is 80 N/cm<sup>2</sup>. The model is tested in water. Find the corresponding pressure drop in the prototype Take density of air 1.24Kg/m<sup>3</sup>. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise. **10**

- b) The pressure difference  $\Delta p$  in a pipe of diameter D and the length l due to turbulent flow depends on the velocity Viscosity density  $\rho$  and roughness K using Buckingham's  $\pi$  theorem obtain an expression for  $\Delta p$ . **10**

Duration: 3hrs

[Max Marks:80]

- N.B. : (1) Question No 1 is Compulsory.  
 (2) Attempt any three questions out of the remaining five.  
 (3) All questions carry equal marks.  
 (4) Assume suitable data, statistical tables if required and state it clearly.

1

a Show that the matrix  $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$  satisfies Cayley Hamilton theorem [5]

b Prove that  $\mathbf{F} = (x+2y+4z)\mathbf{i} + (2x-3y-z)\mathbf{j} + (4x-y+2z)\mathbf{k}$  is solenoidal [5]

c A discrete random variable has the probability distribution given below [5]

X	0	1	2	3	4	5
P(X=x)	k	3k	5k	7k	9k	11k

Find k, mean

d If  $A = \begin{bmatrix} 4 & -2 \\ 5 & -3 \end{bmatrix}$  then show that  $A^4 = 5A + 6I$  [5]

2

a Find eigenvalues and eigen vectors of the matrix  $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$  [6]

b Using Green's theorem evaluate  $\int (xy + y^2)dx + x^2dy$  where c is the closed curve of the region bounded by  $y = x$  and  $y = x^2$  [6]

C Investigate the association between the darkness of eye colour in father and son from the following. [8]

Color of son's eyes	Color of father's eyes	
	Dark	Not Dark
Dark	48	90
Not Dark	80	782

3

a If  $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$  then find  $A^{50}$  [6]

b By using Big M method solve Minimize  $Z = 2x_1 + 3x_2$  Subject to  $x_1 + x_2 \geq 5$  [6]

$$x_1 + 2x_2 \geq 6; \quad x_1, x_2 \geq 0$$

- C The following table gives the number of accidents in a city during a week. Find [8]  
whether the accidents are uniformly distributed over a week using  $\chi^2$  test.

Day	SUN	MON	TUES	WED	THU	FRI	SAT	TOTAL
No. of accidents	13	15	9	11	12	10	14	84

- 4 a Tests made on breaking strength of 10 pieces of a metal wire gave results [6]  
578,572,570,568,572,570,570,572,596,584 kgs. Test if the breaking strength of  
metal wire can be assumed to be 577 kgs?  
( $t_{\text{tab}}$  at 5 % LOS = 1.833)

- b Show that  $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$  is diagonalizable. Also find the diagonal form and [6]  
the transforming matrix

- C Solve the following LPP by simplex method [8]

Maximize  $Z = 4x_1 + 8x_2 + 5x_3$   
Subject to  $x_1 + 2x_2 + 3x_3 \leq 18$ ;  $2x_1 + 6x_2 + 4x_3 \leq 15$ ;  
 $x_1 + 4x_2 + x_3 \leq 6$ ;  $x_1, x_2, x_3 \geq 0$

- 5 a Show that the matrix A is derogatory and find its minimal polynomial  $A =$  [6]

$$\begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$$

- b It is shown that the probability of an item produced by a certain machine will [6]  
be defective is 0.05. If the produced items are sent to the market in packets  
of 20, find the number of packets containing (i) at least 3 (ii) exactly 3 (iii)  
at most three defective items in a consignment of 1000 packets using  
Poisson Distribution

- C If the vector field  $\vec{F}$  is irrotational find the constants a, b, c where  $\vec{F} = (x + 2y + az)\mathbf{i} + (bx - 3y - z)\mathbf{j} + (4x + cy + 2z)\mathbf{k}$ . [8]

- 6 a Use the dual simplex method to solve the following LPP [6]

$$\text{Min. } Z = 6x_1 + x_2$$

Subject to the constraints

$$2x_1 + x_2 \geq 3$$

$$x_1 - x_2 \geq 0$$

$$x_1, x_2 \geq 0$$



- b A group of 10 rats fed on diet A and another group of 8 rats fed on diet B [6]  
recorded the following increase in weight.

Diet A : 5 6 8 1 12 4 3 9 6 10 gms

Diet B : 2 3 6 8 1 10 2 8 gms

Find if the variances are significantly different at 5% level of significance.

- C Reduce the quadratic form  $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_3x_1$  [8]  
into canonical form and hence find rank, index and signature of the matrix

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Duration : 3.00 Hrs.

[Total Marks:80]

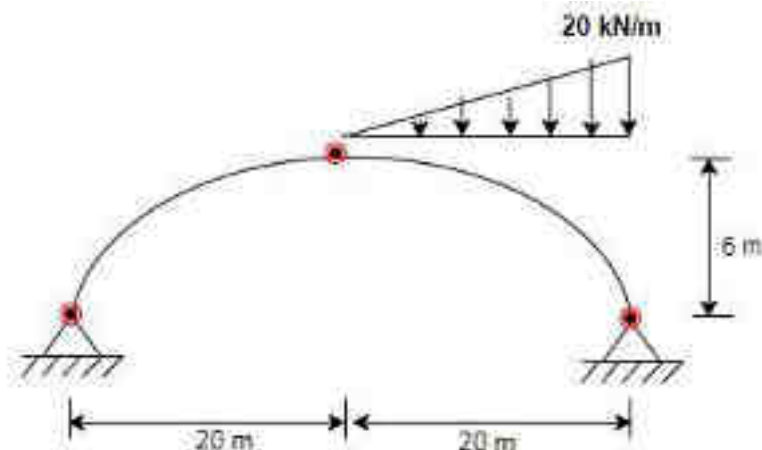
NOTE:

- Question No. 1 is compulsory.
- Attempt any Three out of the remaining five questions.
- Figure to the right indicates full marks. Draw neat sketches wherever necessary.
- Assume suitable data wherever required.

Q.1 Answer **any four** from the following.

20

- (a) Find the vertical reaction and horizontal thrust in three hinged parabolic arch having span 40 m and rise 6 m loaded as shown.



05

- (b) Explain perfect frame, Deficient and redundant frame showing sketch.

05

(c) Define

1. Carry over factor
2. Distribution factor
3. Stiffness
4. Flexibility

05

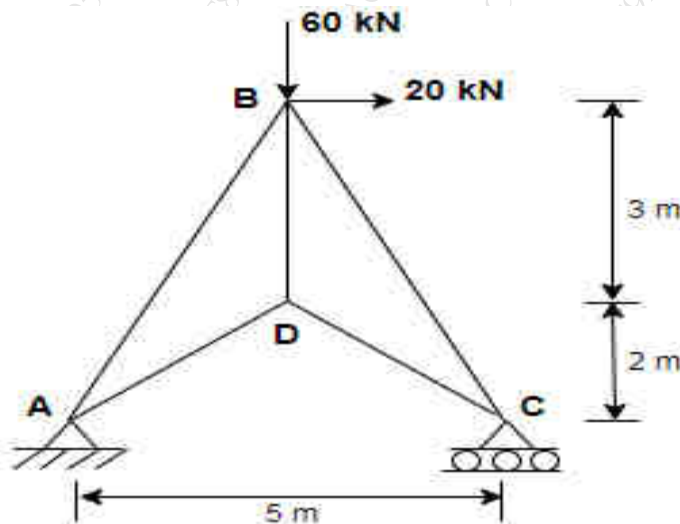
- (d) Differentiate static indeterminacy and kinematic indeterminacy

05

- (e) Show the shape factor for rectangular section is 1.5

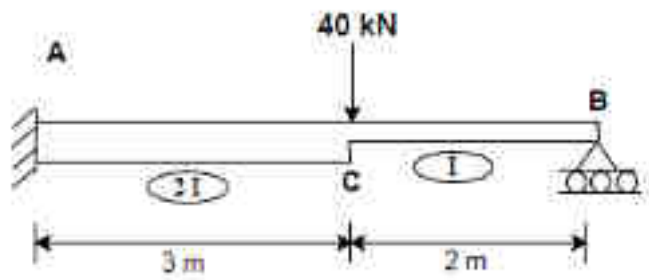
05

Q.2 (a) Analyse the pin jointed frame using method of joints.



12

(b) Determine the reaction at B using flexibility method.



08

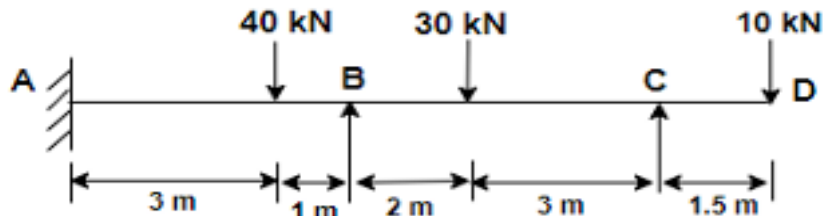
Q.3 (a) A train of 5 wheel loads crosses a simply supported beam of span 22.5 m. Using influence lines, calculate the maximum positive and negative shear forces at mid span and absolute maximum bending moment anywhere in the span.



12

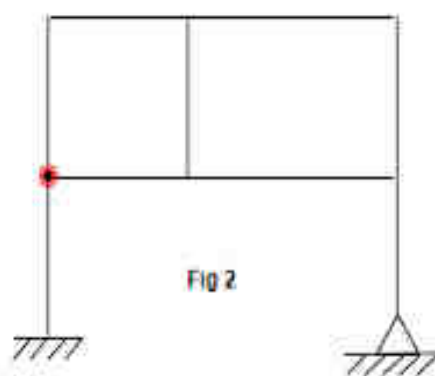
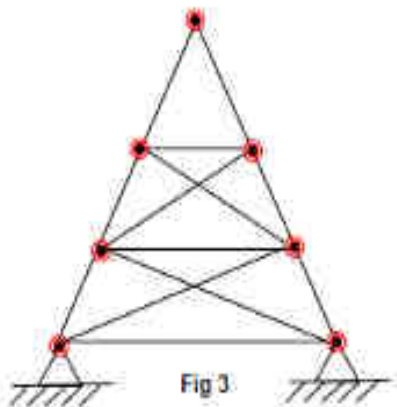
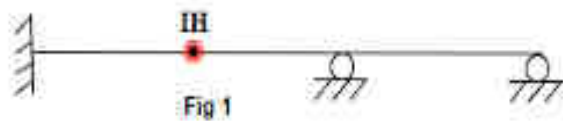


(b) A continuous beam ABCD supported by simple support at A, B, and C, CD is overhang of 1.5 m. Draw BMD Using Three moment theorem.



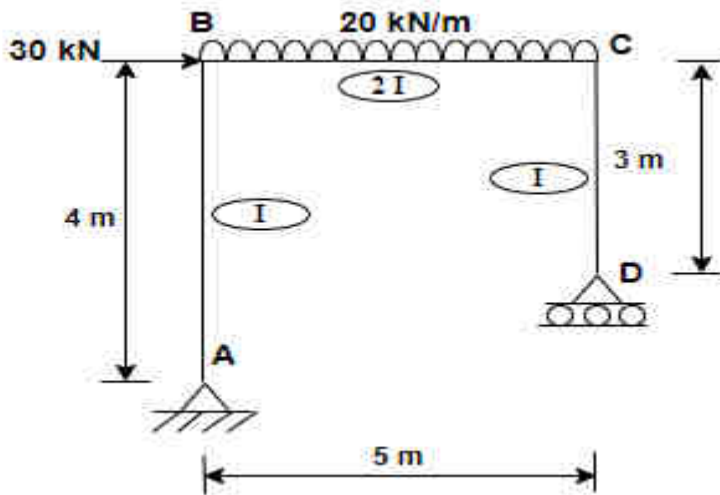
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Q.4 (a) Determine the degree of static and kinematics indeterminacy of following structures



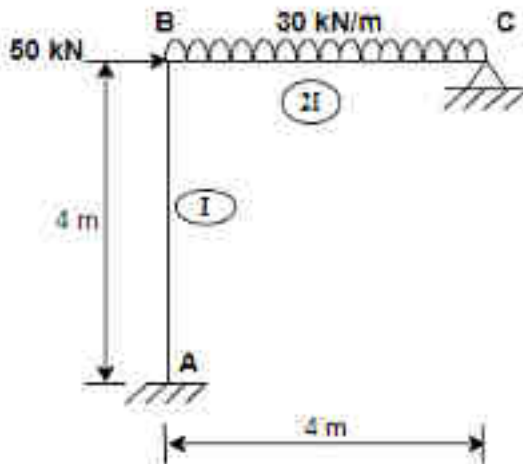
06

(b) Draw BMD of the frame using Moment Distribution method.



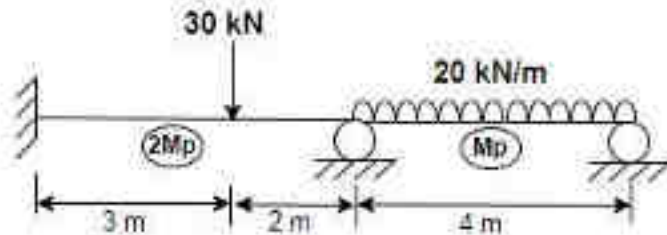
14

Q.5 (a) Draw the BMD for frame using Flexibility method



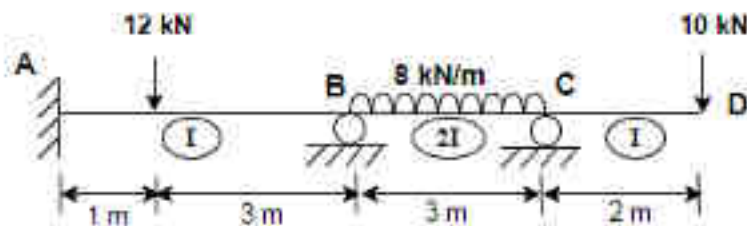
12

(b) Determine the Collapse load for a beam as shown



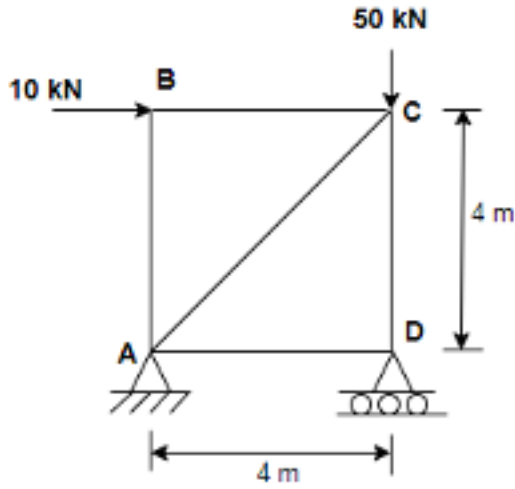
08

Q.6 (a) Analyse the beam by stiffness coefficient method.



10

- (b) Determine the horizontal deflection of Joint D using unit load method. EI is constant for all member and cross section of all member is constant



10

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(03 HOURS)

TOTAL MARKS: 80

- Instructions:** (1) Question No.1 is compulsory  
(2) Answer any **Three Questions** from the remaining questions.  
(3) Draw neat sketches wherever essential.

**Q.1. Solve any Five out of Six 4 Marks each**

- A Classify the basic construction materials used for building construction.
- B Explain merits of accelerators.
- C Write any five types of Paints used in Building construction.
- D What is Water proofing and explain importance of Water proofing.
- E Explain use of Plaster of Paris in construction.
- F What is Admixture? Why it is used in concrete?

**Q.2. Solve any Four out of Six 5 Marks Each**

- A Why Seasoning of timber is important before use in construction? Explain any one Artificial method of seasoning of Timber in Details.
- B Enlist properties of fresh concrete. Explain segregation in detail.
- C Explain various laboratory test of cement. Explain setting time test.
- D Explain factors affecting on selection of construction material?
- E Explain different types of Glass used in construction.
- F Write short note on Mortar.

**Q.3.A Solve any Two out of Three 6 Marks Each**

- 1 Explain the difference between Fine and Coarse Aggregates with respect to their properties and function in construction.
- 2 Write note on Types their uses of cement. (any 6)
- 3 Explain stepwise procedure of Concrete Mix Design by IS 10262 Method.

**Q.3.B Solve any Two out of Three 4 Marks Each**

- 1 What is durability? Explain factors affecting on durability of concrete.
- 2 Explain difference between Nominal Mix and Standard Mix of concrete.
- 3 Why RMC is becoming popular in days then concrete in situ? Explain.

**Q.4. Solve any Five out of Six**

**4 Marks Each**

- A What is NDT of concrete? When it is required?
- B Which are the various tests to find out workability of concrete? Describe any one test of workability in detail.
- C Explain in difference between waterproofing admixture and Bonding admixture.
- D Explain laboratory tests of aggregates. (any 3)
- E Explain manufacturing process of burnt brick.
- F Explain wood properties required for use in construction.

**Q.5. Solve any Two out of Three**

**10 Marks Each**

- A Explain importance of water/cement ratio of concrete.
- B Why curing is required to fresh concrete? Explain any 3 methods of curing of concrete.
- C Draw a proportionate sketch of RMC plant and various component parts. (any 5)

**Q.6. Solve any Four out of Five**

**5 Marks Each**

- A What is Durability? Explain factors affecting on Durability of concrete.
- B What is varnish? Where it is used?
- C What are the various methods of NDT? Describe any one with sketch.
- D What is sound insulating material? Give any two material which can used for sound insulating purpose.

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