

(3 hours)

[Total Marks-80]

Q.1 is compulsory. Attempt any three out of remaining questions.

By suitable data if required, state the same clearly.

Write the right indicate full marks.

Attempt questions in order.

Attempt any four from following:

Explain field procedure of determination of tacheometer constants. (05)

Write detailed note on Beman's Stadia arc. (05)

What is vertical curve? Sketch various types of vertical curves stating their application. (05)

Calculate the ordinate at 10m intervals for a circular curve if the length of long chord is 100m and radius of curve is 200m (05)

Write detailed note on application of GIS and remote sensing in the field of civil engineering. (05)

List various methods of setting out of horizontal curves. Explain setting out of curve by theodolite method. (06)

Explain procedure for calculating data and setting out of vertical curve by chord gradient method. (08)

A 20m chain is used to set out a simple circular curve. Two tangents intersect at stationage 1192m, the deflection angle being 50° . Calculate the necessary data for setting out of a curve of radius 280m using linear method of offsets from chords produced. Take peg interval as 20m. (06)

A tacheometer fitted with annallactic lens is set up at an intermediate point on a traverse course PQ & following observations are made on a vertically held staff: (10)

Staff Station	Staff intercept	Vertical Angle	Axial hair Readings	Remarks
P	2.350	$+8^\circ 36' 0''$	2.105	R L of P is 321.50m
Q	2.055	$+6^\circ 6' 0''$	1.895	

Find length PQ and RL of Q.

Explain how to calculate the R L of top of tower whose base is inaccessible, with one plane method. (05)

Derive an expression for calculating horizontal and vertical distance for line of sight inclined and staff held vertical. (05)

TURN OVER

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- 4
 - a. Calculate the data required for setting out composite curve. It is proposed to right hand 50m radius circular curve with a cubic parabola of 20m length at e. The chainage of intersection point is 80m, the deflection angle being 50° . interval for circular curve & transition curve is 5m. Tabulate the required data instrument used is $20''$.
 - b. Define reverse curve, its necessity and disadvantages of providing reverse curve.
 - c. Write detailed note on errors in stadia surveying

- 5
 - a. A 8m wide road is to deflect through an angle of 60° with the centre line radiu the chainage of point of intersection being 3600m. A transition curve is to be each end of the circular curve of such a length the rate of gain of radial accele 0.5m/s^3 , when the speed is 50kmph. Find: (1) Length of transition curve. (2) cl of all the junction points.
 - b. Explain how surface survey is connected to underground survey and transfer of l while setting out a tunnel.

- 6
 - a. A 0.6% rising gradient meets - 0.7% down gradient. The chainage of and intersection points are 550m and 375m respectively. Calculate the RLs of the p the vertical curve using tangent correction method. The rate of change of grade per peg. The peg interval is 20m. Tabulate the results.
 - b. Explain in detail how to carry out a route survey for a road connecting two states
 - c. Write short note on EDM, its principle and working.

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Q.1 is compulsory.
 2. Attempt any three questions out of the remaining questions.
 3. Assume suitable data if required.
 4. Figures to the right indicate full marks.

the applications of the followings:

Total station
Electronic Theodolite
Remote sensing
GIS

20

in with neat sketches

10

- Composite curve
- Compound curve
- Reverse curve
- Vertical curve

tangents intersect at chainage 2032m having their deflection angle as $46^{\circ}30'$. Calculate all data necessary for setting out a simple circular curve of 250m radius by the offsets from chord produced method. Take P.I. = 20m. 10

straights intersect at chainage 4540m with a deflection angle of 40° . It is proposed to set a circular curve of 330m radius with transition curve 60m long at each end. Compute data necessary for setting out the combined curve having PI = 20m for circular curve and for transition curve? 10

gradient of -1.20% meets a gradient of +1.60% at a chainage of 1410m and elevation of 5m. A vertical curve of length 140m is to be set out with pegs at 10m interval. Calculate elevations of the pegs by chord gradient method. 10

an exhaustive note checking the vertically of high rise structures.
the Road Project in detail. 10
10

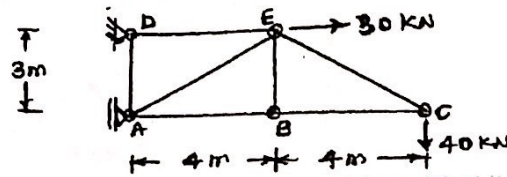
and explain the methods of determining azimuth.
in the procedure of aerial survey. 10
10

notes on:

20

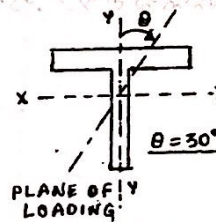
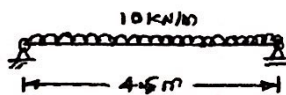
- Soundings
- Site square
- Pentagraph
- Form 7 and Form 12 abstract

- b) Using Castigliano's theorem or virtual work method, determine vertical deflection of joint 'B' of a pin jointed truss loaded as shown in figure. Take $AE =$ Constant for all the members. 10

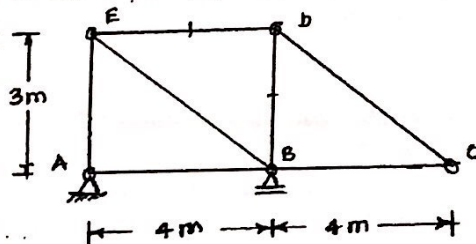


- (a) A 3-hinged stiffening girder of a suspension bridge of span 100 m is subjected to a live load of length 22 m and intensity 30 kN/m moving from left to right. Draw SFD and BMD for the girder, when the head of live load just touches the central hinge on the girder. 12

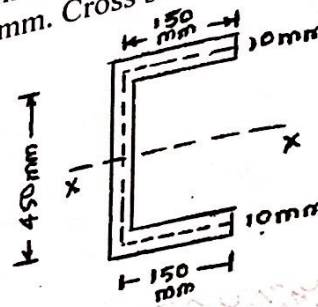
- (b) The cross section of a 4.5 m long simply supported beam is a T-section having flange & web dimensions 200 mm x 20 mm and 16 mm x 180 mm respectively. The beam carries a UDL of 10 kN/m over the entire span and it is acting along a plane, inclined at angle 30° (clockwise) with vertical axis of cross section. Locate the neutral axis of bending. Also find maximum stress produced at the critical section. 8



- (a) Draw ILD for axial force in truss members ED & DB as shown in figure. 4
The live load moves along the bottom chord.



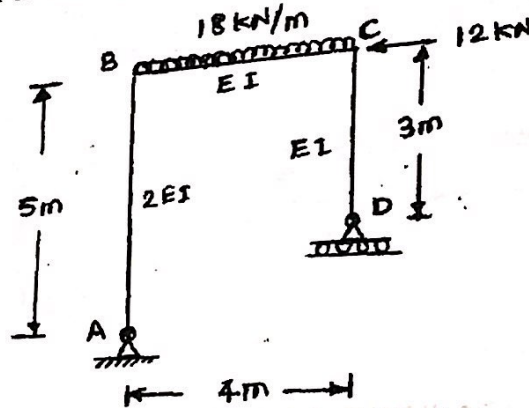
(b) Locate the shear centre for thin walled section as shown in figure. Assume uniform wall thicknesses as 10 mm. Cross sectional dimensions are in mm.



Q.6 A rigid jointed plane frame loaded as shown in figure. Using unit load method determine-

- Rotation at hinge support 'A'.
- Horizontal movement of roller support at 'D'.

Express your answer in terms of EI.



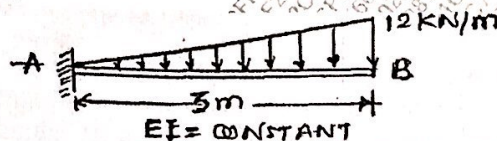
(3 Hours)

(Max. Marks-80)

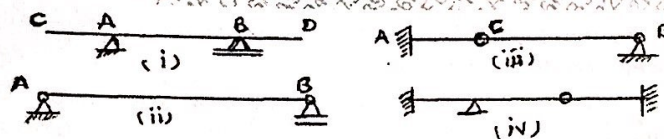
- Question no.1 is **compulsory**. Attempt any three out of remaining five questions.
 Figures to the write indicate full marks.
 Assume suitable data if needed but justify the same.

Answer any four from following-

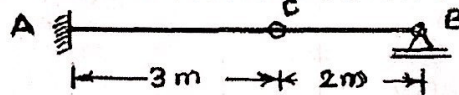
- (a) Define the term Strain Energy and calculate its value for the cantilever beam loaded as shown.



- (b) Figures below show the Conjugate Beams. Draw the neat sketches for their respective Real Beams.



- (c) Draw the qualitative ILDs for V_A , M_A , V_B and shear force just to the right of hinge 'C' in the beam shown below-



- (d) Define the terms- (i) Product of inertia (ii) Unsymmetrical bending and (iii) Shear-centre.

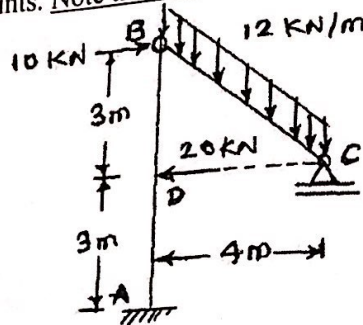
- (e) A suspension cable ACB of span 60 m with central deep 6 m is suspended from two supporting points A and B which are at the same level. It carries UDL of 15 kN/m over the entire span. Find the value of minimum cable tension. Also find the percentage increase in cable tension at left quarter point 'D' and at the supporting points.

- (f) State and explain Castigliano's theorem to find slope & deflection in a given loaded structure. Also state the limitations of this theorem if any.

OR

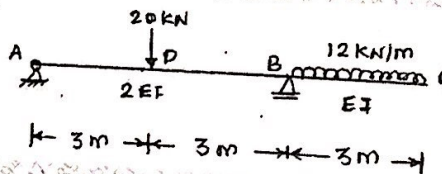
State the salient features of Macaulay's method.

- Q.2 (a) For a rigid jointed plane frame shown in figure, find support reactions, draw AFD, SFD and BMD for the frame. Also draw FBD for AB and BC. Note that there is internal hinge at 'B'.



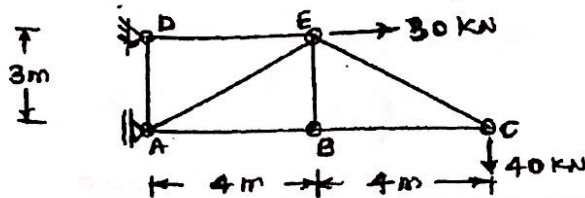
- b) A parabolic arch ACDB of span 30 m and central rise 4 m is hinged at ends and the third hinge is provided in the arch rib at right quarter point C. It carries UDL of 12 kN/m in left half portion AC along with a point load of 18 kN at hinge D. Find –
 (i) Support reactions
 (ii) NT and RSF at left quarter span point.
 (iii) Maximum BM and its location in part AC.
 Also draw BMD for the arch.

- Q.3 (a) Using Moment Area Method OR Conjugate beam method, determine the slope at supports A and B & deflection at point D and C of an overhanging beam loaded as shown.



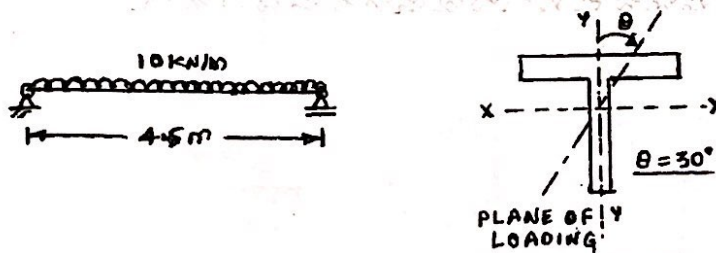
- b) A hollow circular column of length 6 m, external diameter 220 mm and internal diameter 180 mm is fixed at both ends. If the column carries a load of 180 kN applied at distance 50 mm from column axis, determine extreme fibre stresses. Also sketch the stress distribution diagram. Take E for column material as 100 GPa.
- Q.4 (a) A simply supported girder of span 40 m is traversed by a series of four wheel loads 120 kN, 150 kN, 200 kN and 100 kN spaced at distances 2 m, 1 m and 1 m respectively. If the load system is moving from left to right with 100 kN as leading load, find location & magnitude of maximum BM occurs anywhere in the girder.

- b) Using Castigliano's theorem or virtual work method, determine vertical deflection of joint 'B' of a pin jointed truss loaded as shown in figure. Take $AE =$ Constant for all the members. 10

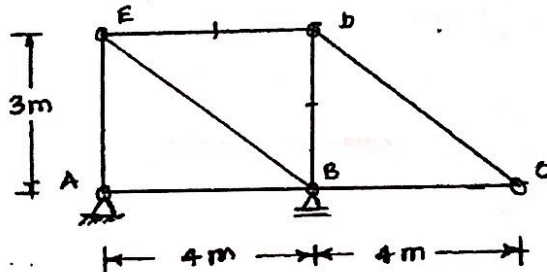


- (a) A 3-hinged stiffening girder of a suspension bridge of span 100 m is subjected to a live load of length 22 m and intensity 30 kN/m moving from left to right. Draw SFD and BMD for the girder, when the head of live load just touches the central hinge on the girder. 12

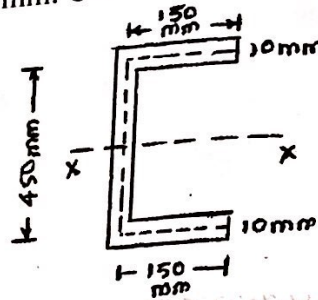
- (b) The cross section of a 4.5 m long simply supported beam is a T-section having flange & web dimensions 200 mm x 20 mm and 16 mm x 180 mm respectively. The beam carries a UDL of 10 kN/m over the entire span and it is acting along a plane, inclined at angle 30° (clockwise) with vertical axis of cross section. Locate the neutral axis of bending. Also find maximum stress produced at the critical section. 8



- (a) Draw ILD for axial force in in truss members ED & DB as shown in figure. The live load moves along the bottom chord. 4



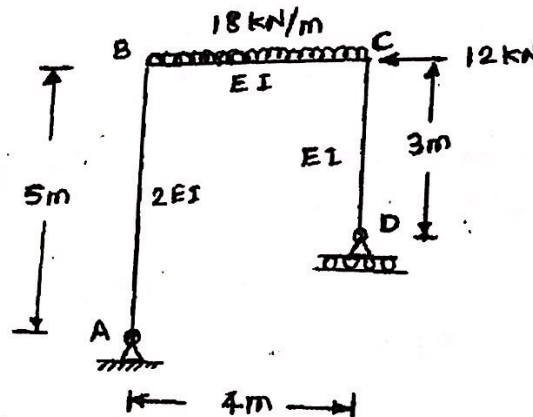
(b) Locate the shear centre for thin walled section as shown in figure. Assume uniform wall thicknesses as 10 mm. Cross sectional dimensions are in mm.



Q.6 A rigid jointed plane frame loaded as shown in figure. Using unit load method determine-

- Rotation at hinge support 'A'.
- Horizontal movement of roller support at 'D'.

Express your answer in terms of EI.



Question no.1 is **compulsory**. Attempt **any three** out of remaining five questions.
 Figures to the write indicate full marks.
 Assume suitable data if needed but justify the same.

Answer any four from following-

i. State and explain-

ii. Betti's theorem

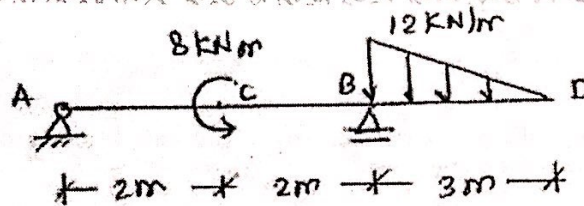
iii. Castigliano's theorem.

iv. Write Prof. Perry's formula, explaining the terms involved. Also state the importance of this formula over Secant formula. 5

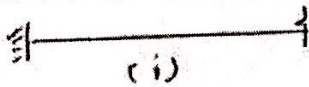
v. A 3-hinged symmetrical parabolic arch is subjected to UDL over the entire span, using the concept of ILD for bending moment (BM); prove that the BM at every section of the arch is zero. 5

vi. Explain with neat sketches the terms-(i) Unsymmetrical bending (ii) Shear centre. Also state their significance in structural analysis. 5

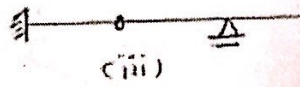
vii. Write the BM equation needed as per Macaulay's method for the beam loaded as shown- 5



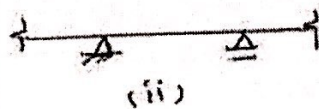
viii. State & explain Moment Area Theorem-II. Also draw the conjugate beams for following real beams shown below- 5



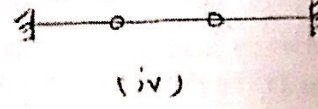
(i)



(iii)

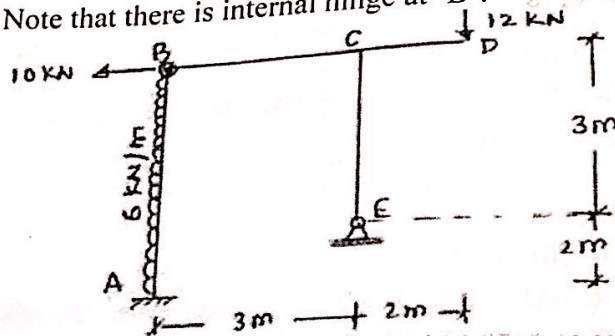


(ii)



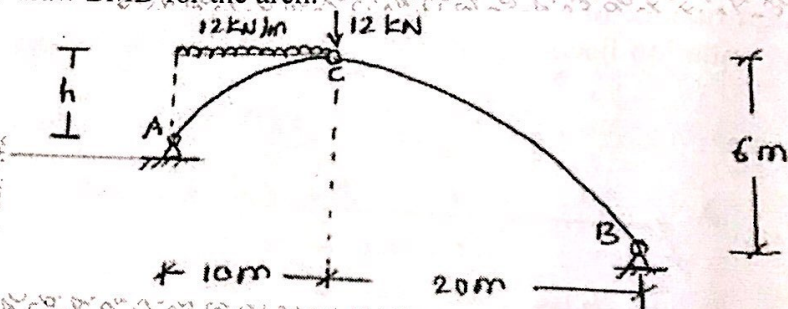
(iv)

- Q.2 (a) For a rigid jointed plane frame shown in figure, find support reactions and draw AFD, SFD and BMD for the frame, indicating important points. Note that there is internal hinge at 'B'.

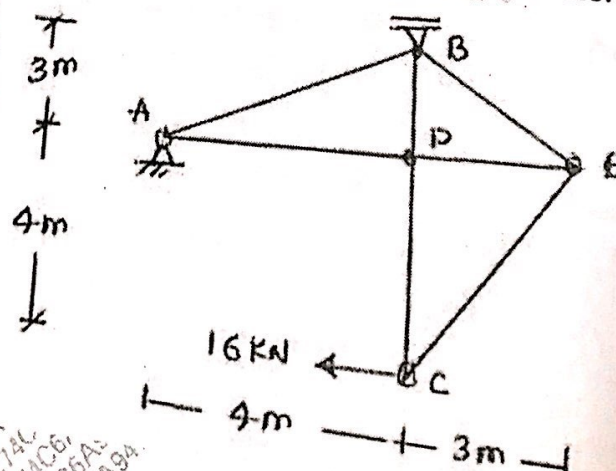


- (b) An unsymmetrical 3-hinged parabolic arch is loaded as shown in figure. Find-

- The position of third hinge at 'C' above the left support.
- Support reactions.
- The position & magnitude of max +ve and max -ve BM in the arch. Also draw BMD for the arch.

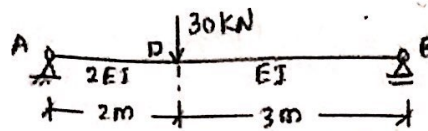


- Q.3 (a) A pin jointed truss is loaded and supported as shown in figure. Determine the horizontal deflection of joint 'C' using Unit Load Method. Take axial rigidity $AE = 30,000 \text{ kN}$ for all members.



Q. P. Code :25896

Using Moment Area Method OR Conjugate beam method, determine the location & magnitude of maximum deflection in a non-prismatic simply supported beam as shown. 10



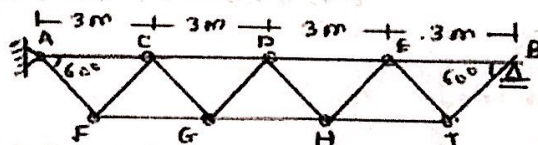
A 3-hinged stiffening girder of a suspension bridge of span 120 m is subjected to point loads of 180 kN and 240 kN at distances 30 m and 80 m respectively from support. The supporting cable has a central dip of 12 m. Draw SFD & BMD for girder, indicating important points. Also find maximum & minimum cable tension. 12

A simply supported girder of span 24 m is traversed by a series of five wheel loads 8 kN, 20 kN, 20 kN, 25 kN and 18 kN spaced at distances 3 m, 2 m, 2 m and 3 m respectively. If the load system is moving from left to right with 18 kN as leading wheel, find the location & magnitude of absolute maximum BM in the girder. 8

A hollow circular column of length 6 m, external diameter 200 mm and internal diameter 150 mm is fixed at both ends. If the column carries a load of 200 kN applied at a distance 40 mm from column axis, determine extreme fibre stresses. Also sketch stress distribution diagram. Take E for column material as 96 GPa. 10

The cross section of a 5 m long simply supported beam is a T-section having flange & web dimensions 120 mm x 20 mm and 20 mm x 180 mm respectively. The beam carries a central point load of 36 kN inclined at angle 30° (anti clockwise) with vertical axis of cross section. Find maximum compressive and maximum tensile stress at the central section. Also draw the stress distribution diagram. 10

Draw ILD for axial force in top member DE of a warren truss shown in figure. 4



A rod AB of uniform cross section is fixed at 'A' and is bent in vertical plane to the shape of quadrant of a circle of radius 'R'. At free end B a horizontal load 'P' (outwards) is applied. Determine- 6

- Strain energy stored in the rod due to bending moment
- Horizontal deflection at B. Assume $EI = \text{Constant}$.

Q.P. Code : 18498

(4 Hours)

(Max. Marks:80)

Q.No. 1 is compulsory

Attempt any three questions from remaining five questions.

Assume any data suitably if not given and state it clearly.

It is proposed to construct a **RESIDENTIAL APARTMENT (STILT+3)** in Thane City. The building is, R.C.C. framed structure, The plot size is 28 m x 30 m. There are two flats on each floor, **Type 1: 1 BHK (Approx. Area 55 sq. mt.)** and **Type 2 : 2BHK (Approx. 70 sq.mt.)**

Provide passages, staircase, parking area etc. as per byelaws.

- | | |
|---|------|
| (a) Draw Typical floor plan. | (15) |
| (b) Draw Stilt Level plan | (05) |
| (a) Explain Principles of planning with neat sketches. | (10) |
| (b) Draw the foundation plan for the building given in Q.No.1 | (10) |
| (a) Draw the detailed sectional elevation passing through staircase and other important units of building given in Q.No.1. | (15) |
| (b) Explain Working drawing and submission drawing | (05) |
| (a) Differentiate among Load Bearing, Framed and Composite structure with neat sketches and examples. | (06) |
| (b) Draw the plan and section of pitched roof on hall measuring 8m x 8m. | (08) |
| (c) Explain Sun Path diagram with its application in building planning | (06) |
| (a) Draw the front elevation of the building given in Q.No.1. | (10) |
| (b) Draw the site plan showing proposed built-up area, internal road, parking area, open space etc of the building given in Q.No.1. | (10) |
| (a) Draw the plan and section of open well staircase for an educational building (G+1) having floor to floor height 3.6 mts. Also show design calculations. | (10) |
| (b) What are various objects of building bye-laws. Explain Carpet area. | (05) |
| (c) Draw roof terrace plan of the building given in Q.No.1 | (05) |

Q. P. Code: 40831

Time: 4 Hours

Max.Marks:80

Q. No. 1 is compulsory.

Attempt any 3 of the remaining questions.

Assume any suitable data, if required and clearly mention the same.

is proposed to construct a Residential Bungalow as (G+1) R.C.C framed structure on a plot of 40 m.X45 m. with Floor-Floor height of 3.3 m. Following are the requirements:

- (i) Living Room = 22 Sq.m.
- (ii) Drawing Room = 20 Sq.m.
- (iii) Master's Bed Room (with A.T) = 20 Sq.m.
- (iv) Kitchen = 12 Sq.m.
- (v) Dining = 16 Sq.m.
- (vi) Bed Room = 16 Sq.m.
- (vii) Guest Room = 14 Sq.m.
- (viii) Pooja Room = 12 Sq.m.

ilets, passages etc. as per the Bye-laws. Draw the following with asuitable scale:

- | | |
|------------------------------|----|
| (a) GROUND FLOOR PLAN | 15 |
| (b) LINE PLAN OF FIRST FLOOR | 05 |

aw 2-Point perspective for the building, you have proposed in Q.No.1	20
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Draw SITE PLAN for the building, you have proposed in Q.No.1	05
--	----

Draw Sectional Elevation for the building, you have proposed in Q.No.1	15
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an, Design and draw a HOTEL (Lodging & Boarding) building in a City with the following facilities as (G+1) R.C.C framed structure. (Floor-Floor height = 3.6 m.).

- (i) Single-Bed Rooms = 6 no.(each 15 Sq.m. with A.T)
- (ii) Double-Bed Rooms = 6 no.(each 20 Sq.m. with A.T)
- (iii) Entrance & Reception = 40 Sq.m.
- (iv) KITCHEN = 60 Sq.m.
- (v) DINING = 100 Sq.m.
- (vi) LAUNDRY = 30 Sq.m.
- (vii) HEALTH CLUB = 60 Sq.m.

ilets, passages etc. as per the Bye-laws. Draw the following with asuitable scale:

- | | |
|------------------------------|----|
| (a) GROUND FLOOR PLAN | 15 |
| (b) LINE PLAN OF FIRST FLOOR | 05 |

Draw Front Elevation for the building, you have proposed in Q.No.1	10
--	----

Draw Foundation Plan & details of one Footing for the building, you have proposed in Q.No.1	10
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ite Short notes on the following:	20
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- Principles of TOWN PLANNING
- GREEN BUILDING
- Principles of Planning for Residential structures
- SUN-PATH DIAGRAM/WIND-ROSE DIAGRAM

(3 Hours)

[Total Marks : 80]

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.

Explain workability of concrete.

Explain in brief shotcreting.

Write a note on grading of aggregate.

Write a note on permeability of concrete.

What do you understand by High strength concrete. What are the constituents of high strength concrete? How is high strength concrete produced?

What is roller compacted concrete? Explain the properties of it.

Differentiate between nominal mix and design mix. Explain the step by step procedure of concrete mix design? What are the factors to be considered for proportioning of concrete?

Explain alkali-aggregate reaction in detail.

Enlist the crack repair techniques. Explain any one in detail.

What do you understand by soundness of cement? Explain the procedure to determine the soundness of cement.

What is High Range Water Reducer (HRWR)? Explain the effects, advantages and disadvantages of HRWR.

Explain the test of flexural strength of concrete.

Write short notes on the following (any four)

- i Mineral admixture
- ii Distress in concrete
- iii Field test on cement
- iv Ferrocement
- v laitance in concrete

Time: 3 hours

(Total Marks 80)

1. Question No. 1 is compulsory.
 2. Attempt any three out of remaining questions.
 3. Assume any suitable data, wherever required and state the same.

Attempt any four of the following.

(20M)

- Explain briefly the factors affecting the requirement of construction material.
- What qualities in bricks are essentially required from construction point of view?
- What are the constituents of cement?
- Explain method of waterproofing.
- Describe the vacuum concreting method.
- State requirements of ideal form work.

a) Explain quarrying of stones (7M)

b) Explain the properties of fine aggregates. (5M)

c) Enlist the types of tests conducted on mortar? Explain any two of them with neat sketch (8M)

a) Explain Brick Bat coba coat used for waterproofing with neat sketch (7M)

b) Write a short note on various operations involved during concreting (8M)

c) State and explain the factors affecting on durability of concrete (5M)

a) Write a short note on glass fibre reinforced plastic (5M)

b) Explain in detail seasoning of timber. (10M)

c) What are the objectives in mix design? (5M)

a) What is the role of transit mixer in construction? (5M)

b) Enlist the joints in stone masonry and Explain any one of them (7M)

c) Sketch plan and elevation of $1\frac{1}{2}$ Brick wall in single Flemish bond (8M)

a) Explain defects in painting (5M)

b) Write short note on Scaffolding? (5M)

c) State advantages and disadvantages of Shahabad stone (5M)

d) Sketch the cross section of king post truss and labelled it (5M)

(3 Hours)

(Total Marks : 80)

- 1) Question no 1 is compulsory.
- 2) Attempt any three questions out of remaining five questions.
- 3) Assume any additional data if necessary and state clearly.
- 4) Draw neat figures as required.

Attempt any four of the following

- 1) Explain the term co-efficient of friction. On what factors does this coefficient depend?
- 2) Define and explain the terms: Hydraulic gradient line and Total energy line.
- 3) What is meant by boundary layer? Why does it increase with distance from the upstream edge?
- 4) What do you mean by sub sonic, sonic and supersonic flows?
- 5) Derive Darcy-Weisbach equation.
- 6) What is siphon? On what principle it works?

The difference of water level of two reservoir is 6m. They are connected by 30m long pipe. The first 20m length the diameter of the pipe is 120mm and for the remaining length the diameter is 200mm, the change in diameter being sudden. Find discharge into lower reservoir. Take $C_{f1} = 0.008$. Draw HGL & TEL also. (10)

Derive an expression for equivalent size of pipe in series. A piping system consists of three pipes arranged in series. The lengths of the pipes are 1000m, 800m, 300m and the diameters are 400mm, 400mm and 300mm respectively when they are connected in series. These pipes are to be replaced by a single pipe of length 2100m. Find the diameter of single pipe. (10)

Explain what is meant by separation of boundary layer? Describe with sketch the methods to avoid separation. (12)

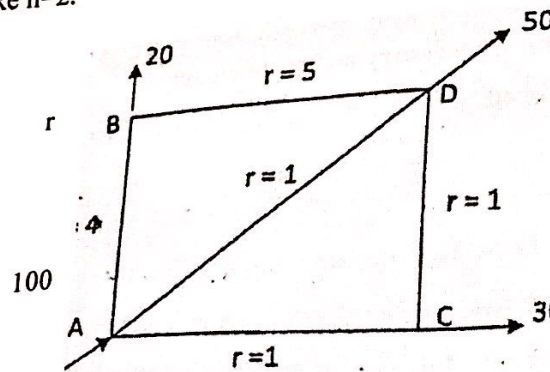
An aeroplane travels in air of pressure of 1 bar at 10°C at a speed of 1800 km/hour. Find the Mach number and Mach angle. Take $k = 1.4$ & $R = 287 \text{ J/Kg K}$. (8)

Explain Water hammer with control measures (6)

Find the velocity of a bullet fired in standard air, if the Mach angle is 30° . For standard air $\rho = 1.2 \text{ Kg/m}^3$, $T = 15^\circ\text{C}$ and $k = 1.4$ (4)

A nozzle is fitted to a pipe 120mm in diameter and 250m long, with coefficient of friction as 0.008. If the available head at the nozzle is 100m. Find the diameter of the nozzle and the maximum velocity transmitted by a jet of water discharging freely out of a nozzle. (10)

Q5a) Calculate the discharge in each pipe of the network shown in fig below by Hardy method. Take $n=2$.



Q5b) Oil of specific gravity 0.82 is pumped through a horizontal pipeline 15mm in diameter 3Km long at the rate of $0.015 \text{ m}^3/\text{s}$. The pump has an efficiency of 68% requires 7.5 hp to the oil. (i) What is the dynamic viscosity of oil?

(ii) is the flow laminar?

Q6) Attempt any four of the following

- Define Mach number and state its significance in compressible fluid flow.
- Write a note on Moody's diagram.
- Explain Prandtl's mixing length theory.
- Explain Dashpot mechanism.
- What are the important characteristics of laminar flow? Give examples where such encountered.
- Write a note on Water Hammer & Control measures.

Paper / Subject Code: 38806 / FLUID MECHANICS -II

(3 Hours)

[Total Marks: 80]

Question No.1 is compulsory.
 Attempt any three from remaining.
 Assume any suitable data if required, state the same clearly.
 Figures to the right indicate full marks.
 Attempt sub questions in order.

Attempt any five

Compare Pipes in series and pipes in parallel.
 Compare Laminar flow and Turbulent flow.
 Compare Hydro dynamically smooth and rough boundaries.
 What is siphon? Explain its working.
 Write short note on Mach cone & Mach line.
 Explain HGL and TEL

(20)

Describe Kinetic energy correction factor & momentum correction factor. (06)

Write detailed note on Dash pot mechanism and its application. (05)

An oil of viscosity 1.5 poise and relative density 0.9 is flowing through circular pipe of diameter 30mm and length 3m at one tenth of the critical velocity for which Reynolds number is 2450. Find (1) the velocity of flow through the pipe. (2) the pressure head of oil to maintain the flow in the pipe. (3) the power required to overcome viscous resistance to flow of oil. (09)

The speed of supersonic aircraft flying at an altitude of 1100m corresponds to Mach number 2.5. Find the time elapsed between the instant the aircraft was directly over head of an observer & the instant observer feels the disturbance due to aircraft. Consider following three cases: when (a) observer is stationary (b) observer is moving in the direction of aircraft at $M=0.5$. (c) observer is moving in opposite direction of aircraft with $M=0.5$. Take $\gamma = 1.4$, $R = 287 \text{ J/kg K}$ & temperature at given height is 280°K . (10)

Laminar flow takes place in circular tube. At what distance from the boundary the local velocity is equal to the mean velocity. (04)

A compound pipe system consists of 1800 m of 50cm diameter, 1200m of 40cm diameter, 600m of 30cm diameter connected in series. (i) What is equivalent length of 40cm diameter pipe of same material? (ii) If three pipes are connected in parallel, what would be the equivalent length of 50cm diameter pipe? (06)

An equilateral triangle is divided into two parts by a vertical from the vertex to the horizontal base. The value of K for vertical bisector, two base pipes and other two sides of triangle are 4, 2 and 3 respectively. Take $n = 2$, find the flow distribution in not more than two trials for an input of 100 units at vertex & output of 30 units each from left and right junction and 40 units from the mid point of junction. (08)

- b. Two reservoirs with a difference in elevation of 15m are connected by three pipes. The pipes are 300m long of diameter 30cm; 150m long of diameter 20cm and 150m long of diameter 25cm. The friction factor for three pipes are 0.018; 0.020 and 0.025. The contraction and expansion are sudden. Determine the flow rate in lps. Pipe

5. a. Derive Hagen Poiseuille Formula for laminar flow through circular pipes.
b. Show that the diameter of the nozzle for maximum transmission of power is given by

$$d = \left[\frac{D^5}{8fL} \right]^{1/4} \text{ where } D \text{ is diameter of pipe and } L \text{ is length of pipe.}$$

- c. A pipe line carrying water has surface protrusions of average height 0.1mm. The roughness developed is 8Pa; determine whether the pipe surface acts as a smooth; rough or transition. Take density of water as 1000kg/m³ and kinematic viscosity 0.0093 stokes.

6. a. A smooth pipe of 80mm diameter and 1000m long is carrying water at the rate of 100 lps. Kinematic viscosity 0.015 stoke; calculate (1) loss of head (2) wall shear stress (3) velocity (4) velocity and shear stress at 20mm from the pipe wall (5) thickness of laminar layer.

- b. Write short note on Prandtl Mixing length theory.

- c. Rewrite following with correct choice:

- (i) The most essential feature of turbulent flow is

- (a) high velocity (b) velocity and pressure exhibit irregular fluctuations of high magnitude
(c) large discharge (d) none of above

- (ii) In case of viscous flow through a circular pipe the average velocity of fluid is

- (a) Twice the maximum velocity (b) half the maximum velocity
(c) 1.5 times the maximum velocity (d) none of above

- (iii) The energy loss in a pipeline is due to

- (a) surface roughness only (b) viscous action only
(c) friction of pipe wall and viscous function (d) none of above

- (iv) The region outside the mach cone is called

- (a) zone of action (b) zone of silence (c) control volume
(d) none of above

[3 Hours]

Marks: 80

- B:
- Question No.1 is compulsory.
 - Solve any three questions out of the remaining questions.
 - Assumptions, if any, should be clearly stated. Draw sketches wherever required.

1 (Solve Any four sub-questions. Each carries 05 marks)

- Explain the field procedure to set out a simple circular curve by Rankine's method of deflection angles.
- Describe the roles and responsibilities of Survey of India department.
- Write a note on Remote Sensing and its applications in Civil Engineering.
- Draw the format of a 7/12 Abstract and state the data mentioned in it.
- Explain the working of a handheld GPS receiver.

(20)

2 (20)

- Two tangents intersect at a chainage 1950 m, the deflection angle being 38° . Calculate all the necessary data for setting out a curve with a radius of 350 m by Rankine's method. Take Peg Interval as 30 m. 12
- Two straights AB and BC intersect at a chainage of 2520 m. The deflection angle is 52° . It is proposed to insert a circular curve of radius 340 metres between two transition curves of length 85 metres each. Calculate all the elements required to set out the curves. 08

(20)

- A downgrade of 2.5% is followed by an upgrade of 3.5%. The RL of point of intersection is 350 m & its chainage is 1400 m. A vertical curve of 200 m length is to be introduced to connect the two grades. If the peg interval is 20 m. Calculate the elevations of the points on the curve using tangent correction method. Tabulate the results. 12
- What do you understand by setting out of a work? Explain the procedure for setting out a building. 08

(20)

- Explain Any one of the following projects in detail : 10
 - Radial contouring
 - Profile levelling.
- Explain stepwise procedure of collecting the data of a traverse ABCD using Total station including the initial temporary adjustments. 10

(20)

- Mention the general and Civil Engineering specific applications of GPS. 10
- The meridian altitude of a star was observed to be $64^\circ 36' 20''$ on a certain day, the star lying between the zenith and the equator. The declination of the star was $26^\circ 12' 10''$ N. Find the latitude of the place of observation. 05
- State the duties and responsibilities of a Tehsildar. 05

Q 6.

- a) Explain spatial and non-spatial data in GIS. Enlist names of few softwares.
- b) A section line AB appears to be 10.16 cm on a photograph for which the length is 16 cm. the corresponding line measures 2.54 cm on a map which is to a scale 1/50,000. The terrain has an average elevation of 200 m above mean sea level. Calculate the flying altitude of the aircraft above mean sea level when the photograph was taken.
- c) Explain the working principle of EDM.

(3 Hours)

(Maximum Marks 80)

B.

- Question No.1 is compulsory.
 Attempt any three questions out of remaining questions.
 Assume suitable data if required but justify the same.

Attempt any four from following-

A circular section having of 300 mm external diameter and 20 mm thickness is used as a column of 4.2 m length. Both ends of the column are fixed. It carries a load of 80 KN at an eccentricity of 30 mm from the axis of the column. Find the maximum bending moment. Take $E = 94,000 \text{ MPa}$. 5

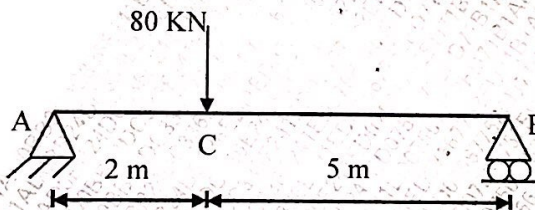
Define influence lines and explain its importance. Draw typical ILD for R_A and M_A for a cantilever beam AB, where A is fixed and B is free. 5

State and explain the two Mohr's theorems of Moment Area Method. 5

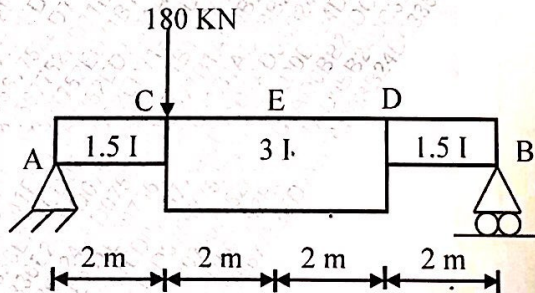
Using strain energy method, determine the deflection at free end of a cantilever having length L and carrying a point load of P at free end. 5

A cable carrying a load of 20 KN/m run of horizontal span is suspended between two supports 120 m apart. The supports are at the same level and the central cable dip 6 m. Find maximum and minimum tensions in the cable. 5

Find slope at A using Macaulay's Method. 5



Find rotation at A, B and deflection at E (mid-span) for the beam shown in figure using Conjugate Beam method. $EI = \text{Constant}$. 8

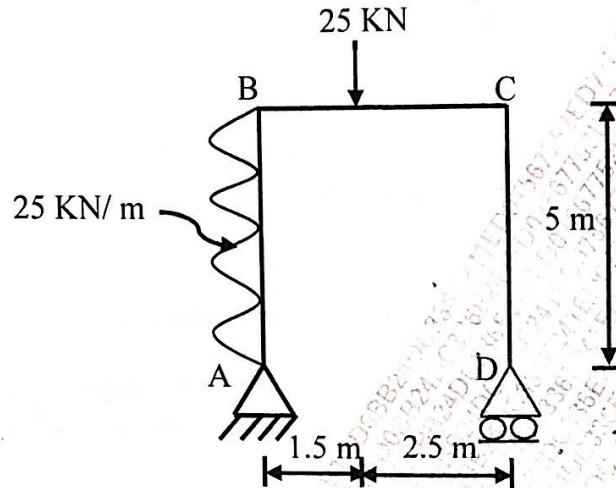


A three hinged symmetrical parabolic arch ADCEB having central rise 6 m has a span 40 m. It is hinged at A, B and at crown C. Point D and E are 10 m away from left and right support respectively. The arch carries an UDL of 20 KN/m over the portion DE. Find, 12

i) Support Reactions. ii) BM, Normal Thrust at D
 BM and Radial Shear force at E.

Q.3

- A cantilever beam of 6 m span carries a UDL of 24 kN/m over half span starting from fixed end. Find slope and deflection at free end by Moment Area Method. $EI = \text{Constant}$.
- Draw AFD, SFD and BMD for each member shown in following figure

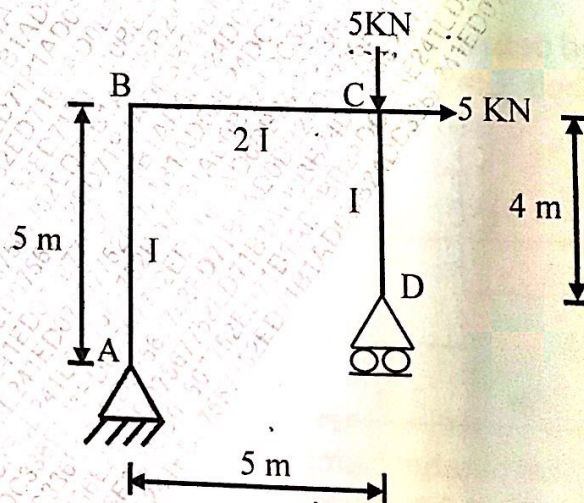


Q.4

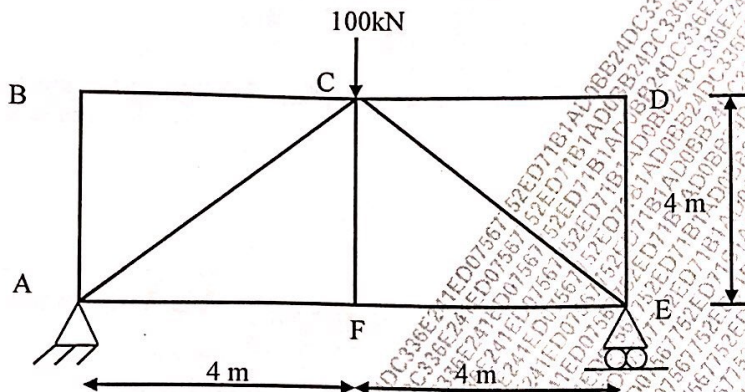
- A cable of 150 m span has a central dip of 15 m. It carries a load of 5 kN/m over its entire span. Calculate the maximum and minimum tension in the cable. Also calculate the horizontal and vertical force in the pier if the cable passes over a frictionless support at the top of pier.
- Four point loads having magnitudes of 10 kN, 18 kN, 18 kN and 12 kN are at 2 m centre-to-centre spacing from each other with the 12 kN load leading. They traverse a girder of 30 m span from left to right. Calculate the maximum moment and maximum shear force at 8 m from the left support.

Q.5

- Find horizontal deflection at the roller support for the frame as shown in figure using the Load Method.



Find vertical deflection of the joint B in the truss loaded as shown in following figure. 10
Area of each section is 5000 mm². $E = 2 \times 10^5$ MPa.

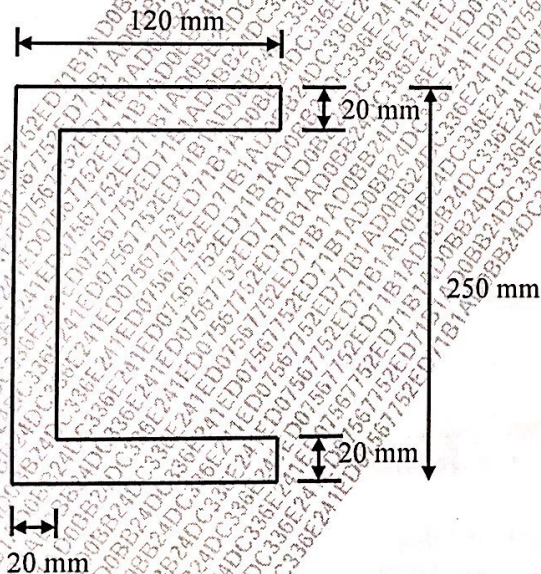


Define principal moment of inertia and explain unsymmetrical bending with neat sketch. 6

State the internal forces developed in the following members with neat free body diagram. 6

- Arch.
- Cable.
- Beam.
- Pin Jointed Frame.
- Rigid Jointed Frame

State shear centre for a thin walled channel section shown in figure. 8



(4 Hours)

(Max. Marks:80)

Q. No. 1 is compulsory

Attempt any three questions from remaining questions.

Assume any data suitably if not given and state it clearly.

A building is proposed to allot a residential bungalow as (G+1) R.C.C. framed structure. Following are the various units of the bungalow, according to their function in two floors. The plot area measuring

30 m x 35 m.

- () Living Room : 24 sq. mt.
- () Master Bedroom with A.T : 24 sq. mt.
- () Bedrooms (2 Nos.) : 15 sq. mt., each
- () Dining Room : 16 sq. mt.
- () Guest Room : 20 sq. mt.
- () Study Room : 14 sq. mt.
- () Kitchen : 12 sq. mt.
- () Store : 12 sq. mt.

Provide passages, staircase, open space etc. as per byelaws.

Draw Ground floor plan. (15)

Draw First Floor Line Plan (05)

What are the Building Bye-Laws & Zoning Regulations. Explain properly. (10)

Explain in detail about PRINCIPLES OF PLANNING for RESIDENTIAL BUILDINGS (10)

Draw the detailed sectional elevation passing through staircase and other important parts of building given in Q.No.1. (20)

Draw the Foundation plan of the building & section of one Footing, which you have planned for Q.No.1. (14)

Draw the Site Plan showing proposed built-up area, internal road, parking area, open space etc of the building given in Q.No.1. (06)

Draw the plan and section of King-Post Roof Truss (10)

Draw the front elevation of the building given in Q.No.1 (10)

Draw roof/ terrace plan of the building given in Q.No.1 (08)

Draw the plan and section of Dog-Legged staircase for a Residential I building as (G+1) building, having floor to floor height 3.9 mts. Also show design calculations. (12)

(3 Hours)

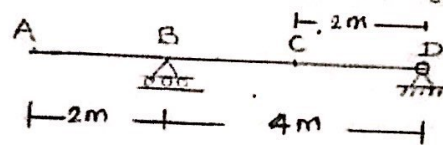
Maximum Marks-80

B:

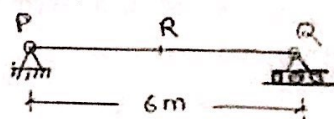
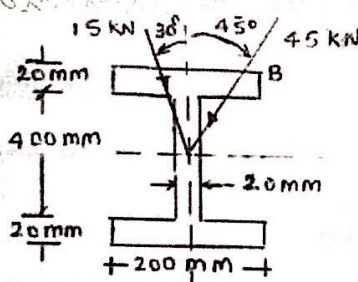
- 1 Q. No. 1 is compulsory. Attempt any three out of remaining five questions.
- 2 Figures to the right indicate full marks.
- 3 Assume suitable data if necessary but justify the same.
- 4 Draw neat sketches wherever necessary.

2.1 Attempt any four questions.

- (a) Write Moment Area Theorems - I & II, giving neat sketches. 5
- (b) Differentiate between symmetrical & Unsymmetrical bending, giving suitable examples. 5
- (c) State and explain-(i) Maxwell's theorem (ii) Betti's theorem 5
- (d) Define the term 'Strain Energy' and state its expression for (i) Axial force (ii) Bending moment (iii) Shear force and (iv) Torsion 5
- (e) Explain the necessity & function of stiffening girder in a Cable-Suspension bridge. 5
- (f) For the beam shown in figure draw the qualitative influence line diagram (ILD) for (i) BM at C (ii) SF at section taken, just to the right of support B. 5

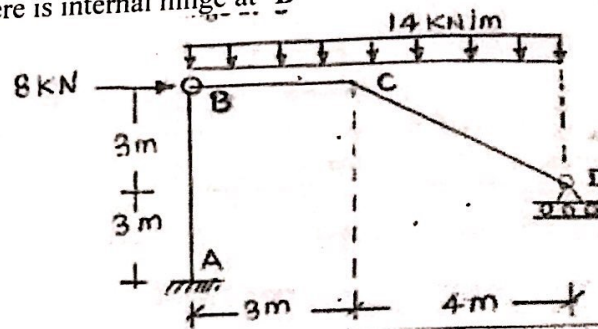


- (a) A simply supported beam of span PQ = 6 m is subjected two point loads 15 KN and 45 KN applied at mid span point R through two different planes as shown in I-section of the beam. Find- 10
 - (i) Resultant plane of loading
 - (ii) Location of neutral axis.
 - (iii) Nature and magnitude of maximum stress at corner B.

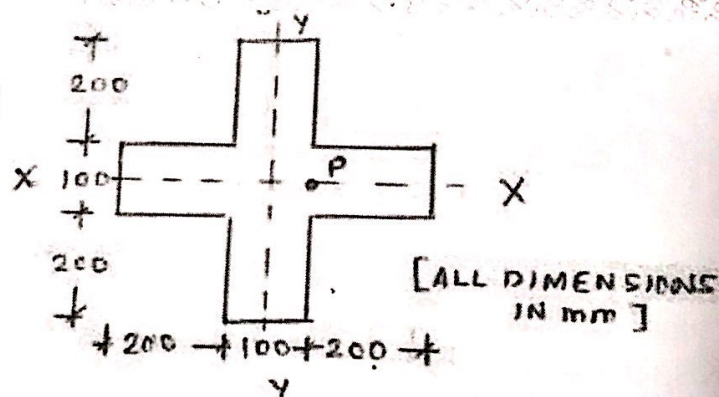


- (b) For the rigid jointed plane frame ABCD loaded as shown in figure- 10
 - (i) Find support reactions.
 - (ii) Draw Free body diagram (FBD) of all members.

(iii) AFD, SFD and BMD for the frame indicating salient points.
Note that there is internal hinge at 'B'

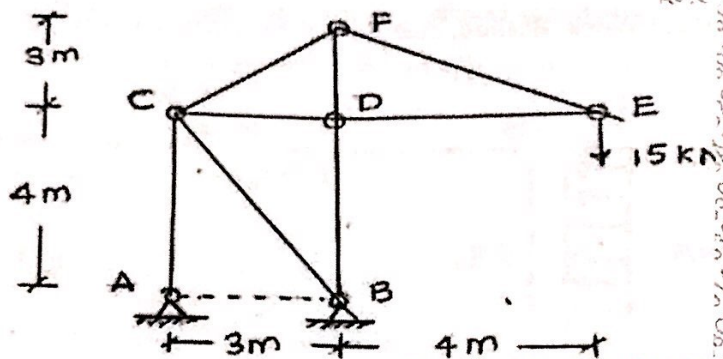


- Q.3** (a) A 3-hinged symmetrical circular arch of span 30 m and central rise 6 m subjected UDL of 12 kN/m over the entire span. Determine—
(i) Support reactions.
(ii) BM, NT and RSF at left quarter span point.
Also draw BMD for the arch clearly indicating the location & magnitude of maximum bending moment.
(b) Figure shows the **plus** cross section (symmetrical) of a column which is 3 m long with both ends hinged. This column is subjected to a load of P kN applied at an eccentricity of 50 mm from the axis of column. Determine the extreme fibre stresses if $E = 150$ GPa for column material. Also sketch the stress distribution diagram.

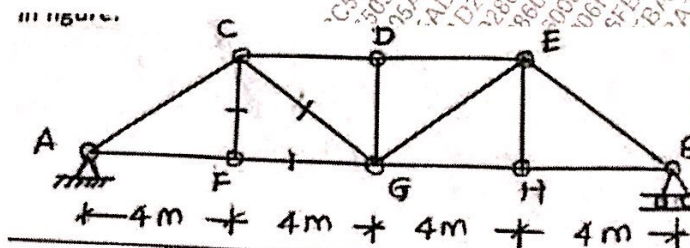


- Q.4** (a) A non-prismatic cantilever beam ABC fixed at 'A' with $AB = BC = 3$ m having flexural rigidity $2EI$ & EI respectively. It is subjected to UVL having zero intensity at B and maximum 12 kN/m at C. Using **Moment Area Method** or **Conjugate Beam Method**, determine slope at 'B' and deflection at free end 'C' in terms of EI .

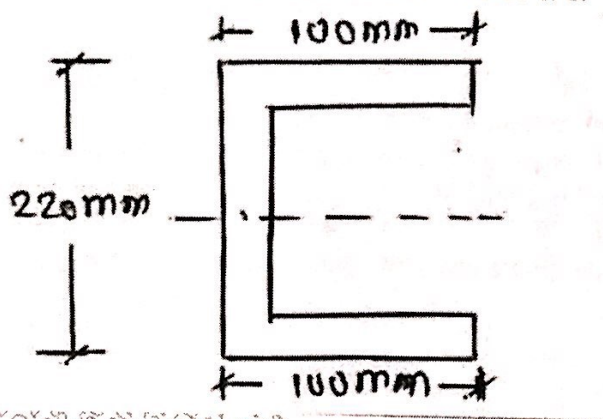
- Q.4** (b) A pin-jointed frame loaded and supported as shown in figure. Determine horizontal deflection of joint 'E'. Take $AE = \text{constant}$ for all the members. Use **unit load method** or any other suitable method.



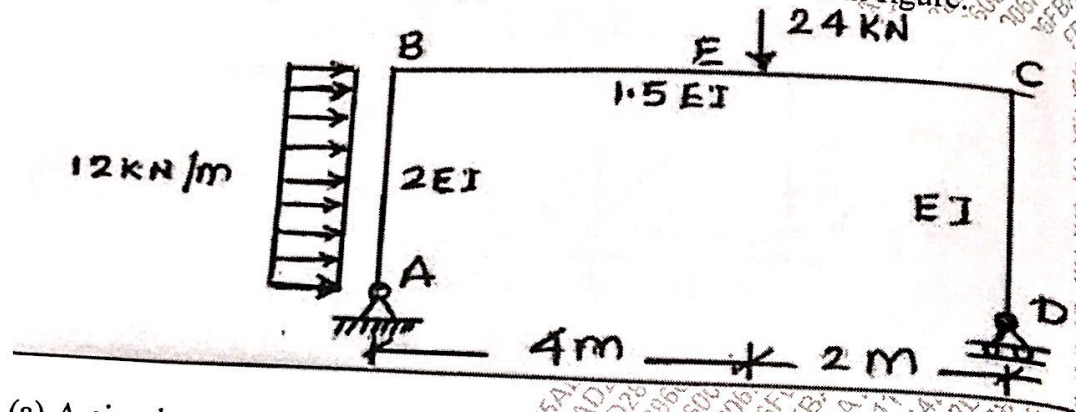
Draw ILDs for axial force in member CG, FG and CF of a through type bridge truss shown in figure. 6



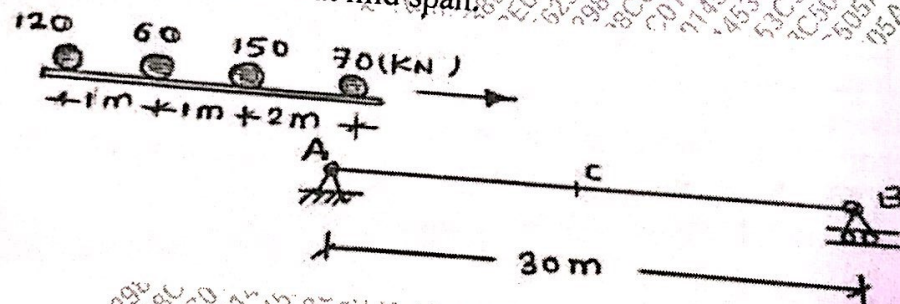
Define the term 'Shear Centre' and its importance in structural analysis. 5
so locate clearly the shear centre for a thin walled channel section shown in figure. Take uniform wall thickness as 8 mm.



(c) Using **Virtual Work Method**, determine the horizontal deflection of joint E in a rigid jointed plane frame supported & loaded as shown in figure.



- Q.6 (a) A simply supported girder of span 30 m is traversed by a system of wheel loads 120 kN, 60 kN, 150 kN & 70 kN spaced at 1 m, 1 m & 2 m respectively moving from left to right with 70 kN leading load as shown in figure. Determine-
- Maximum positive & negative SF at mid span section.
 - Maximum BM at mid span.



- (b) A suspension cable of span 120 m & central dip 12 m carries UDL of 1 kN/m over the entire span. Find the forces transmitted to the supporting pier-
- If the cable passes over a smooth pulley fixed on the top of pier
 - If the cable is clamped to a saddle with smooth rollers mounted on the top of pier.
- For each of the above cases the anchor cable is inclined at 30° angle with horizontal.

(4 Hours)

[Total Marks: 80]

- :(1) Question No. 1 is compulsory.
 (2) Answer any **three** questions from remaining **five** questions.
 (3) Assume suitable data if required and state it clearly.

It is proposed to construct a **Boys Hostel** building as (G+1) RCC framed structure with the following requirements.

1) 2 Seated Rooms	10 nos	-each 15 m ²
2) 3 Seated Rooms	10 nos	-each 25 m ²
3) Guest Room		- 20 m ²
4) Entrance and Reception		- 20 m ²
5) Hostel Warden Room		- 15 m ²
6) Indoor Games		- 35 m ²
7) TV/Audio Room		- 40 m ²
8) Newspapers & Magazines		- 30 m ²
9) Kitchen		- 40 m ²
10) Dining Area		- 120 m ²

Provide passage, toilet, Dog legged staircase, etc as per the bye-laws. Assume floor to floor height as 4 m.

Draw with suitable scale

- Draw the ground floor plan.
- Draw the line plan of first floor.

15
5

It is proposed to construct a Residential Bungalow as (G+1) R.C.C framed structure with the following requirements.

- Living Room - 24 m²
- Master Bedroom with A.T - 20 m²
- Bed Room - 18 m²
- Kitchen - 12 m²
- Dinning Area - 14 m²
- Guest Room - 15 m²

Provide entrance porch for vehicle parking, verandah, staircase, passage and sanitary units as per byelaws.

Assume floor to floor height - 3.3 m.

- Draw the **Ground Floor plan**.
- Draw the **line plan** of first floor.

15
05

Draw the Sectional Elevation for the Boys Hostel you have planned in Q.no1.

20

Explain all types of pitched roof in detail, with proper diagrams

10

Write principles of planning for Residential Building.

10

Draw Two -point perspective for the Boys Hostel you have planned in Q.no.1

20

Explain various types of Staircases with proper sketches.

10

Explain Sun path diagram & Wind rose diagram with sketches.

10

5(C). - Height of Frame shall be taken as 4 m

- 7) TV/Audio Room
- 8) Newspapers & Magazines - 30 m²
- 9) Kitchen - 40 m²
- 10) Dining Area - 120 m²

Provide passage, toilet, Dog legged staircase, etc as per the bye-laws. Assume floor to floor height as 4 m .

Draw with suitable scale

- i) Draw the ground floor plan
- ii) Draw the line plan of first floor.

15
5

It is proposed to construct a Residential Bungalow as (G+1) R.C.C framed structure with the following requirements.

- a) Living Room - 24 m²
- b) Master Bedroom with A.T - 20 m²
- c) Bed Room - 18 m²
- d) Kitchen - 12 m²
- e) Dinning Area - 14 m²
- f) Guest Room - 15 m²

Provide entrance porch for vehicle parking, verandah, staircase, passage and sanitary units as per byelaws.

Assume floor to floor height -3.3 m.

- i) Draw the **Ground Floor plan**.
- ii) Draw the **line plan** of first floor.

15
05

Draw the Sectional Elevation for the Boys Hostel you have planned in Q.no1.

20

Explain all types of pitched roof in detail, with proper diagrams

10

Write principles of planning for Residential Building.

10

Draw Two -point perspective for the Boys Hostel you have planned in Q.no.1

20

Explain various types of Staircases with proper sketches.

10

Explain Sun path diagram & Wind rose diagram with sketches.

10

(3 Hours)

[Total Marks: 80]

TE.:

- 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.
- What are Bogue's compounds? State the effects of Bogue's compounds on properties of cement. 05
 - Define bulking of sand and fineness modulus of sand. State their effect on the strength of concrete. 05
 - Define workability. What is the significance of workability in concrete? 05
 - What are the benefits of using fibers in concrete? 05
 - What are the functions of aggregate in concrete? Classify the aggregates based on their properties. 10
 - Define hot weather concreting. What are the effects of hot weather on concrete? What are the precautions to be taken during hot weather concreting? 10
 - Define concrete mix design. Explain step by step procedure of concrete mix design by IS code method. 10
 - Define High strength concrete. What are the constituents of high strength concrete? Explain the method of making high strength concrete. 10
 - Differentiate between the destructive, nondestructive tests on concrete with examples. Explain in detail ultrasonic pulse velocity method. 10
 - What do you understand by soundness of cement? Explain the procedure to determine the soundness of cement. 10
 - Describe in brief various types of admixtures used in concrete. 10
 - Define w/c ratio in concrete? Explain the effect of w/c ratio on the strength and durability of concrete. 10
- Write short notes on the following (any four) 20
- Light weight concrete
 - Routing and sealing method of repairs
 - Load test
 - HPC
 - Compression test on concrete

(03 HOURS)

TOTAL MARKS: 80

- Questions : (1). Question No .1 is compulsory
(2) Answer any three questions from the remaining questions.
(3) Each full question carries 20 marks.
(4) Assume suitable data, if needed and state it clearly.

Attempt any four

Enlist in detail classifications of engineering materials. (05M)

What is the effect of 'Bulking of sand & Water absorption of CA on the concrete mix proportioning. (05M)

State the elastic properties of hardened concrete and explain any one of them in brief. (05M)

Explain defects in timber due to seasoning with neat sketch. (05M)

Draw Queen closer & King closer sketches with dimensions in case of standard brick. (05M)

Which field tests are conducted in the field on cement? (05M)

Which IS code is required to perform compressive strength test on burnt clay brick? Explain step by step procedure to determine compressive strength of brick in the lab as per IS code. (10M)

Which IS code is required to perform compaction factor test? Calculate how much quantities of ingredients of concrete in 'Kg.' are required to perform this test in the lab? If the nominal mix proportions for M20 grade of concrete by ratio are 0.6 : 1 : 1.67 : 3.33. Take internal dimensions of the upper hopper as, top diameter = 254 mm, bottom diameter = 127 mm & height = 279 mm and also take density of concrete = 2350 Kg/m³. (10M)

State the physical properties of OPC as per IS code? Explain in brief Standard Consistency of cement and give applications of it. (06M)

What are the various applications of cement mortar? (04M)

Explain in-detail, how will you decide dosage of chemical WRA's to enhance the properties of concrete by reducing W/C ratio of the mix. Plot graph of it. (10M)

Describe English bond in case of single brick wall in brief with labeled sketches. (10M)

Enlist the various types of pointing of masonry work and explain any one of them with sketch. (06M)

Define cladding. Explain 'Attached system' of installation method of cladding. (04M)

Design M25 grade of concrete for flexure in accordance with IS 10262, for the following data: (12M)

Design Parameters :

$f_{ck} = 25 \text{ MPa}$

MSA = 20 mm

Shape of CA : Angular

Degree of Workability : 0.78 of CF.

Degree of Quality Control : Very good

Degree of Exposure : Moderate.

Data On Material :

Cement used : OPC.

Specific Gravity of Cement : 3.15

Specific Gravity of FA : 2.65

Specific Gravity of CA : 2.71

CA : 20 mm & 10 mm size in 60:40 ratio.

FA (Sand) : Confirming to zone-I (08M)

Explain the Wedging method of quarrying of stone with neat labeled sketch. (10M)

- Q.6 a) Explain with neat labeled sketch "Couple roof".
 b) Explain "Marble Flooring".
 c) Draw a neat labeled sketch of D.P.C. treatment for ground flooring.

Data For Q. 5 a)

Data for Concrete Mix Design from Indian Standard Codes

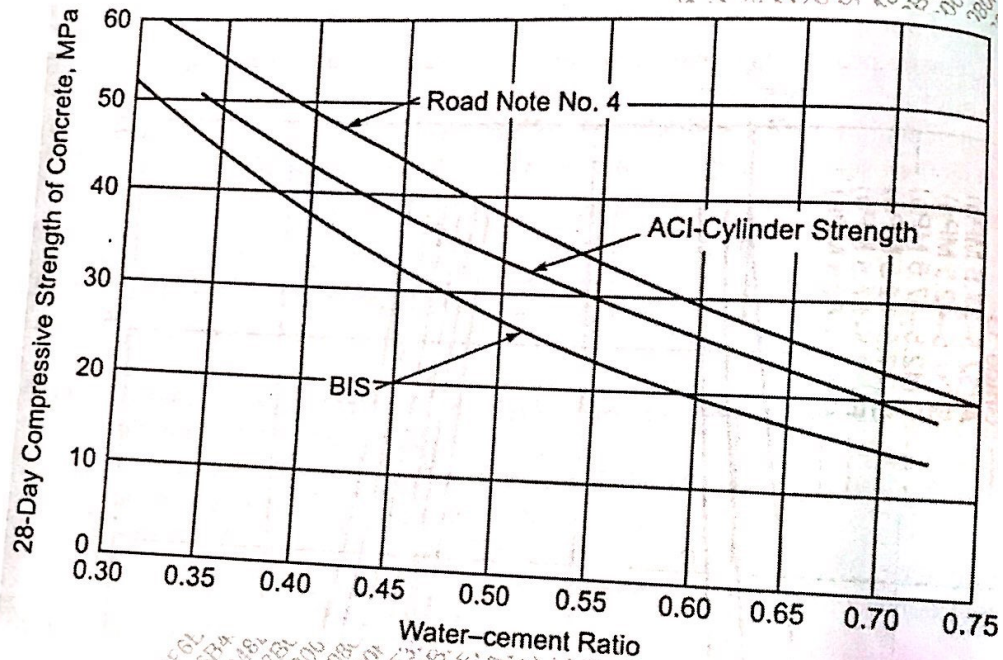


Table 1: Values of 'k' OR 't'

Percentage of results below the characteristics strength	Values of 'k' OR 't'
50	0
16	1.00
10	1.28
5	1.65
2.5	1.96
1	2.33
0.5	2.58
0.0	Infinity

Table 2 : Suggested Values of Standard Deviation

Grade of Concrete	Standard deviation for degree of control in %	
	Very good	Good
M10	2.0	2.3
M15	2.5	3.5
M20	3.6	4.6
M25	4.3	5.3
M30	5.0	6.0
M35	5.3	6.3
M40	5.6	6.6
M45	6.0	7.0
M50	6.4	7.4
M55	6.7	7.7
M60	6.8	7.8

Table 3 : Approximate Air Content

Maximum size of aggregate (mm)	Percentage of Entrapped air (%)
10	3.0
20	2.0
40	1.0

Table 4: Minimum cement content, maximum water-cement ratio & minimum concrete grade (20 mm nominal max. size of aggregates)

Exposure	Reinforced Concrete		
	Min. cement content (kg/m ³)	Max. free water-cement ratio	Min. concrete grade
Mild	300	0.55	M20
Moderate	300	0.50	M25
Severe	320	0.45	M30
Very Severe	340	0.45	M35
Extreme	360	0.40	M40

Table 5: Approximate sand & water content per m³ of concrete*

Grade	Nominal size of	Water content	Sand as % of	Remarks
Up to M35	10	208	40	Sand zone II, water-cement ratio = 0.6,
	20	186	35	
	40	163	30	
Beyond M35	10	200	28	Compaction Factor = 0.8
	20	180	25	

These values apply to the conditions given in the remarks column. For other conditions, corrections are to be applied as per Table 6.

Table 6: Corrections to the values given in Table 5, to be applied for conditions other than those given in the remarks column of Table 5.

Change in conditions other than those given in Table 5	Correction for water content	Correction for sand content in total aggregates
Aggregate conforming to zone I, III or IV	0	+1.5 for zone I, - 1.5 for zone III, - 3.0 for zone IV
Increase or decrease in compacting factor value by 0.1 (for workability)	±3%	0
Each 0.05 increase or decrease in water-cement ratio	0	±1%
Unrounded aggregates (gravel)	- 15 kg/m ³	- 7%

Section in 1T00624 - S.E (Civil Engineering)(SEM-IV)(Choice
e) / 40405 - Building Materials & Construction Technology
Code: 71347

- se read as
- b) 08 Marks
 - a) 10 Marks
 - b) 05 Marks
 - c) 05 Marks

A - 202

B - 203

E - 206

P. K. Singh
29/5/2019
C C

Two sharp ended pipes of diameter 50 mm and 100 mm resp. each of length 100m
resp. is connected in parallel between two reservoirs which have a difference of level
of 10m. If friction factor for each pipe is 0.32, calculate :-

1) Stagnation Pressure 2) Stagnation Temp. 3) Stagnation Density.

Take $R = 287 \text{ J/kg K}$ and $k = 1.4$.

Two sharp ended pipes of diameter 50 mm and 100 mm resp. each of length 100m
resp. is connected in parallel between two reservoirs which have a difference of level
of 10m. If friction factor for each pipe is 0.32, calculate :-

- 1) Rate of flow for each pipe
- 2) The diameter of single pipe 100 m long which would give the same discharge,
if it were substituted for the original two pipes.

Derive Prandtl's universal velocity distribution for turbulent flow in pipes.

A siphon of diameter 200 mm connects two reservoirs having a difference in
elevation of 12m. The total length of siphon is 600 m and the summit is 4m above
the water level in the upper reservoir. If the separation takes place at 2.8 m of water
absolute, find the maximum length of siphon from upper reservoir to the summit.
Take $f=0.004$ and atmospheric pressure=10.3 m of water.

(3 Hours)

(Total Marks : 80)

- 1) Question no 1 is compulsory.
- 2) Attempt any three questions out of remaining five questions.
- 3) Assume any additional data if necessary and state clearly.
- 4) Draw neat figures as required.

Answer any 4 of the following.

Derive Dupit's Equation.

Explain different steps in solving distribution network by Hardy Cross method.

Explain boundary layer separation and its control measures.

Explain propagation of pressure waves in a compressible fluid.

Explain kinetic correction factor and momentum correction factor. *100 mm from Center*

Explain Prandtl's mixing length theory.

In a pipe of 300 mm diameter, the centre line velocity and velocity at a point 2.3 m/s and 2 m/s resp. Assuming the flow in pipe to be turbulent find discharge through the pipe, co-efficient of friction, height of roughness projections. **10**

An aeroplane is flying at 1000 km/hr through still air having a pressure of 78.5 kN/m² (abs) and temp. - 8 °C. Calculate on stagnation point on the nose of plane
 1) Stagnation Pressure 2) Stagnation Temp. 3) Stagnation Density. **10**

Take $R = 287 \text{ J/kg K}$ and $k = 1.4$

Two sharp ended pipes of diameter 50 mm and 100 mm resp. each of length 100m resp. is connected in parallel between two reservoirs which have a difference of level of 10m. If friction factor for each pipe is 0.32, calculate :- **10**

- 1) Rate of flow for each pipe
- 2) The diameter of single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes.

Derive Prandtl's universal velocity distribution for turbulent flow in pipes. **10**

A siphon of diameter 200 mm connects two reservoirs having a difference in elevation of 12m. The total length of siphon is 600 m and the summit is 4m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of siphon from upper reservoir to the summit. Take $f=0.004$ and atmospheric pressure=10.3 m of water. **10**

- b. Water is flowing in a pipe of 140mm diameter with a velocity of 2.5 m/s. When suddenly brought to rest by closing the valve. Find the pressure rise assuming elastic. $E=206 \text{ GN/m}^2$, Poisson's ratio = 0.25,
 K for water = 2.06 GN/m^2 Pipe wall is 5mm thick.
- c Explain Hydraulic Gradient Line and Total Energy Line.

- 5 a. A lubricating oil of viscosity 1 poise and sp.gr.0.9 is pumped through 300mm diameter pipe. If the pressure drops per meter length of pipe is 20 kN/m^2 . Determine 1) the mass flow rate in kg/min 2) the shear stress at the pipe wall 3) Reynolds number of flow 4) The power required per 50 m length of the pipe to maintain the flow.

- b. The velocity distribution in boundary layer is given by

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

δ = boundary layer thickness

Calculate the displacement thickness, momentum thickness and energy thickness

- 6 a. Experiments were conducted in a wind tunnel with a wind speed of 60 km/hr over a flat plate of size 2m long and 1 m wide. The density of air is 1.15 kg/m^3 . Coefficient of lift and drag 0.75 and 0.15 resp. Determine :
1) Lift Force 2) Drag force 3) Resultant force 4) Direction of resultant force 5) Power exerted by air on plate.
- b. In a rough pipe of diameter 0.5 m and length 4400 m water is flowing at the rate of $0.5 \text{ m}^3/\text{s}$. If the average height of roughness is 0.48 mm, find power required to maintain this flow.
- c Explain Hydraulically smooth and rough boundaries.

(3 Hours)

[Total Marks: 80]

Please check whether you have got the right question paper.

1. Question no.1 is compulsory
2. Solve any 3 questions out of remaining.
3. Assume data wherever necessary and clearly mention the assumptions made.
4. Attempt sub questions in order.

Attempt any four

- a. What is equivalent pipe? Derive an equation for equivalent size of pipe for pipes connected in parallel.
- b. Explain with sketch assumptions made in Hardy cross method of pipe network.
- c. Derive an expression for velocity of sound wave in compressible fluid.
- d. What size should be installed to carry a discharge of 5.5/ps of oil having viscosity 6×10^{-2} stokes under laminar flow conditions?
- e. Prove that the head loss due to friction is equal to one-third of the total head at inlet for maximum power transmission through pipes or nozzles.
- f. For turbulent flow in pipes, calculate the distance from pipe wall at which velocity is equal to the average velocity of flow.

a. Establish the following relation for a one dimensional compressible flow through duct of varying area: $(dA/A) = (dp/\rho V^2)(1-M^2)$

b. Write detailed note on shockwaves and its types.

c. Thermodynamic state of an air is given by pressure $p = 2.3\text{bar}$, temperature $T = 300^\circ\text{K}$ and velocity of flow = 250m/s. Calculate the stagnation pressure if (i) compressibility is neglected and (ii) Compressibility is accounted for. Comment on results.

d. Compare pipes in series and pipes in parallel.

e. Compare hydraulically smooth and rough boundaries

f. Compare HGL and TEL.

Describe characteristics of Laminar flow.

Describe Reynolds experiment

A pipe of 5cm diameter is 5m long and carries a discharge of $0.005\text{m}^3/\text{s}$. Find the head loss due to friction. The central 2m length of the pipe next is replaced by a pipe 7.5cm diameter, the changes of section being sudden. Determine the head loss and corresponding power due to adoption of this alternative. Take friction coefficient $4f = 0.01$ for the pipes of both the diameters and contraction loss coefficient = 0.5.

A pipe line 50cm diameter and 4500m long, connects two reservoirs whose constant difference of water level is 12m. A branch pipe, 1250m long and taken from a point at a distant 1500m from the reservoir A, leads to reservoir C whose water level is 15m below that of reservoir A. find the diameter of the branch pipe so that the flow in both the reservoirs is same. Take friction coefficient $4f = 0.03$ for all the pipes.

- 5
- a. A steel penstock 60cm in diameter has a shell thickness of 1.2cm. modulus of elasticity of the shell material is $2.1 \times 10^5 \text{ N/mm}^2$ and the modulus of water is $2.1 \times 10^3 \text{ N/mm}^2$. The pipe is designed to discharge water at a mean velocity of 2.1m/s. Determine the water hammer pressure rise caused by sudden closure of valve at downstream end (i) by neglecting elasticity of the pipe material and also (ii) by considering the elasticity of pipe material.
 - b. Laminar flow takes place through circular pipe. At what distance from boundary does the local velocity equal to the average velocity?
 - c. Oil of viscosity 0.97 poise and relative density 0.9 is flowing through horizontal circular pipe of 100mm diameter and of length 10m. if 10 oil is collected at the outlet in 30 seconds, calculate the difference in pressure at the two ends of the pipe. Also verify that the flow is laminar.
- 6
- a. For uniform laminar flow between two stationary parallel plates separated by distance B, show that $h_f = (12\mu VL) / (\gamma B^2)$
 - b. A 30cm diameter pipe conveying water in turbulent regime. Calculate discharge in the pipe if the centre line velocity is 3.75m/s. Take $f=0.02$.
 - c. A smooth pipe 200mm diameter carries crude oil of relative density 0.9 and velocity of 2.5m/s. Estimate the type of flow, head loss in 100m and power required to maintain the flow. Assume kinematic viscosity as stokes.

(3 hours)

Total marks: 80

(1) Question no.1 is compulsory.

(2) Attempt any 3 questions out of the remaining 5 questions.

(3) Assume data wherever necessary and clearly mention the assumptions made.

(4) Draw neat figures as required.

Solve any four from the following

20

- a Derive an expression for the equivalent size of the pipe to replace the pipes in series.
 - b A nozzle is fitted at the end of a pipe of length 300 m and diameter 100 mm. For the maximum transmission of power through the nozzle, find the diameter of nozzle. Take $f = 0.009$.
 - c Define Mach Cone, Mach angle, Zone of action and Zone of Silence.
 - d Explain the effect of pressure gradient on boundary layer separation.
 - e Write a short note on Moody's diagram.
 - f Explain Dash Pot Mechanism.
-
- a An old water supply distribution pipe of 250 mm diameter of a city is to be replaced by two parallel pipes of equal diameter having equal lengths and identical friction factor values. Find out the new diameter required. 10
 - b A siphon of diameter 200 mm connects two reservoirs whose water surface level differ by 40 m. The total length of the pipe is 8000 m. The pipe crosses a ridge. The summit of ridge is 8 m above the level of water in the upper reservoir. Determine the minimum depth of the pipe below the summit of the ridge, if the absolute pressure head at the summit of siphon is not to fall below 3 m of water. Take $f = 0.006$ and atmospheric pressure head = 10.3 m of water. The length of siphon from the upper reservoir to the summit is 500 m. Find the discharge. 10
 - a A pipeline of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if $4f = 0.04$. The head at inlet is 300 mm. 10

- b Derive an expression for velocity of sound wave in a compressible fluid.

Q4 a Derive Momentum thickness and energy thickness for the given velocity profile

$$\frac{u}{U} = 2 \left(\frac{y}{\delta} \right) - \left(\frac{y}{\delta} \right)^2$$

- b What do you understand by stagnation properties of a fluid? Find the Mach number when an airplane is flying at 900 kmph through still air having a pressure of 8.0 and temperature -15°C . Take $k = 1.4$ and $R = 287 \text{ J/kg K}$. Calculate the pressure temperature and density of the air at the stagnation point on the nose of the plane.

Q5 a A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in tank in 30 seconds.

- b Prove that for viscous flow through a circular pipe the kinetic energy correction factor is equal to 2 while momentum correction factor is equal to 4/3.

Q6 a Derive Prandtl's universal velocity distribution equation for turbulent flow in pipe. What do you understand by velocity defect?

- b A smooth pipe line of 100 mm diameter carries 2.27 m³ per minute of water at 20°C with kinematic viscosity of 0.0098 stokes. Calculate the friction factor, maximum velocity as well as shear stress at the boundary.

1. IV) (Choice Based) (CIVIL ENGG.) / T10043 / FUILD MACHANICS II Q.P Code :

le eter is 100 mm in stead of 100 m.



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A siphon of diameter 200 mm connects two reservoirs whose surface level differ by 40 m. (10)
The total length of the pipe is 8000 m. The pipe crosses a ridge. The summit of ridge is 8 m above the level of water in the upper reservoir. Determine the minimum depth of the pipe below the summit of the ridge, if the absolute pressure head at the summit of siphon is not to fall below 3.0 m of water.

Take $f = 0.006$ and atmospheric pressure head = 10.3 m of water. The length of siphon from the upper reservoir to the summit is 500 m. Find the discharge also.

Three reservoirs A, B, and C are connected by a pipe system having length 700 m, 1200 m (10)
and 500 m and diameter 400 mm, 300 mm, and 200 mm respectively. The water level in reservoir A and B from a datum line are 50 m and 45 m respectively. The level of water in reservoir C is below level of water in reservoir B. Find the discharge into or from the reservoirs B and C if the rate of flow from reservoir A is 150 liters per sec. Find the height of water level in the reservoir C. Take $f = 0.005$ for all pipes.

(05)

(i) Prove that the velocity through nozzle is given by

$$V = \sqrt{\frac{2gH}{1 + \frac{4fL}{D} \times \frac{a^2}{A^2}}}$$

(3 hours)

Total marks : 80

Question no. 01 is compulsory.

Attempt any 3 questions out of the remaining 5 questions.

Use the data wherever necessary and clearly mention the assumption made.

Neat figures as required.

Attempt any Four

Define HGL and TEL and draw HGL and TEL for uniform pipe connecting two reservoirs.

Derive condition for Maximum power transmission through nozzle.

Explain water hammer and state remedial measures.

Derive Area velocity relationship $\frac{dA}{A} = \frac{dv}{v} (M^2 - 1)$ for compressible flow.Prove that the co-efficient of viscosity by the dash pot arrangement is given by $\mu = \frac{4Wt^3}{3\pi LD^3V}$

Derive an expression for the loss of head due to sudden enlargement of a pipe. (10)

A siphon of diameter 200 mm connects two reservoirs whose surface level differ by 40 m. (10)

The total length of the pipe is 8000 m. The pipe crosses a ridge. The summit of ridge is 8 m above the level of water in the upper reservoir. Determine the minimum depth of the pipe below the summit of the ridge, if the absolute pressure head at the summit of siphon is not to fall below 3.0 m of water.

Take $f=0.006$ and atmospheric pressure head = 10.3 m of water. The length of siphon from the upper reservoir to the summit is 500 m. Find the discharge also.Three reservoirs A, B, and C are connected by a pipe system having length 700 m, 1200 m and 500 m and diameter 400 mm, 300 mm, and 200 mm respectively. The water level in reservoir A and B from a datum line are 50 m and 45 m respectively. The level of water in reservoir C is below level of water in reservoir B. Find the discharge into or from the reservoirs B and C if the rate of flow from reservoir A is 150 liters per sec. Find the height of water level in the reservoir C. Take $f=0.005$ for all pipes. (05)

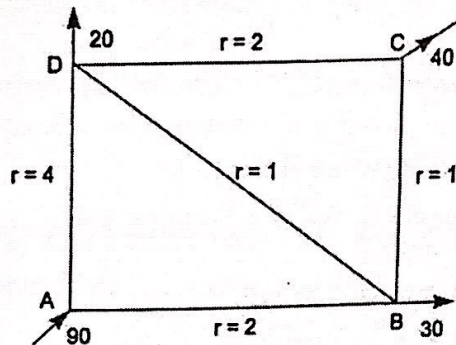
(i) Prove that the velocity through nozzle is given by

$$V = \sqrt{\frac{2gH}{1 + \frac{4fL}{D} \times \frac{a^2}{4^2}}}$$

- (ii) Find the maximum power transmitted by a jet of water discharging freely and out Nozzle fitted to a pipe = 300m long and 100 mm diameter with co-efficient of $f = 0.01$. The available head at the nozzle is 90m.

Q4:-

- a) Calculate the discharge in each pipe of the network shown in below Fig. The pipe network consists of 5 pipes. The head loss h_f in a pipe is given by $h_f = rQ^n$ for various pipes and also the inflow or outflow at nodes are shown in the figure



- b) Find Mach number when an aeroplane is flying at 900 km/hour through still air having pressure of 8.0 N/cm² and temperature -15°C. Take $k=1.4$ and $R=287$ J/kg K. Calculate pressure, temperature and density of air at the stagnation point on the nose of the p

Q5:-

- a) An oil of viscosity 0.1 Ns/m² and relative density 0.9 is flowing through a circular pipe of diameter 50mm and of length 300m. The rate of flow of fluid through the pipe is find the pressure drop in a length of 300m and the shear stress at the pipe wall. Take $\mu=0.1$ Ns/m²
- b) Prove that for viscous flow through a circular pipe the kinetic energy correction factor equal to 2 while momentum correction factor = $\frac{4}{3}$.

Q6:-

- a) A rough pipe of diameter 400mm and length 1000m carries water at the rate of 0.4 m³/s. The wall roughness is 0.012 mm. Determine the co-efficient of friction, wall shear stress, line velocity and velocity at a distance of 150mm from the pipe wall.
- b) (i) Obtain an expression for the velocity distribution for turbulent flow in smooth pipe (ii) What do you mean by Prandtl mixing Length Theory? Find an expression for shear stress due to Prandtl.

- 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.

- (a) What is alkali-aggregate reaction? Explain the factors promoting the alkali-aggregate reaction. 05
- (b) Explain in short retrofitting. Mention the methods of retrofitting. 05
- (c) Explain ultralight weight concrete. 05
- (d) Define creep. What are the factors affecting creep? 05
- (a) What do you understand by High strength concrete? What are the constituents of high strength concrete? How is high strength concrete produced? 10
- (b) Define hot weather concreting. What are the effects of hot weather on concrete? What are the precautions to be taken during hot weather concreting? 10
- (a) What is concrete mix design? Explain step by step procedure of concrete mix design by IS code method. 10
- (b) What is fineness of aggregate? Explain the procedure to determine it. 10
- (a) Give the list of nondestructive tests on concrete. Explain any one in detail. 10
- (b) What do you understand by soundness of cement? Explain the procedure to determine the soundness of cement. 10
- (a) What is High Range Water Reducer (HRWR)? Explain the effects, advantages and disadvantages of HRWR. 10
- (b) Define w/c ratio in concrete? Explain the effect of w/c ratio on the strength and durability of concrete. 10

Write short notes on the following (any four) 20

- i Fly ash
- ii Distress in concrete
- iii flexural test on concrete
- iv Ferrocement
- v Pull out test

Time: 3 hours

(Total Marks 80)

1. Question No. 1 is compulsory.
2. Attempt any three out of remaining questions.
3. Assume any suitable data, wherever required and state the same.

Attempt any four of the following.

(20M)

- a) Explain the properties of materials used for building construction
- b) Explain with neat sketch "Reticulated Finish".
- c) State the engineering properties of ceramics with its uses.
- d) State the properties of mortar.
- e) Demerits of distemper as compared to paints.
- f) Write a note on "false ceiling"

- a) Explain the preservative treatments for stones. (5M)
- b) Explain the manufacturing process of hollow concrete block. (5M)
- c) Explain various tests carried on lime. (10M)

- a) Sketch for providing damp proof courses in foundation of Plinth stating materials used for damp proofing. (6M)
- b) Write a short note on grade of concrete. (4M)
- c) Explain various operations involved during concreting. (10M)

- a) States the types of glass and its Applications. (5M)
- b) Explain with neat sketches defects in timber. (10M)
- c) Write a short note Trial mixes in mix design. (5M)

- a) Sketch elevation and section of uncaused Random Rubble masonry Showing through stone. (6M)
- b) Write a short note on "Gypsum as an interior material". (4M)
- c) Explain with neat sketch form work for slab. (5M)
- d) Write a short note on slip formwork. (5M)

- a) Explain Terrazzo flooring. (5M)
- b) Explain requirements of a good roof covering. (5M)
- c) Explain with neat sketch "lean to roof". (10M)

(3 hours)

- (1) Question no. 1 is compulsory
- (2) Attempt any three questions out of remaining five questions
- (3) Assume any additional data, if necessary, and state it clearly
- (4) Explain answers with neat sketches, wherever necessary

- a) Explain the procedure for setting out centre line of a tunnel [05]
- b) Discuss necessity of curves. Classify horizontal curve with neat sketches. [05]
- c) Differentiate between fixed hair and movable hair method of tacheometry [05]
- d) What do you understand by Remote Sensing? Give its applications. [05]

- a) Compare Radial Contouring Project with Block Contouring Project w.r.t the type of terrain, instruments and accessories used, time required, accuracy obtained, area covered, table for recording data, etc. [10]
- b) A simple curve, of radius of curvature 250 m, connects two straights, intersecting at 900 m chainage and an intersection angle of $34^{\circ}30'$. A chain of length 20 m is used. Calculate all necessary data for setting out half of the curve by perpendicular offsets from the back tangent [10]

- a) The readings given below were made with a tacheometric theodolite having a multiplying constant of 100 and no additive constant. The reduced level at station A was 100.0 m and the height of the instrument axis 1.35 m above the ground. Calculate the gradient expressed as the horizontal distance one meter rise or fall vertically between the stations B and C. [10]

Station	To	WCB	Vertical angle	Stadia readings
A	B	$48^{\circ}00'$	$+11^{\circ}30'$	2.048, 1.524, 1.000
	C	$138^{\circ}00'$	$-17^{\circ}00'$	2.112, 1.356, 0.600

- b) Explain how do you perform project/ route survey for a highway [10]
- c) The stadia hairs of a tacheometer are separated by a distance of 1.15 mm. from the central hair. The focal length of the object glass of the telescope is 23 cm. The distance of the object glass from the trunnion axis is 7 cm. Calculate the tacheometric constants [05]
- d) What do you understand by Stadia Charts and Tacheometric Tables [05]
- e) Discuss briefly about the Global Positioning System. [05]
- f) Discuss the principle and applications of Electronic Distance Measuring Instruments [05]
- g) A gradient of -1% meets a gradient of +2% at a chainage of 1110.00 and elevation of 335.75 m.; The vertical curve of length 140 m is to be set out with pegs at 10 m interval. Calculate the elevations of the pegs by the method of Tangent Correction [10]
- h) Explain the problems encountered while setting out simple circular curve [05]
- i) A railway curve is to be connected through a transition curve to a straight for a limiting velocity of 80 kmph. Calculate the length of the transition curve if superelevation is to be built up 0.025 m. per sec. of vehicular travel [05]

Write short notes on: (any 4) [20]

- a) Composite Curve
- b) Instruments for setting out works
- c) Subtense bar
- d) GIS
- e) Total Station

Civil - IV

BDD - I

Q. P. Code: 40832

(Total Marks: 80)

(4 Hours)

1. Question No. 1 is compulsory.
2. Answer any three questions from remaining five questions.
3. Assume suitable data if required and state it clearly.

It is proposed to construct a R.C.C framed structure Residential Bungalow as

(G+1) with the following requirements.

- a) Drawing Hall - 25 m²
- b) Master Bedroom (with A.T) - 18 m²
- c) Bed Room (Two Nos.) - each 12 m²
- d) Kitchen - 8 m²
- e) Dinning Area - 12 m²
- f) Guest Room - 15 m²

Provide verandah, staircase, passage and sanitary units as per byelaws. Assume

floor to floor height - 3.3 m.

i) Draw the ground floor plan.

ii) Draw the line plan of first floor.

15

5

Draw the sectional elevation for the bungalow you have planned in Q.no.1

20

Explain principles of planning in hospital building.

7

Draw line plan of school Building using following requirements, on Ground Floor.

13

- a) Class room (6- numbers) - each 70 m²
- b) Laboratory (3- Nos.) - each 60 m²
- c) Computer Room - 75 m²
- d) Principal Room - 45 m²
- e) Staff Room - 60 m²
- f) Office - 75 m²
- g) Library cum Reading Room - 75 m²
- h) Gymkhana - 100 m²

Provide adequate passage, staircase, sanitary unites as per byelaws.

Draw one point perspective for the Bungalow you have planned in Q.no.1

20

Explain Principles of Planning for Residential Buildings.

10

Calculate number of risers and treads for commercial building having staircase room 3030 mm x 2270 mm internal size (excluding wall thickness). Floor to floor height is 3.2 m, also draw plan of staircase. Consider wall thickness is 230 mm.

10

Write short note on,

20

- a) Green Building
- b) Zoning
- c) Types of foundations for Residential & Public Buildings
- d) Use of computers in planning and designing of Buildings

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Civil - IV

29/5/18

BDD

(4 Hours)

Q. P. Code: 40833

Max.Marks:80

Question No 1 is compulsory.

Attempt any three questions out of remaining five questions.

Figures to the right indicate full marks.

Assume suitable data if required and specify the same clearly.

Proposed to construct (G+1) R.C.C residential bungalow with the following requirements,
Building Floor-Floor height as 3.3 m. on a Plot of 40 m.X40 m.

Living Room:- 20M²

Kitchen cum dining:- 20 M²

Bed Room:- 18 M²

Bed Room:- 25 M²

Bed Room:- 20 M²

Bed Room-15 M²

Draw developed plan of ground floor.

15

Draw line plan of first floor.

05

Draw the Front elevation of the bungalow designed in Q. No.1.

08

Draw the cross-section passing through staircase and sanitary unit of the bungalow designed in Q. No. 1.

12

Draw the foundation plan & details of one footing of the bungalow in Q. No.1

10

Draw the site plan of the bungalow designed in Q. No. 1.

10

Draw plan & sectional elevation of CCTW double shuttered fully panelled door.

12

Explain the Building bye- laws with examples.

08

Draw main Sun path diagram

06

Explain any two principles of planning.

04

Design the best type of pitched roof for factory of size 8M.X 20M. Draw plan & section for the same.

10

Write notes on followings (Any 4)

20

Explain the importance of drawings & Submission drawings.

Explain the importance of drawings

Explain the criteria of dog legged staircase

Explain the use diagram.

Explain the Development Control (D.C) rules

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Time: 3 Hrs.

Marks: 80

- Instructions: 1. Question No. 1 is Compulsory
2. Answer Any 3 from the remaining
3. Figures to right indicate full marks.

Show that for a three hinged parabolic arch carrying U.d.l. of w /unit run through out the span (l) the parabolic shape is funicular shape. (5)

Find the Shear Centre for a section shown in fig. 1. (5)

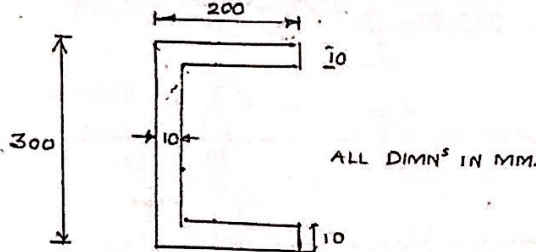


FIG. 1

Define strain energy write the expression for strain energy due to shear force, bending moment and twisting moment. (5)

A symmetrical cable of span 60 mtr and central dip of 6 mtrs subjected to udl of intensity 30 kn/m Find the maximum and minimum tension in the cable. (5)

2a) Sketch AFD, SFD & BMD for a frame shown in fig. 2

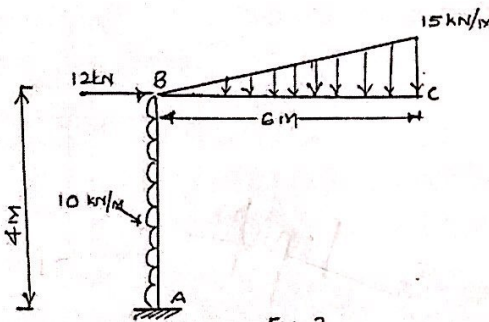


Fig. 2

A Three hinged parabolic arch carried udl as shown in Fig. 3 (10)

- Determine
a) Max. Bending Moment
b) Normal Thrust
c) Radial Shear at point D. and what will be max Bending Moment in the portion CB of the Arch
Ref. Fig. 3

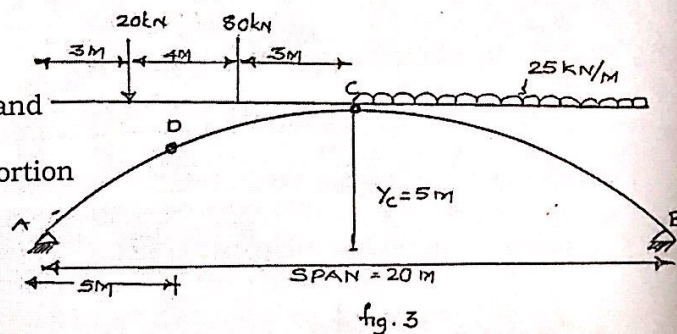


Fig. 3

Q.3 a) Draw influence line diagram for V_B , V_D & M_D . Ref. Fig. 4

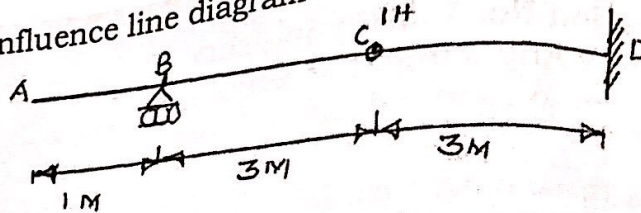


Fig. 4

b) Find the slope at points B and C, and deflection at point D using conjugate beam method. Ref. Fig. (5)

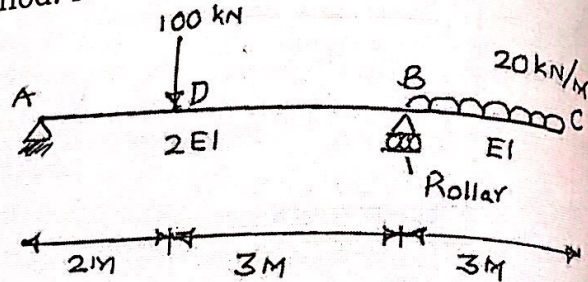


Fig. 5

Q.4 a) Find the rotation at Point B'. Ref. Fig. 6. Using unit load method or any other energy method.

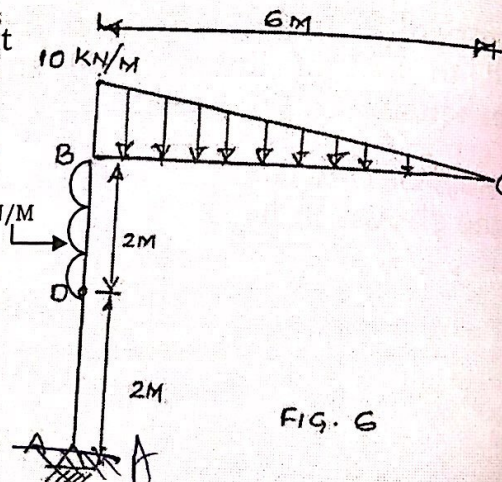


FIG. 6

b) Find slope at points A, D & F and Deflection at D & F. Ref. Fig. 7. Use Macaulay's method. Take Uniform EI throughout.

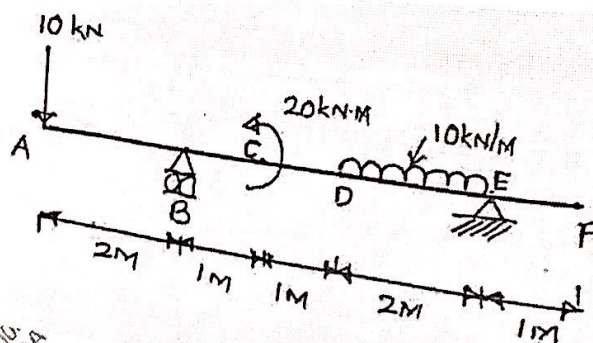
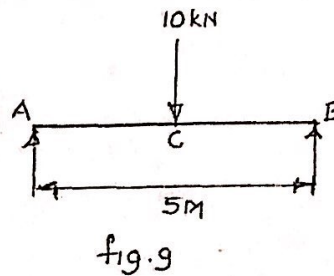
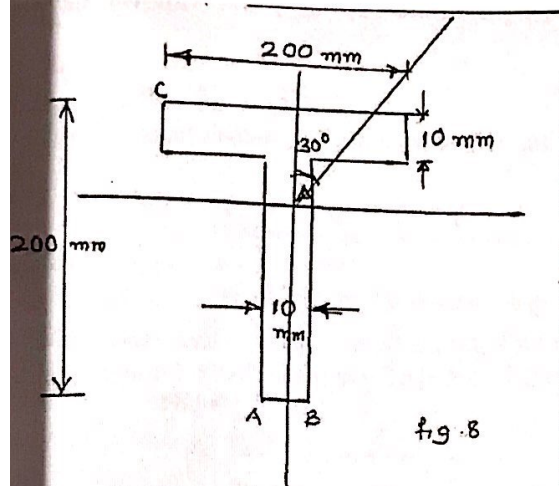


fig. 7

- a) A simply supported beam of span 5 m. carries a load of 10 kN at mid span, the load is not vertical but inclined at 30° to the minor axis & passing through the CG of the 'T' Section as shown in fig. (8). Calculate the bending stress at A, B & C. Ref. Fig. 8 and Fig. 9 for details (10)



The load system crosses simply supported girder of 90 m. Determine the value of absolute max. bending moment. Ref. Fig. 10. (10)

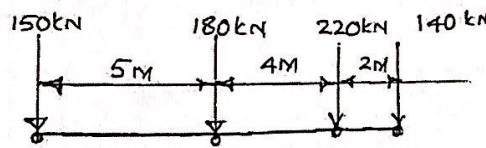


Fig. 10

- a) Using unit load method or any other energy method. Find the vertical displacement at point 'D' of the pin jointed truss loaded and supported as shown in figure 11. Take AE constant for all members. (10)

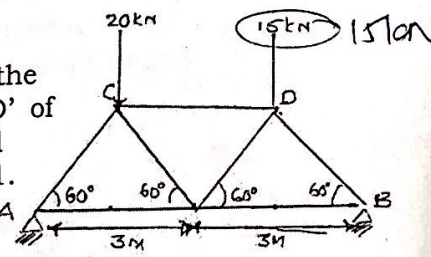


Fig. 11

AE CONSTANT FOR ALL MEMB.

A column of hollow circular section of External diameter 200 mm and thickness 10 mm is 5 m. long and has its both the end fixed. The column carries a load of 140 kN. at an eccentricity of 30 mm, find out the stresses produced at extreme fibres of the column sections. (10)

Take $E = 200 \text{ kN/mm}^2$

Civil - IV

(CBCUS)

May 18

SA - I

Q.P.Code:50330

(3 Hours)

(Max. Marks-80)

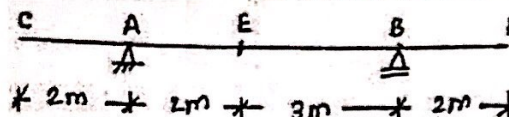
Question no.1 is compulsory. Attempt any three out of remaining five questions.

Figures to the right indicate full marks.

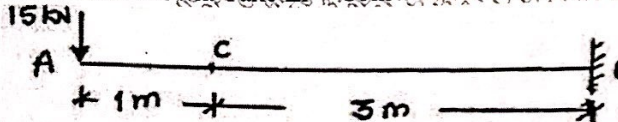
Assume suitable data if needed but justify the same.

Attempt any five from following-

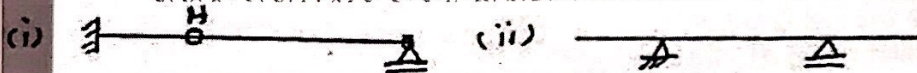
a) For the beam shown in figure, draw qualitative ILD for V_A , V_B , SF_E and BM_E .



b) Using Maxwell's reciprocal theorem, find the deflection at point 'C' for the antilever beam loaded as shown. Take $EI = \text{Constant}$.

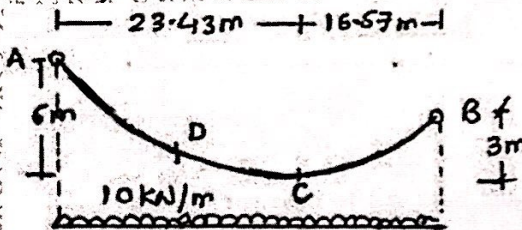


c) State the propositions used in Conjugate beam method to find slope & deflection and convert the following beams into conjugate beams.



d) Define the term product of inertia. Also state its importance in structural analysis.

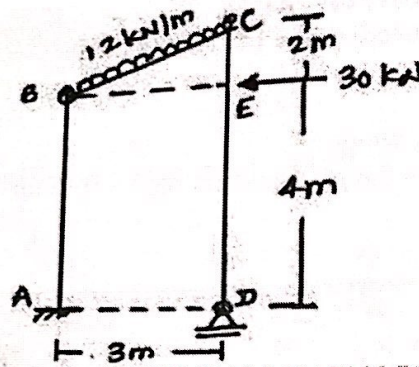
e) In an unsymmetrical cable of span 40 m is loaded as shown, find cable tension T at point 'D', located 15 m away from left support 'A'.



f) Based on basic approaches, classify the various methods used to find displacement of structures. Which one of these methods is most versatile in your opinion? Give reason for your choice.

TURN OVER

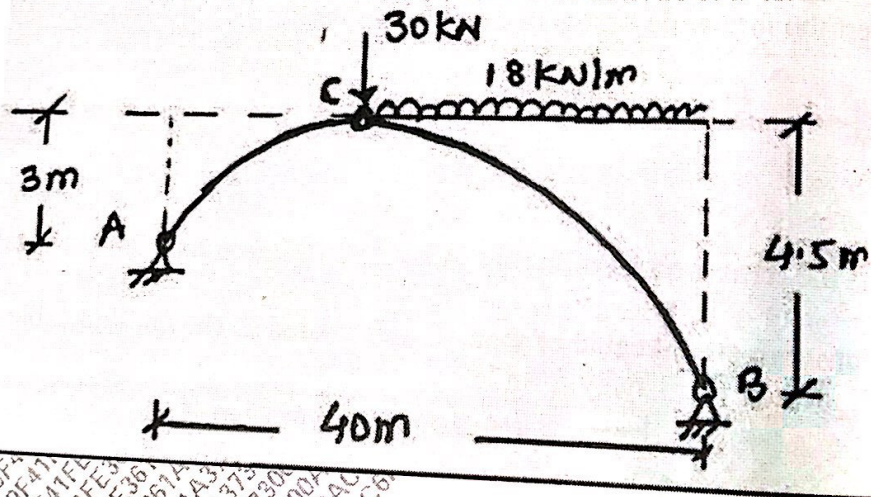
- Q.2 (a) For a rigid jointed plane frame shown in figure, find support reactions, FBD for all three members. Also draw AFD, SFD and BMD for the frame. Important points. Note that there is internal hinge at 'B'.



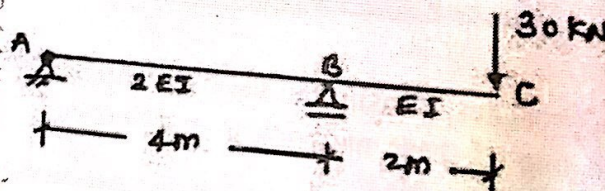
- (b) An unsymmetrical 3-hinged parabolic arch is loaded as shown in figure. Determine the position of third hinge C and determine-

- 1) Support reactions.
- 2) NT and RSF at section 'D', 10 m away from A.
- 3) Location & magnitude of maximum BM in portion CB.

Also draw BMD for the arch.



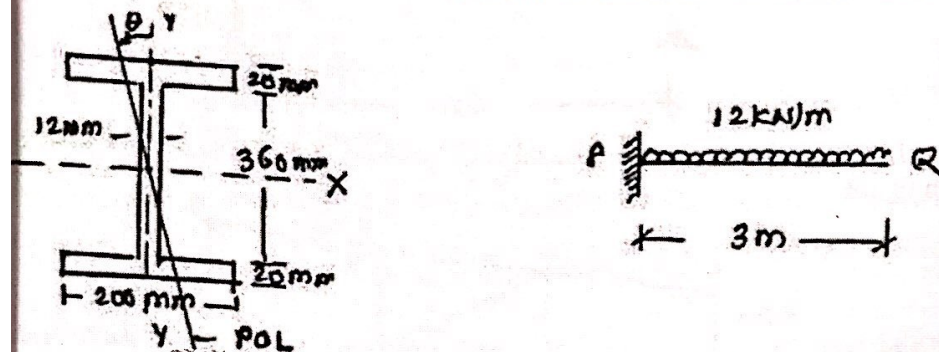
- Q.3 (a) Using Moment Area Method OR Conjugate beam method, determine in terms of $\frac{EI}{L}$ the slope and deflection at the free end 'C' of an overhanging beam loaded as shown.



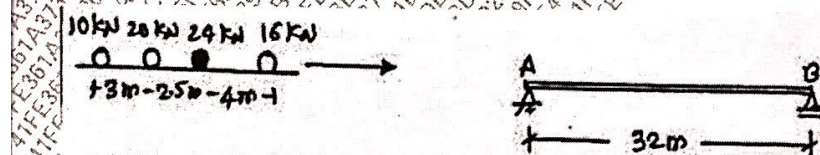
Q.P.Code:50330

A hollow circular column of length 6 m, external diameter 200 mm and internal diameter 160 mm is fixed at one end & hinged at the other end. If the column carries a load of 160 kN applied at distance 40 mm from column axis, determine extreme stresses. Take E for column material as 120 GPa.

Figure shows the symmetrical I-section of a cantilever beam of span 3 m. Flange 200 mm x 20 mm & web size 12 mm x 360 mm. The beam is loaded with UDL intensity 12 kN/m over the entire span as shown but the plane of loading is inclined at an angle $\theta = 32^\circ$ with vertical axis. Locate the neutral axis and find the maximum compressive & tensile stresses produced at critical section. Also sketch the bending stress distribution diagram.



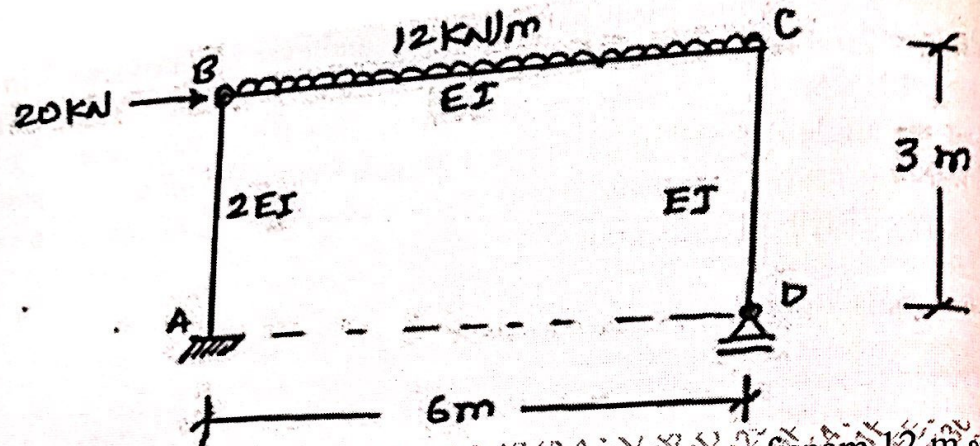
A simply supported girder of span 32 m is traversed by a series of four wheel loads 10 kN, 20 kN, 24 kN and 16 kN spaced at distances 3 m, 2.5 m and 4 m respectively. If the load system is moving from left to right with 16 kN as leading wheel, find maximum BM under 24 kN load. Is it absolute maximum BM? Give reason.



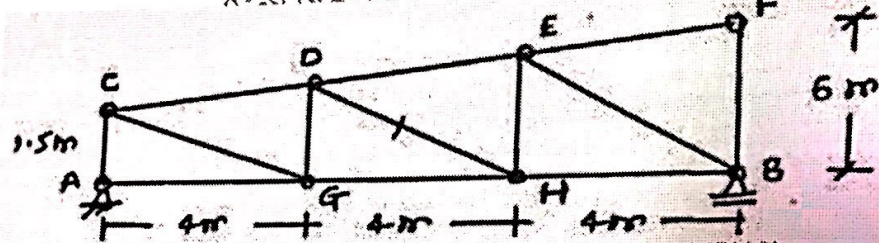
A 3-hinged stiffening girder of a suspension bridge of span 120 m is subjected to a moving load of length 25 m and intensity 30 kN/m moving from left to right. Draw SFD and BMD for the girder, when the head of live load just touches the central hinge on the girder.

TURN OVER

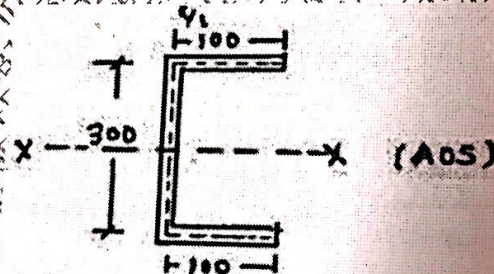
(b) Determine horizontal movement of roller support at 'D' in a rigid jointed frame loaded as shown. Use Virtual work method. Note that there is an internal hinge at 'B'.



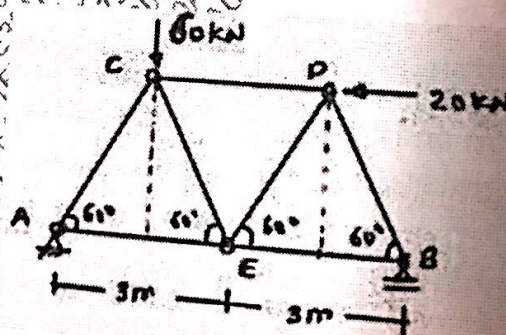
Q.6 (a) Draw ILD for axial force in member DH of a bridge truss of span 12 m as shown in figure.



(b) Locate the shear centre for thin walled channel section as shown in figure. Assume the uniform thickness as 10 mm. Cross sectional dimension are in mm



Q.6 (c) Using Unit load method or any other Energy method, determine deflection of joint E of the pin jointed truss loaded as shown in figure. Take Constant for all the members



(1) Question No 1 is compulsory.

(2) Attempt any **THREE** questions from the remaining questions.

(3) Assumptions made should be clearly stated.

(4) **Figures** to the **right** indicate **full marks**

Attempt any **FIVE** questions

20

(a) Draw a simple circular curve and explain all the elements of the same.

(b) What are the objectives of hydrographic surveying?

(c) Define Exposure station, Nadir point, Flying height and Swing.

(d) What are the objectives of GIS?

(e) Distinguish between conventional theodolite and electronic theodolite.

(f) Two straights intersect at chainage of 2056.44m and angle of intersection is 120° . If the radius of simple curve is 600m calculate tangent distance and chainage at point of commencement.

(a) The centre line of a road is to be tangential to each of the following lines. Calculate the radius of curve and tangent lengths

10

Line	WCB	Length
AB	0°
BC	90°	450.24m
CD	$143^\circ 12'$

(b) What is electronic digital theodolite? Mention its field application of it.

10

(a) What do you mean by setting out work? Explain setting out work for a building

10

(b) Distinguish between land survey and construction survey

5

(c) A straight length of a highway AB appears to be 12.5cm on a vertical air photograph of 15cm length. The corresponding distance of the highway on 1:50000 topographical maps are 6.25cm. Assuming the average elevation of the terrain as 1250m above MSL. Calculate the flying height of the camera above the MSL.

5

(a) How the details generated to plot 'L' section and 'C' section in survey camp? What is the use of the section for an engineer?

10

Q4.(b) In a road alignment a grade of -1.0% is followed one of $+0.5\%$. The chain intersection point are 400m and 250.50m respectively. The rate of change of grade is 20m . Calculate the necessary data for setting out the vertical curve take peg interval of 20m .

Q5.(a) Describe various obstacle in laying out of simple curve with neat sketch

Q5.(b) What is GPS ? Give the principle, types of GPS and application of GPS in civil field.

Q6. Attempt any **FOUR**

- a) Distinguish between composite curve and compound curve.
- b) Explain 7/12 utara.
- c) Principle and use of aerial photogrammetry.
- d) Define remote sensing system and necessity of the same.
- e) Field application of Total station.

Question no. 1 is compulsory

Attempt any three questions out of remaining five questions

Assume any additional data, if necessary, and state it clearly

Explain answers with neat sketches, wherever necessary

Explain the procedure for setting out centre line of a tunnel [05]
 Discuss necessity of curves. Classify horizontal curve with neat sketches. [05]
 Differentiate between fixed hair and movable hair method of tacheometry [05]
 What do you understand by Remote Sensing? Give its applications. [05]

Compare Radial Contouring Project with Block Contouring Project w.r.t the type of terrain, instruments and accessories used, time required, accuracy obtained, area covered, table for recording data, etc. [10]

A simple curve, of radius of curvature 250 m, connects two straights, intersecting at 900 m chainage and an intersection angle of $34^{\circ}30'$. A chain of length 20 m is used. Calculate all necessary data for setting out half of the curve by perpendicular offsets from the back tangent [10]

The readings given below were made with a tacheometric theodolite having a multiplying constant of 100 and no additive constant. The reduced level at station A was 100.0 m and the height of the instrument axis 1.35 m above the ground. Calculate the gradient expressed as the horizontal distance one meter rise or fall vertically between the stations B and C. [10]

Station	To	WCB	Vertical angle	Stadia readings
A	B	$48^{\circ}00'$	$+11^{\circ}30'$	2.048, 1.524, 1.000
	C	$138^{\circ}00'$	$-17^{\circ}00'$	2.112, 1.356, 0.600

Explain how do you perform project/ route survey for a highway [10]

The stadia hairs of a tacheometer are separated by a distance of 1.15 mm. from the central hair. The focal length of the object glass of the telescope is 23 cm. The distance of the object glass from the trunnion axis is 7 cm. Calculate the tacheometric constants [05]
 What do you understand by Stadia Charts and Tacheometric Tables [05]

Discuss briefly about the Global Positioning System. [05]

Discuss the principle and applications of Electronic Distance Measuring Instruments [05]

A gradient of -1% meets a gradient of +2% at a chainage of 1110.00 and elevation of 335.75 m.; The vertical curve of length 140 m is to be set out with pegs at 10 m interval. Calculate the elevations of the pegs by the method of Tangent Correction [10]

Explain the problems encountered while setting out simple circular curve [05]

A railway curve is to be connected through a transition curve to a straight for a limiting velocity of 80 kmph. Calculate the length of the transition curve if superelevation is to be built up 0.025 m. per sec. of vehicular travel [05]

Write short notes on: (any 4) [20]

Composite Curve

Instruments for setting out works

Subtense bar

GIS

Total Station

Q.P Code: 38841

Total Marks: 80

(3 Hours)

1. Question No. 1 is compulsory.
2. Attempt any three out of remaining five questions.
3. Make suitable assumptions wherever necessary and justify.
4. Figures to right indicate full marks.

Answer the following

Write the difference between greedy method and dynamic programming.

Explain the general procedure of divide and conquer method.

Determine the frequency counts for all statements in the following algorithm segment.

```
I=1;
While(I<=n)
{
    X=X+I;
    I=I+1;
}
```

What is backtracking Approach? Explain how it is used in Graph Coloring

5M

Explain with example how divide and conquer strategy is used in binary search?

10M

Solve sum of subsets problem for following

10M

$N=6$ $W=\{3, 5, 7, 8, 9, 15\}$ & $M=20$ Also write the Algorithm for it.

Obtain the solution to knapsack problem by Greedy method $n=7, m=15$ (p_1, p_2, \dots, p_7) = (10, 5, 15, 7, 6, 18, 3) (w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)

10M

Sort the list of the elements 10, 5, 7, 6, 1, 4, 8, 3, 2, 9 using merge sort algorithm and show its computing time is $O(n \log n)$.

10M

Explain different string matching algorithms.

10 M

What do you understand by NP Complete? Explain Is Subset sum problem NP complete? If so explain.

10M

Write a detailed note on Hamiltonian cycles.

10 M

Explain how backtracking is used for solving n- queens problem. Show the state space tree.

10M

Write Short Note on (any 2)

20 M

Job sequencing with deadlines

queens problem

Longest common subsequence

Total Marks: 80

Q1 is compulsory

Solve any three out of the remaining from Q.2 to Q.6

Figures on the right hand side indicate marks.

Use of statistical tables is allowed.

Q.1. a) A continuous random variable has P.D.F. $f(x) = kx^2(1 - x^3)$, $0 \leq x \leq 1$ and $f(x) = 0$, otherwise.. Find k and mean.

b) If $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ then prove that $A^{-1} = A^2 - 5A + 9I$.

c) By using Green's theorem evaluate the integral over the square formed by the line $x = \pm 1, y = \pm 1, \oint (x^2 + xy)dx + (x^2 + y^2)dy$

d) Calculate Karl Pearson's coefficient of correlation from the data.

x	3	5	4	6	2
y	3	4	5	2	6

2. a) Random sample of 900 items is found to have a mean of 65.3cm. Can it be regarded as a sample from a large population whose mean is 66.2 cm. and standard deviation 5cm. at 5% level of significance?

b) Use the Lagrange's method of multipliers to solve the NLPP, optimize

$Z = 6x_1^2 + 5x_2^2$, subjected to $x_1 + 5x_2 = 7, x_1, x_2 \geq 0$

c) A vector field is given by $\vec{F} = (x^2 + xy^2)\vec{i} + (y^2 + x^2y)\vec{j}$, prove that \vec{F} is irrotational, find the scalar potential

Q3. a) If x is a Poisson variable such that, $p(x=1) = p(x=2)$. find $E(x^2)$

b) Evaluate by using Stokes theorem, $\oint 3ydx + 4zdy + 6ydz$ where c is the curve of the intersection of sphere $x^2 + y^2 + z^2 = 8z$ and $z = x + 4$.

c) A die was thrown 132 times and the following frequencies were observed. Test the hypothesis that the die is unbiased.

[PTO]

Number obtained	1	2	3	4	5	6	Total
Frequency	15	20	25	15	29	28	132

Q.4 a) Obtain Spearman's coefficient of rank correlation from the given data

x	32	55	49	60	43	37	43	49	10	20
y	40	30	70	20	30	50	72	60	45	25

b) Use Gauss's divergence theorem to evaluate, $\iint_S x^2 dydz + y^2 dzdx + z^2 dxdy$ and S is the surface of the cube bounded by $x=0, x=1, y=0, y=1, z=0, z=1$.

c) Using the Kuhn Tucker method solve the NLPP. Maximize $Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$ subjected to $x_1 + x_2 \leq 2, 2x_1 + 3x_2 \leq 12, x_1, x_2 \geq 0$

Q.5. a) Show that the matrix $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix.

b) Regression lines are given by $6y = 5x + 90, 15x = 8y + 130, \sigma_x^2 = 16$, Find mean for x and y, correlation coefficient between x and y, and σ_y^2 .

c) The standard deviations calculated from two random samples of sizes 9 and are 1.99 and 1.9. can it be regarded as a sample drawn from the normal populations with the same standard deviations? (Given: $F_{0.025, 3.51, \text{with } dof = 8 \text{ and } 12, F_{0.025} = 4.20, \text{with } dof = 12 \text{ and } 8)$)

Q6.a) Find A^{50} if $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

b) The monthly salary x in a big organization is normally distributed, with mean Rs. 3000 and standard deviation Rs. 250. What should be the minimum salary a worker in this organization so that the probability that he belongs to top 5 workers?

c) The heights of six randomly chosen sailors are in inches: 63, 65, 68, 69, 71 and 72. The heights of ten randomly selected soldiers are 61, 62, 65, 66, 69, 69, 70, 71, and 73. Discuss in the light that this data suggests that the soldiers are on average taller than sailors.

CIVIL / IV Surveying - I

26/11/17

Q. P. Code: 26092

Time: 3 hours

Marks: 80

Question No.1 is compulsory. Attempt any three questions out of remaining.
Assume suitable data if required, state the same clearly.
Figures to the right indicate full marks.
Explain answers with neat sketches, wherever necessary

Sub questions in order.

Write short notes on any four from following:

Types of horizontal and vertical curves stating application of each in civil engineering (05)

Reverse curve, its necessity, elements of reverse curve. (05)

Batter board, boning rod. (05)

Tacheometry, its principle and advantages of tacheometry (05)

EDM, its principle and working. (05)

List various methods of setting out of curves. Explain setting out of curve by two theodolite method. (06)

Describe various obstacles in laying out of simple curves. (08)

Explain procedure for calculating data and setting out of vertical curve by chord gradient method. (06)

The following readings were taken with a tacheometer fitted with analectic lens. Calculate gradient between station P and Q. (10)

Investment Station	Staff station	WCB	Vertical angle	Stadia readings	Central hair reading
O	P	40°	10°	2.050	1.40
	Q	160°	-8° 30'	1.980	1.35

The RL of instrument station is 280.50 m and the height of instrument axis is 1.450m.

Explain how to calculate the R L of top of tower whose base is inaccessible, with two plane method. (05)

Derive an expression for calculating horizontal and vertical distance for line of sight inclined and staff held vertical. (05)

The bearings of three lines AB = 21°45', BC = 80°30', CD = 147°15'. Find the radius of curve tangential to three lines. Length BC = 450m. Also determine the tangent lengths. (08)

What is compound curve? What are elements of compound curve (06)

Explain setting out procedure of compound curve. (06)

A 8m wide road is to deflect through an angle of 60° with the centre line radius 300m, the chainage of point of intersection being 3600m. A transition curve is to be used at each end of the circular curve of such a length the rate of gain of radial acceleration is 0.5m/s³, when the speed is 50kmph. Find: (1) Length of transition curve. (2) chainages of all the junction points. (10)

Explain setting out of sewer line. (05)

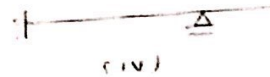
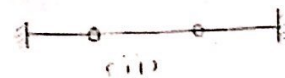
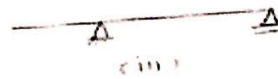
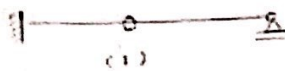
Describe survey project carried out by you at site for tacheometric contouring. (05)

- 6 a. A 3% rising gradient meets 2% down gradient. A vertical curve 200m long is to be used. The pegs are to be fixed at 20m interval. Calculate the RLs of the points on the vertical curve using tangent correction method, given that the height of collimation is 350m R L of apex is 350m and its chainage is 1000m. Tabulate results.
- b. Write short note on working of digital planimeter
- c. Write short note on remote sensing and its applications in civil engineering

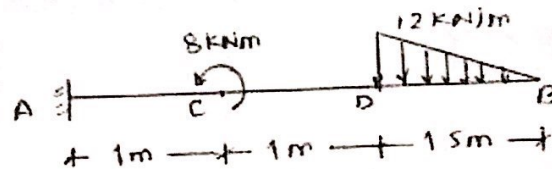
- Question no.1 is compulsory. Attempt any three out of remaining five questions.
Figures to the write indicate full marks.
Assume suitable data if needed but justify the same.

Answer any four from following-

- (a) For a 3-hinged symmetrical parabolic arch subjected to UDL over the entire span, prove that the radial shear force at every section is zero. 5
(b) Write Prof.Perry's formula, explaining the terms involved. Also state the importance of this formula over Secant formula. 5
(c) State & explain Moment Area Theorem-II. Also draw the conjugate beams for following real beams shown below- 5



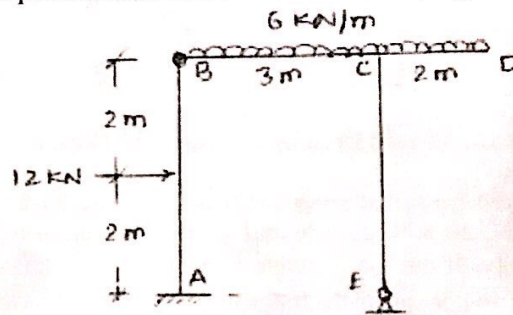
- (d) Explain with neat sketches the terms-(i) Unsymmetrical bending (ii) Shear centre. Also state their significance in structural analysis. 5
(e) Write the BM equation needed as per Macaulay's method for the beam loaded as shown- 5



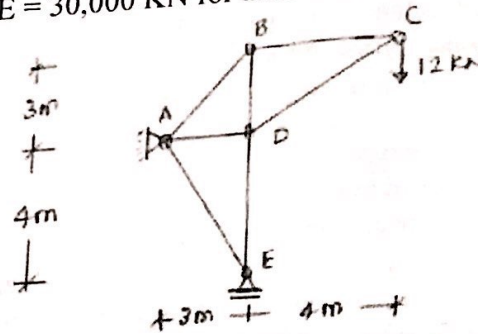
- (f) State and explain-

- Principle of superposition
- Castigliano's theorem.

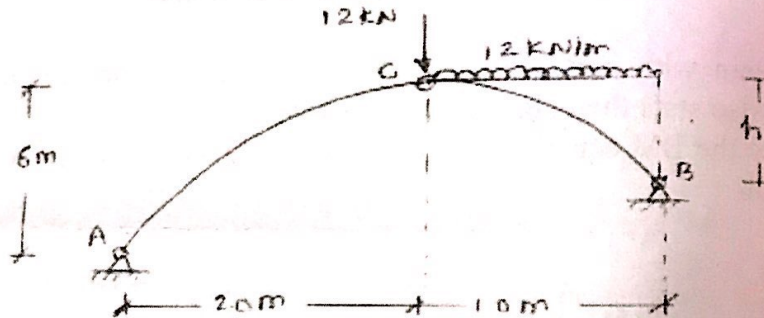
- (a) For a rigid jointed plane frame shown in figure, find support reactions and draw FBD for all four members. Also draw AFD, SFD and BMD for the frame, indicating important points. Note that there is internal hinge at 'B'. 10



(b) A pin jointed truss is loaded and supported as shown in figure. Determine the horizontal deflection of joint 'C' using Unit Load Method. Take axial rigidity $AE = 30,000 \text{ kN}$ for all members.

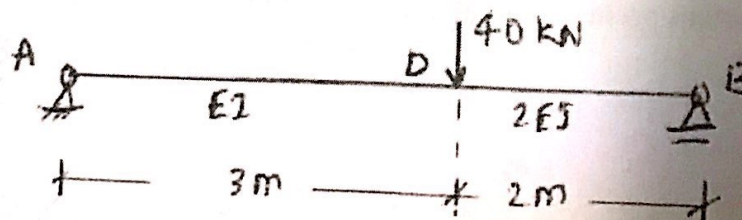


- Q.3 (a) An unsymmetrical 3-hinged parabolic arch is loaded as shown in figure. Find-
- The position of third hinge at 'C' above the right support.
 - Support reactions.
 - The position & magnitude of max +ve and max -ve BM in the arch. Also draw BMD for the arch.



- Q.3 (b) A hollow circular column of length 6 m, external diameter 200 mm and internal diameter 150 mm is fixed at both ends. If the column carries a load of 18 kN applied at distance 45 mm from column axis, determine extreme fibre stresses. Also sketch the stress distribution diagram. Take E for column material as 96 GPa.

- Q.4 (a) Using Moment Area Method OR Conjugate beam method, determine the location and magnitude of maximum deflection in a non-prismatic simply supported beam loaded as shown.



- (b) A simply supported girder of span 24 m is traversed by a series of five wheel loads 10 kN, 20 kN, 25 kN and 15 kN spaced at distances 3 m, 2 m, 2 m and 3 m respectively. If the load system is moving from left to right with 15 kN as leading load, find the location & magnitude of absolute maximum BM in the girder.

1. Q.No. 1 is compulsory
2. Attempt any Three questions from remaining Five questions.
3. Assume any data suitably if not given and state it clearly.

1. It is proposed to construct a **RESIDENTIAL BANGALOW** in the suburban area of Thane District for an executive engineer of P.W.D.. The building is (G+1) R.C.C. framed structure. The plot size is 30 mx28 m. Following are the requirements:

- | | | |
|--------|-------------------------|---------------|
| (i) | Entrance Lobby | min 3 mt wide |
| (ii) | Engineer's Office | 25-30 sq mt |
| (iii) | Living Room | 20-25 sq mt |
| (iv) | Study Room | 12-15 sq mt |
| (v) | Master Bedroom | 20-25 sq mt |
| (vi) | Bedroom (2 Nos) | 10-12 sq mt |
| (vii) | Kitchen cum Dining Room | 20-25 sq mt |
| (viii) | Children room | 10-12 sq mt |
| (ix) | Stores | 10-12 sq mt. |

Provide passages, staircase, sanitary unit, parking area etc. as per byelaws. Place the units as per their requirements on Ground and First Floor.

- | | |
|--|------|
| (a) Draw Ground floor plan. | (15) |
| (b) Draw first floor line plan. | (05) |
| 2. (a) Explain Principles of planning with neat sketches. | (10) |
| (b) Draw the foundation plan for the building given in Q.No.1 | (10) |
| 3. (a) Draw the detailed sectional elevation passing through staircase and other important units of building given in Q.No.1 | (15) |
| (b) Explain Working drawing and submission drawing | (05) |
| 4. (a) Differentiate among Load Bearing, Framed and Composite structure with neat sketches and examples. | (06) |
| (b) Draw the plan and section of pitched roof on hall measuring 8m x 8m. | (08) |
| (c) Explain Sun Path diagram with its application in building planning | (06) |
| 5. (a) Draw the front elevation of the building given in Q.No.1. | (10) |
| (b) Draw the site plan showing proposed built-up area, internal road, parking area, open space etc of the building given in Q.No.1. | (10) |
| 6. (a) Draw the plan and section of open well staircase for an educational building (G+1) having floor to floor height 3.6 mts. Also show design calculations. | (10) |
| (b) What are various objects of building bye-laws. Explain Carpet area. | (05) |
| (c) Draw roof terrace plan of the building given in Q.No.1 | (05) |

CT

Q.P.Code:17042

DURATION : 03 HOURS

MAX. MARKS : 80

INSTRUCTIONS :

1. Question number 1 is **COMPULSORY**.
2. Attempt any **THREE** questions from the remaining **FIVE** questions.
3. Each full question carries **EQUAL** marks.
4. Numbers in parenthesis are right to indicate **FULL** marks.
5. **ASSUME** any suitable data wherever required.

Q.1 Attempt any **FIVE** of the following :

- A) Explain Bulking Phenomenon of Sand. [04M]
 B) Explain Curing of concrete. [04M]
 C) Explain 'Boiling Water Method' to determining compressive strength of accelerated-cured concrete test specimens as per IS : 9013 - 2004. [04M]
 D) Write a short note on High Performance Concrete. [04M]
 E) Write a short note on Shotcrete. [04M]
 F) Explain Concept of retrofitting in-case of UCRM load bearing structure. [04M]

Q.2 A) Design a nominal mix of M15 concrete grade for sand of zone-II grading and maximum size of CA is 40 mm to carry-out PCC work, by using the table 9 of IS : 456 - 2000 whose clause no. is 9.3. Determine the mix proportions:
 1) by mass (weight) & 2) by ratio. It is decided to use volume batch mixing on the site, find out the volumetric proportions for the mix. Take bulk densities of cement, sand and coarse aggregate as 1450 Kg./m³, 1600 Kg./m³ and 1700 Kg./m³ respectively. [10M]

- B) Enlist the "Bogue's Compounds" of OPC. Explain their effects on properties of cement. [05M]
 C) Define Workability of Plastic concrete. Enlist factors affecting of it and explain any one of them. [05M]

Q.3 A) The concrete mix design is carried out for M25 concrete grade as per Indian Standards. The mix proportions per m³ of concrete is obtained as below :

Water (Kg.)	Cement (Kg.)	Sand (Kg.)	Coarse Aggregates (Kg.)
190	425	682	1064

Correct this proportions with explanation to suit the site conditions such that the free surface moisture of sand and crushed granite coarse aggregates are 2 % & 1 % respectively. Coarse aggregates contain 60 % of 20 mm size and 40 % of 12.5 mm size. Report your answers in weights as well as in ratios. [08M]

- B) Define coarse aggregate. Classify coarse aggregates on the basis of surface texture. How does surface texture influences on the properties of plastic as well as hardened concretes ? [07M]
 C) Define light weight concrete. Classify LWC on the basis of making method and enlist applications of aerated concrete (min. 4). [05M]

Q.4 A) Calculate approximately the ingredients of concrete, required to perform the slump cone test in the lab. If the mix proportions for M20 grade of concrete is 0.5 : 1 : 1.5 : 3. Take dimensions of slump cone is D = 200 mm, d = 100 mm and H = 300 mm. [08M]

Turn Over

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- B) Define admixture. Enlist chemical admixtures and explain WRAs based on, how does they works to increase workability and strength of the concrete ?
- C) Define special concrete. Explain roller compacted concrete with field applications.
- Q.5 A) Explain with neat sketches Routing & Sealing and Stitching methods of the crack repair techniques.
- B) Define Fibre Reinforced Concrete. Explain cracking mechanism in FRC member subjected to flexure with neat labelled sketch.
- C) Define Hot Weather Concreting. What are the precautions are to be taken while concreting in hot weather condition?

Q.6 A) Choose & write the correct options :

- a) The Flow Table Test on fresh concrete is explained in IS _____
i) IS 456 : 2000 ii) IS 1199 : 1959 iii) IS 457 : 1957 iv) IS : 383 : 1970
- b) The Flexural Tensile Strength on hardened concrete is explained in IS _____
i) IS 516 : 1959 ii) IS 10262 : 2009 iii) IS 456 : 2000 iv) IS 1199 : 1959
- c) The gradation of FA & CA are given in IS _____
i) IS 2386(part 1) : 1963 ii) IS 269 : 2013 iii) IS 383 : 1970 iv) IS 455 : 198
- d) The guidelines for Concrete Mix Design are given in IS _____
i) IS 10262 : 2009 ii) IS 10086 : 1982 iii) IS 10510 : 1983 iv) IS 10080 : 198
- e) Air entrainment in the concrete increases _____
i) workability, ii) strength, iii) the effect of temp. Variation, iv) the unit weight.

B) Enlist the advantages of Ready Mixed Concrete.

C) Write a note on Rebound Hammer Test on concrete.

D) Define High Strength Concrete and explain setting & hardening property of it.

Data for Nominal Mix Design [Q.2 A)]

Table 9 Proportions for Nominal Mix Concrete

(Clauses 9.3 and 9.3.1)

Grade of Concrete	Total Quantity of Dry Aggregates by Mass per 50 kg of Cement, to be Taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, kg, Max	Proportion of Fine Aggregate to Coarse Aggregate (by Mass)	Quantity of Water per 50 kg of Cement, Max
(1)	(2)	(3)	(4)
M 5	800	Generally 1:2 but subject to an upper limit of 1:1½, and a lower limit of 1:2½,	60
M 7.5	625		45
M 10	480		34
M 15	330		32
M 20	250		30

NOTE—The proportion of the fine to coarse aggregates should be adjusted from upper limit to lower limit progressively as the of fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be

Example

For an average grading of fine aggregate (that is, Zone II of Table 4 of IS 383), the proportions shall be 1:1½, 1:2 and 1 maximum size of aggregates 10 mm, 20 mm and 40 mm respectively.

Q. P. Code: 26419

(3 hours)

Total marks: 80

(1) Question no.1 is compulsory.

(2) Attempt any 3 questions out of the remaining 5 questions.

(3) Assume data wherever necessary and clearly mention the assumptions made.

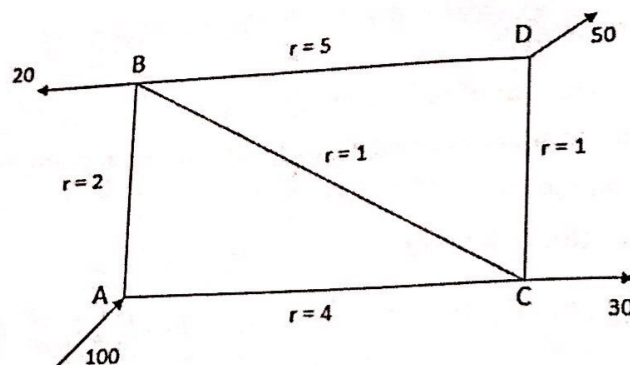
(4) Draw neat figures as required.

20

Solve any four from the following

- a Define and explain the terms (i) Hydraulic gradient line and (ii) Total energy line.
 - b Write a note on Water Hammer & Control measures.
 - c Define Mach Cone, Mach angle, Zone of action and Zone of Silence.
 - d Explain Prandtl's Mixing Length Theory.
 - e Explain the term co-efficient of friction. On what factors does this co-efficient depend?
- a The difference of water levels of two water reservoirs is 8 m. They are connected by a 40 m long pipe. For the first 25 m length, the diameter of the pipe is 120 mm and for the remaining length, the diameter is 200 mm, the change in diameter being sudden. Find the discharge into the lower reservoir. Take $f = 0.008$. 10
 - b. A syphon pipe 800 m long connects two reservoirs whose water surface levels differ by 9 m. The diameter of the pipe is 400 mm. Taking $f = 0.008$, find the discharge. 10
If the summit of the syphon pipe is 6 m above the surface level of the upper reservoir, calculate the maximum length of the inlet leg for the pipe to run full. Neglect all losses other than friction. Take atmospheric pressure head = 10.3 m of water and separation pressure head = 2.3 m of water.
 - a Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m. If the co-efficient of friction for each pipe is (4f) 0.32, calculate the rate of flow for each pipe and also the diameter of a single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes. 10
 - b Find the maximum power transmitted by a jet of water discharging freely out of a nozzle fitted to a pipe = 300 m long and 100 mm diameter with co-efficient of friction as 0.01. The available head at the nozzle is 90 m. 5
 - c Show that the diameter of nozzle for maximum transmission of power is given by $d = \left[\frac{D^5}{8fL} \right]^{1/4}$ 5

- Q4 a For a pipe network shown below, determine the flow in each pipe. The value may be assumed as 2.0.



- b Calculate the stagnation pressure, temperature and density on the stagnation point of the nose of a plane, which is flying at 800 km/hour through still air having a pressure of 8.0 N/cm^2 (abs) and temperature -10°C . Take $R = 287 \text{ J/kg K}$ and $k = 1.4$.
- Q5 a Determine (i) the pressure gradient, (ii) the shear stress at the two horizontal plates and (iii) the discharge per meter width for the laminar flow of oil with a maximum velocity of 2 m/s between two horizontal fixed plates, which are 100 mm apart. Given $\mu = 2.4525 \text{ N s/m}^2$.
- b Prove that the velocity distribution for viscous flow between two parallel plates, both plates are fixed across a section is parabolic in nature. Also prove that maximum velocity is equal to one and a half times the average velocity.
- Q6 a For turbulent flow in a pipe of diameter 300 mm , find the discharge when the centre line velocity is 2 m/s and the velocity at a point 100 mm from the centre as measured by pitot tube is 1.6 m/s .
- b A rough pipe of diameter 400 mm and length 1000 m carries water at the rate of $1 \text{ m}^3/\text{s}$. the wall roughness is 0.012 mm . Determine the co-efficient of friction, shear stress, centre-line velocity and velocity at a distance of 150 mm from the wall.

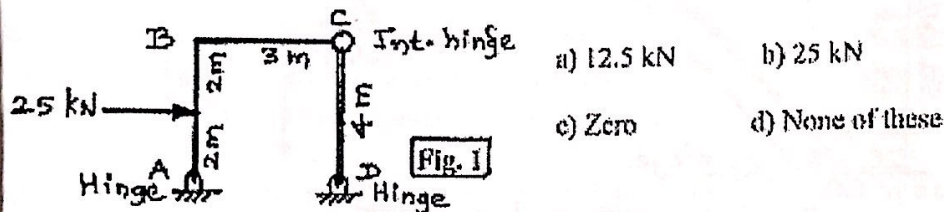
Question No. 1 is compulsory.

Answer any three from the remaining.

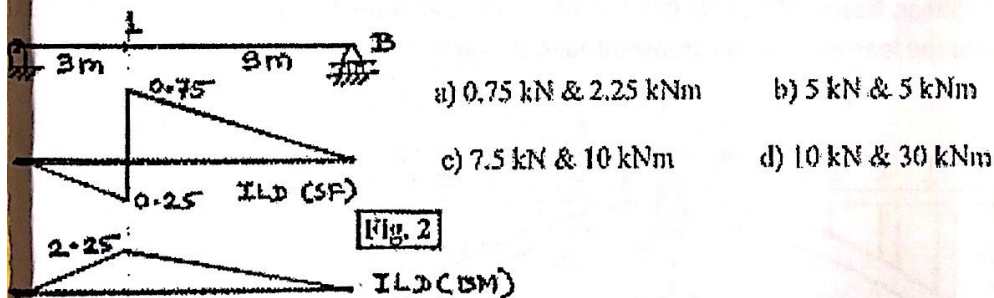
Each full question carries equal marks.

Assume suitable data if needed and state it clearly.

- Three hinged parabolic arch, supported at the same level, carries a UDL (w) throughout length (l). The central rise is (h). If the rise is halved (i. e. reduced to $h/2$), prove that the horizontal thrust (H) at the lower hinges gets doubled. 4
- For the frame in (Fig. 1), the axial force experienced by the beam BC is (write the correct option): 2



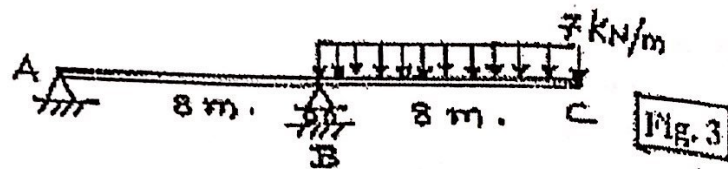
- Fig. 2 shows a beam with its influence lines for Shear Force & Bending Moment at section 1. 2
- The Shear Force & Bending Moment at section 1 due to a point load of 20 kN, placed at mid-span, will be (write the correct option).



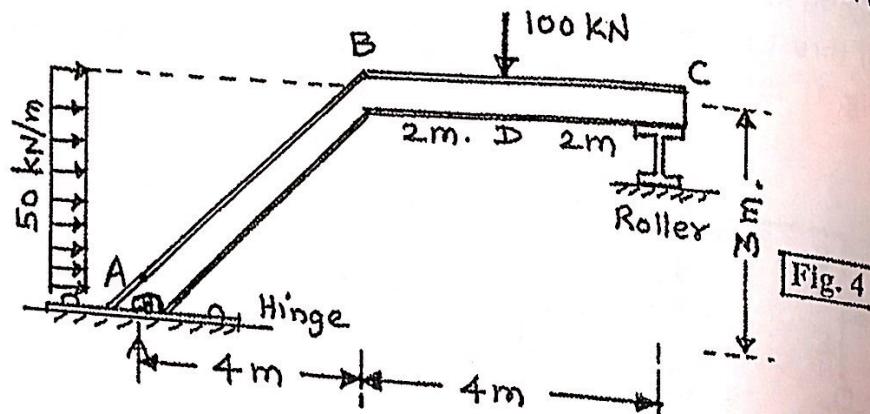
- A suspension cable having supports at the same level, has a span of 30 m & a maximum dip of 3 m. The cable is loaded with a UDL of 12 kN/m throughout its length. Find the maximum tension in the cable. 4
- State the two theorems of Moment-Area Method, with necessary diagrammatic illustrations. 4
- Explain the method of virtual work, as applied to beams & frames, to find the rotations and translations. 4

[TURN OVER]

2. (a) Determine the deflection at point C of the beam (Fig. 3). Use Moment-Area Method. QP Co
 $E = 200 \text{ GPa}$ & $I = (250 \times 10^6) \text{ mm}^4$.

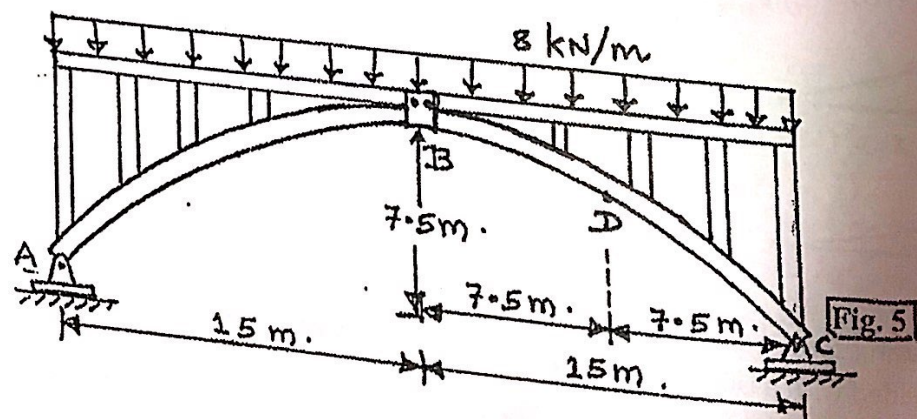


- (b) Draw Axial Force Diagrams, Shear Force Diagrams and Bending Moment Diagrams for the statically determinate rigid jointed plane frame shown in (Fig. 4).



- (c) State the two theorems of Conjugate Beam Method.

3. (a) The three-hinged arch bridge (Fig. 5) has a parabolic shape & supports the UDL. Calculate the Radial Shear, Normal Thrust & Bending Moment at an intermediate point D along the arch rib ABC. Assume the load is uniformly transmitted to the arch rib ABC.



B - Hinge

Determine the absolute maximum Bending Moment in a Simply Supported beam. (girder), when the three wheel loads pass from right to the left on the girder. Support (A) is a roller & support (B) is a hinge. Refer (Fig. 6).

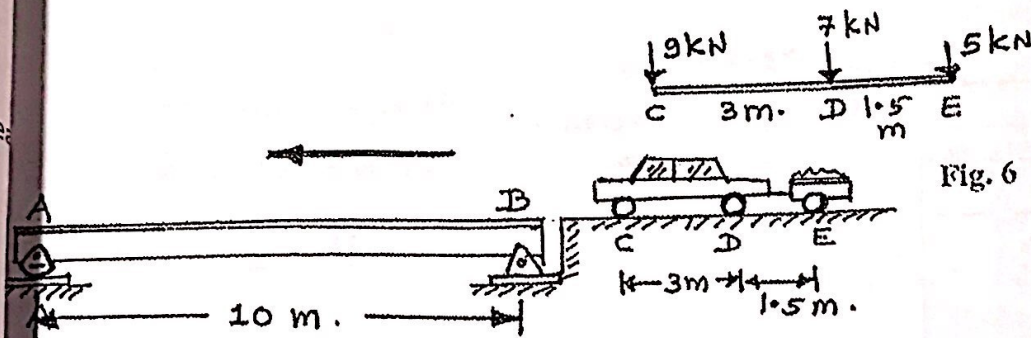


Fig. 6

A hollow circular column has external diameter = 200 mm, internal dia = 160 mm, length = 4 m. and carried by column is 200 kN at an eccentricity of 25 mm. Both ends are fixed. Young's modulus = 94×10^3 MPa. Find the maximum bending moment.

A suspension bridge of 250 m span has three hinged stiffening girder supported by a cable, with a central dip of 25 m. If 4 point loads of 150 kN each are placed at the distances of 20 m, 40 m and 50 m from the left hand hinge, find the shear force and bending moment in the girder at 62.5 m from each end, Also find the maximum tension in the cable.

Using Castigliano's theorem, determine vertical displacement of point C of beam (Fig. 7). $E = 200$ GPa, $I = 150 \times 10^6$ mm⁴.

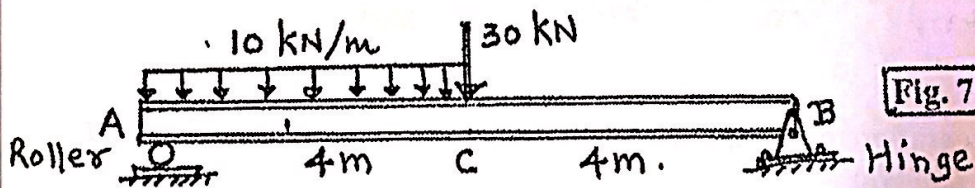
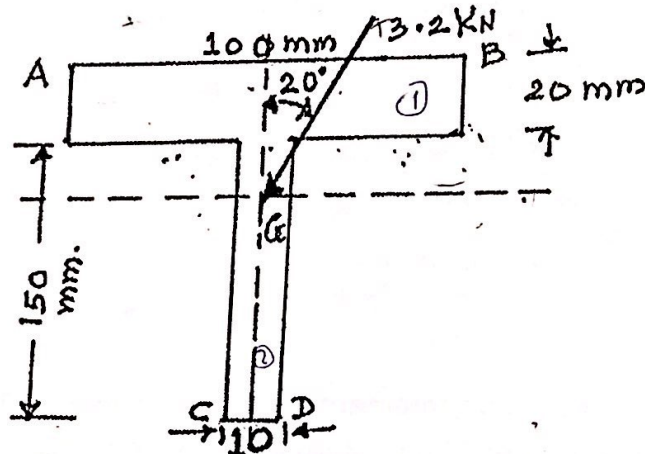


Fig. 7

Use the Maxwell's Reciprocal theorem & Betti's theorem.

5. (a) A beam of T-section (Fig. 8) is 2.5 m long and is simply supported at the ends. It carries a load of 3.2 kN inclined at 20° to the vertical and passing through the centroid of section. If $E = 200 \text{ GN/m}^2$, calculate maximum tensile stress and maximum compressive stress.



$$\text{Flange} = (100 \times 20) \text{ mm}$$

$$\text{Web} = (10 \times 150) \text{ mm}$$

Fig. 8

- (b) Draw the Influence Line Diagrams for the forces in members A & B for the pin-jointed plane truss (Fig. 9).

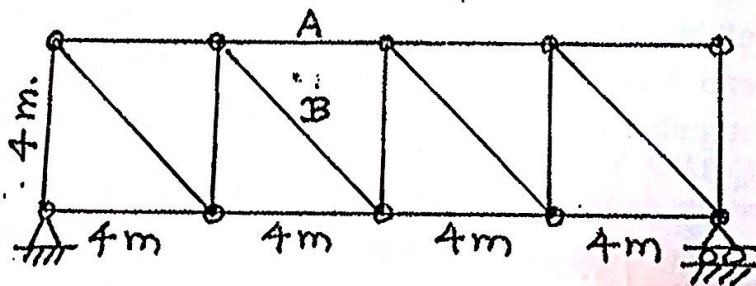


Fig. 9

- (c) Using double integration method, determine the slope at the free end (B) of the cantilever beam (Fig. 10).

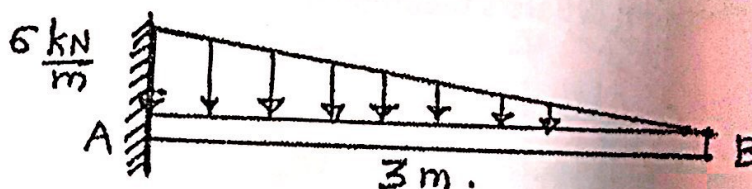


Fig. 10

Using Unit Load Method, find the vertical deflection of joint (C) of a pin-jointed plane truss (Fig. 11). Area of C/S of each member = 1100 mm^2 and $E = 2.1 \times 10^5 \text{ MPa}$.

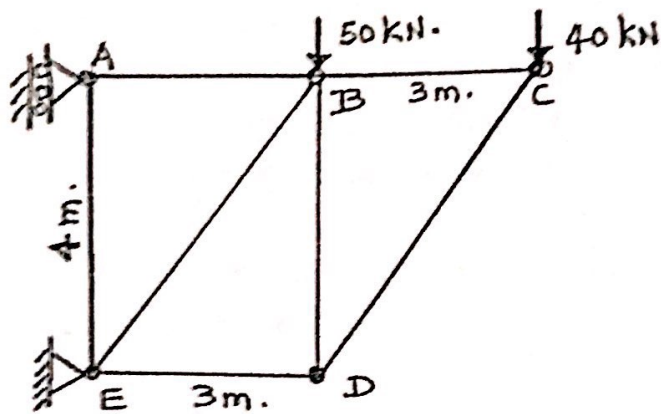


Fig. 11

Using Castigliano's theorem, calculate the horizontal displacement of roller support (D) for the rigid jointed plane frame (Fig. 12). $E = 2 \times 10^5 \text{ MPa}$ & $I = 5 \times 10^8 \text{ mm}^4$.

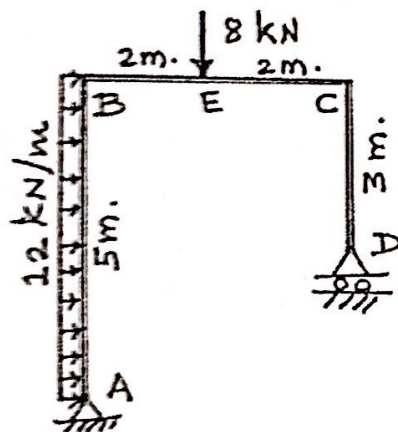
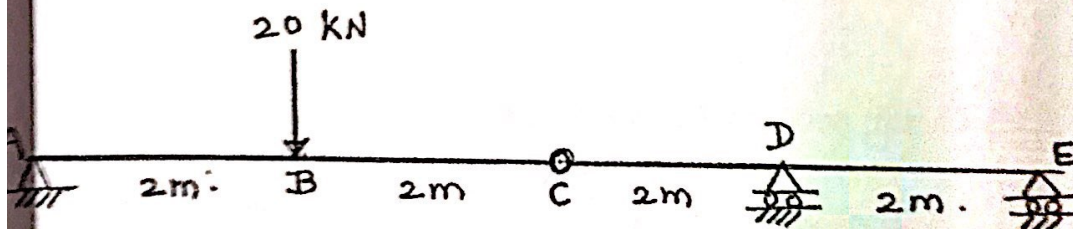


Fig. 12

Find the slope at B for the beam (Fig. 13). Use Conjugate Beam Method. C is an internal hinge. Take $E = 2 \times 10^5 \text{ MPa}$ & $I = 5 \times 10^7 \text{ mm}^4$.



(Fig. 13)

Q.P. Code : 589204

(Revised Course)

(4 Hours)

[Total Marks : 80]

- (1) Question No.1 is compulsory.
- (2) Attempt **any three** out of remaining **five** questions.
- (3) **Figures** to the **right** indicate **full marks**.
- (4) Assume suitable **data** and **clearly state the same**.

is proposed to plan, design and draw a residential bungalow for a family in western suburbs (G + 1, RCC framed structure) with the following facilities:

- (i) Living Room (16 to 18 sqm)
- (ii) Master Bedroom (16 to 20 sqm)
- (iii) Kitchen (6 to 8 sqm)
- (iv) Dining Room (12 to 14 sqm)
- (v) Bed Rooms two nos. (15 to 16 sqm)
- (vi) Guest Room (15 to 16 sqm)
- (v) Garage (15 to 16 sqm)

Provide verandah, staircase, passage and sanitary units etc as per bye laws. Assume floor to floor height = 3.3m. Plot size 20m x 30m.

- (1) Draw the developed Ground Floor plan clearly indicating the opening for doors, windows etc. 15
- (2) Draw the line plan of 1st floor. 5
- Draw the cross section passing through staircase, bath & WC with sunk slab, door and windows etc of building drawn in Q. No.1. 15
- Calculate carpet area and built up in a tabular form of building drawn in Q. No.1. 5
- Draw the well labelled and well dimensioned foundation plan for the building drawn in Q. No.1 along with diagonal check. 10
- What is pitch roof? State the conditions when king post and queen post truss are used. Suggest the type of pitch roof truss for a factory of clear size 6 m x 18 m. Draw the plan showing the location of roof truss with centre to centre distance and section of the same with complete details. 10

TURN OVER

Q.P. Code : 559204

2

4. (a) Draw various types of lines used in civil engineering drawing. Explain each stands for.
- (b) How are building classified as per NBC 2003? In which category building of Q.No.1 fall into?
- (c) Draw the site plan and location plan for building drawn in Q. No.1.
5. (a) Explain with the help of sketches, suitability, merits and demerits of bearing structure, framed structure and composite structure.
- (b) What are the various types of door? Suggest the type of main door provided in building of Q. No.1 with justification. Draw the plan and section of that door.
- (c) What is wind rose diagram? What are the data required to draw a wind rose diagram? Explain in brief.
6. Answer the following questions (any four).
 - (1) State the minimum dimensions provided for various components of a staircase.
 - (2) What are the minimum areas for different rooms in a residential building as per bye laws?
 - (3) What is the importance of planning principle 'aspect' and 'prospect' in building planning?
 - (4) Write a note on set back distance and its importance.
 - (5) State the importance of schedule of opening and area statement in civil engineering drawing.

T0924 / T1016 CONCRETE TECHNOLOGY

Q.P.Code:17040

[REVISED COURSE]

(3 Hours)

[Total Marks : 80]

TE:.

- 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.

- (a) What is hydration of cement? Describe the role played by Gypsum in the hydration reaction of cement. 05
- (b) What are the properties one looks for in sand & water and how does one test them for its acceptance for use in concrete? 05
- (c) According to IS-456 2000, state the various types of workability with slump value, compaction factor and applications, in a tabular form. 05
- (d) How will you decide the maximum aggregate size, zone of sand and air content in aggregate. 05
- (a) Why grading of aggregate is important in concrete. Write explanatory notes on i) uniform grading, ii) Gap grading and, iii) continuous grading. 10
- (b) Define cold weather concreting. What are the effects of cold weather on concrete? What are the precautions to be taken during cold weather concreting? 10
- (a) Enlist the various factors required for mix design. How do they affect the process of mix design? 10
- (b) Define High Performance concrete. What are the constituents of HPC? Explain the method of making high performance concrete. 10
- (a) Define the destructive, non destructive and partial destructive tests on concrete with examples. Explain in detail core test. 10
- (b) What do understand by setting times of cement? Explain the procedure to determine the setting times of cement.. 10
- (a) State the various physical properties of aggregates. How do they affect the strength of concrete? 10
- (b) Why w/c ratio is so important in concrete? Explain the effect of w/c ration on the strength and durability of concrete. 10

Write short notes on the following (any four)

20

- i No fines concrete
- ii Retrofitting
- iii Load test
- iv HPC
- v Nominal mix and design mix



T0924 / T1017 FLUID MECHANICS II

Q.P. Code: 16400

(CBGS)

(3 hours)

Total marks: 80

- (1) Question no.1 is compulsory.
- (2) Attempt any 3 questions out of the remaining 5 questions.
- (3) Assume data wherever necessary and clearly mention the assumptions made.
- (4) Draw neat figures as required.

Solve any four from the following

20

- a Derive an expression for the equivalent size of the pipe to replace the pipes in series.
 - b Write a short note on hydraulic gradient line and total energy line.
 - c What do you understand by hydrodynamically rough and smooth boundaries?
 - d Explain the propagation of pressure waves in a compressible fluid when $M > 1$.
 - e Write a short note on dashpot mechanism.
- a Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400 m. The rate of flow of water through the pipe is 300 lps. Consider all losses and take the value of $f = .008$. Draw Hydraulic Gradient Line and Total Energy Line. 10
 - b A siphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The total length of the siphon is 600 m and the summit is 4 m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of siphon from the upper reservoir to summit. Take $f = .004$ and atmospheric pressure = 10.3 m of water. 10
 - a A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if $4f = 0.04$. The head at inlet is 300 mm. 10
 - b Find an expression for the diameter of nozzle for maximum transmission of power. 5
 - c A valve is provided at the end of a cast iron pipe of diameter 150 mm and of thickness 10 mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2 N/cm^2 . Take K for water as $19.62 \times 10^4 \text{ N/cm}^2$ and E for cast iron pipe as $11.772 \times 10^6 \text{ N/cm}^2$. 5
 - a State assumptions in Hardy-Cross method used for solving pipe network problems and obtain an expression for correction in discharge for value of $n=2$. 10
 - b Calculate the stagnation pressure, temperature and density on the stagnation point on the nose of a plane, which is flying at 800 km/hour through still air having a pressure 8.0 N/cm^2 (abs) and temperature -10°C . Take $R = 287 \text{ J/kg K}$ and $k = 1.4$. 10

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Q.P. Code: _____

- Q5 a** An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m . The rate of flow of fluid through the pipe is 3.5 l/s . Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall.
- b** Show that the momentum correction factor and energy correction factor for laminar flow through a circular pipe are $4/3$ and 2.0 respectively.
- Q6 a** A smooth pipe of diameter 400 mm and length 800 m carries water at the rate of $0.04 \text{ m}^3/\text{s}$. Determine the head lost due to friction, wall shear stress, centre line velocity and thickness of laminar sub-layer. Take the kinematic viscosity of water as 0.018 stokes .
- b** Write short notes on
- Prandtl's mixing length theory
 - Moody's diagram

xxx

CIVIL - IV

Surveying - II

(19/5/17)

Q.P. Code: 16798

[Time : 3 Hours]

[Marks : 80]

Please check whether you have got the right question paper

- N.B:**
1. Questions No.1 is compulsory. Attempt any three out of remaining questions.
 2. Assume any suitable data if required, state the same clearly.
 3. Figures to the right indicate full marks.
 4. Attempt sub-questions in order.

Compare any Four :

- a) Digital Level and Auto Level.
- b) Compound Curve and Composite Curve.
- c) Fixed Hair Method and Movable Hair Method.
- d) Transit Theodolite and Digital Theodolite.
- e) Block Contouring and Radial Contouring.

- a) In a tacheometric surveying the observations were taken with tacheometer having multiplying constant 100 and additive constant 0.5. Calculate the gradient of line PQ. The staff was held vertical during observations. The RL of station R is 41.800 m.

Instrument Station	H. I. (m)	Staff Station	Bearing	Vertical Angle	Staff readings (m)
R	1.600	P	85°	+4° 30''	1.000, 1.417, 1.833
		Q	135°	-4° 00'	1.000, 1.657, 2.313

- b) Determine the constant of tacheometer from the following data :

Distance of staff from vertical axis of tacheometer in m	Readings of stadia wires	
	Lower Wire	Upper Wire
30	1.086	1.383
60	0.924	1.521

- c) Explain how to calculate the RL of top of tower whose base is inaccessible, with two plane method.
- d) List various methods of setting out of curves. Explain setting out of curve by offsets from chord produced method.
- e) Describe various obstacles in laying out of simple curves.
- f) What is vertical curve? Sketch various types of vertical curves.

4. a) Two straights PQ and QR intersect at a chainage of 4090 m and interior angle 150° . It is required to set out 4° simple circular curve. Tabulate necessary data to layout the curve with chord interval of 30 m using Rankine method of deflection angle.
- b) Explain transferring the levels to underground for setting out of a tunnel.
5. a) Explain in detail how road project was executed in survey camp?
- b) A 0.5% rising gradient meets -0.7% down gradient. The chainage of intersection points are 550 m and 375 m respectively. Calculate the RLs of points on the vertical curve using Chord gradient method. The rate of change of grade is 0.1% per peg. The peg interval is 20m. Tabulate the results.
6. Write short notes on (any four):
- Tangent correction method.
 - GPS and its applications.
 - Project Survey for dam.
 - Sub-tense bar method.
 - Significance of transition curve and its length determination.

OLD COURSE

Time : 3Hrs.

Marks : 100

N.B.: (1) Question No.1 is compulsory.

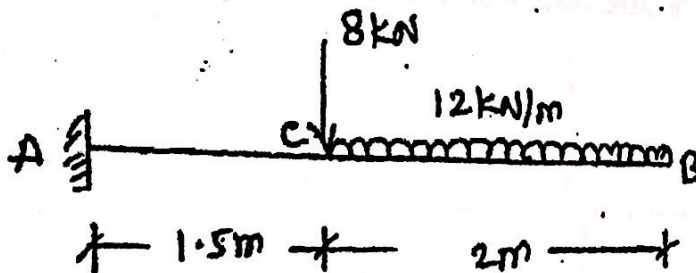
(2) Attempt any Four questions out of remaining questions.

(3) Assume suitable data if required but justify the same

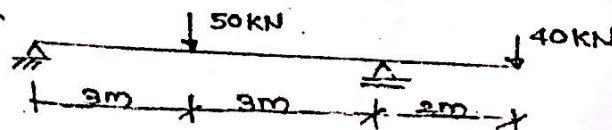
Attempt any four

(20)

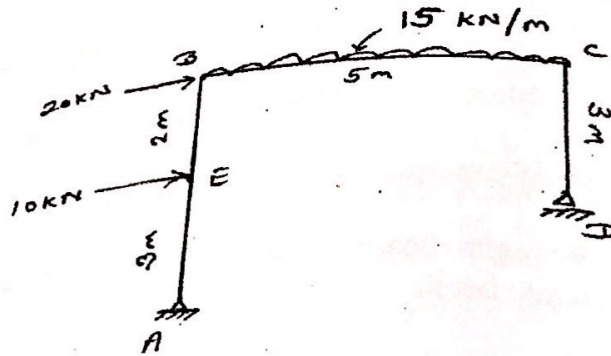
- (a) Explain the principle of superposition with example.
- (b) What is meant by conjugate beam? State the Mohr's Theorem no I & II as applied to the conjugate beam.
- (c) Define ILD and explain its importance in Structural analysis
- (d) Explain function of each component of suspension bridge consisting of suspension cable and three hinged stiffening girder.
- (e) Explain the concept of unsymmetrical bending. Also state the condition where unsymmetrical bending in flexural members can occur.
- (a) Using moment area method, determine the vertical deflection and slope at free end of the beam as shown in fig. (10)



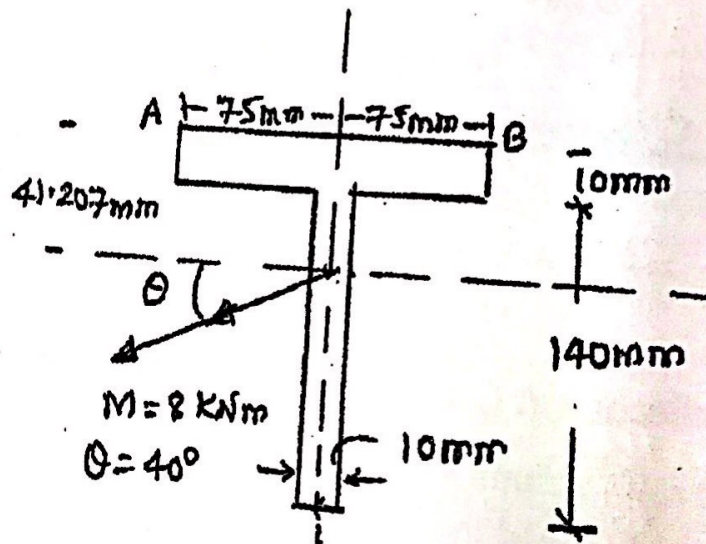
- (b) Determine slope and deflection at C in the overhanging beam ABC as shown (10) in fig below. Take $E = 2 \times 10^5 \text{ N/mm}^2$ $I = 100 \times 10^6 \text{ mm}^4$



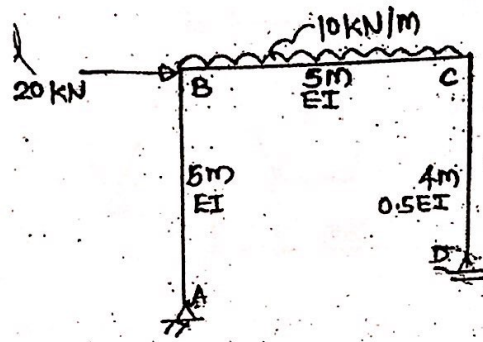
- Q.3 (a) Analyse the rigid jointed frame shown in fig. Draw Free Body Diagram of each member separately and construct AFD, SFD, BMD for the same.



- Q.3 (b) A symmetrical cable of span 100m with central dip 15m is loaded with U of 30kN/m. Find the maximum and minimum tension in the cable.
- Q.4 (a) Figure shows the cross section of a T beam with its CG 41.207mm below top surface AB. The c/s is subjected to sagging bending moment of 8kNm acting in plane as shown in figure. Find the maximum compressive and tensile stresses induced in c/s. Also locate the neutral axis position.

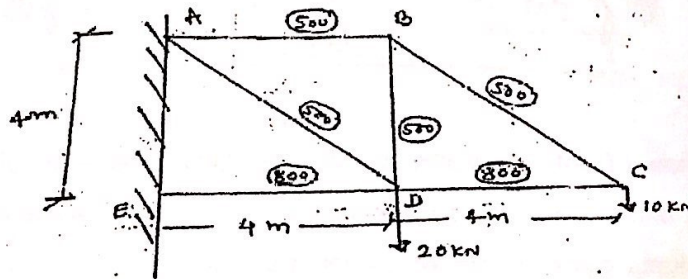


For the pin jointed plane frame as shown in figure, calculate vertical deflection of point D as shown in figure. (10)



Find the vertical deflection of the truss shown in figure at the joint C. Cross-sectional areas in mm^2 of all the members are shown in figure. (10)

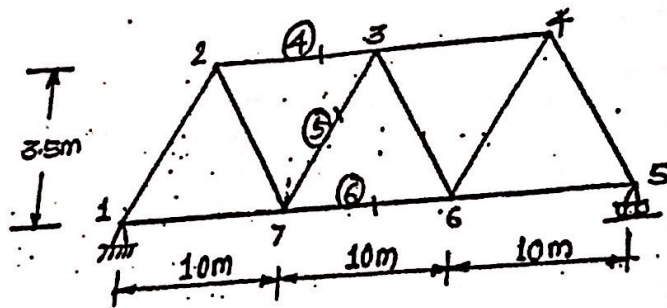
Take $E = 2 \times 10^5 \text{ N/mm}^2$.



Draw ILD for members 4, 5 and 6 of truss shown in fig. Assume that the load (10)

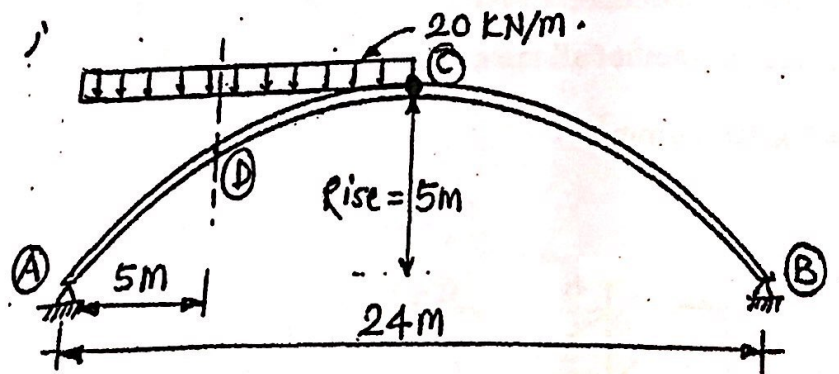
Turn Over

moves along the bottom chord.



Q.6 (a)

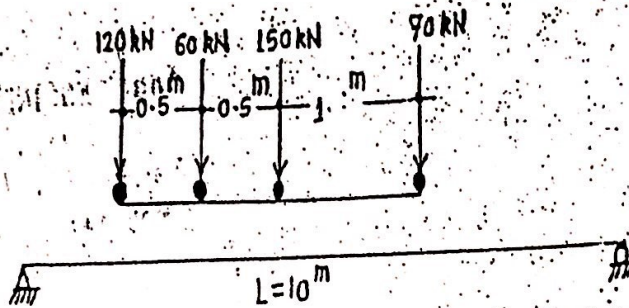
A three hinged symmetrical parabolic arch is loaded as shown in figure. Calculate: i) Support Reaction ii) Maximum bending moment in the portion AC and BC (Draw neat sketch). iii) Normal thrust and radial SF at D.



- (b) A column of hollow circular section with 200mm external diameter and 100mm internal diameter is of length 4m. The column is pinned at both ends. The column carries a load of 100kN at an eccentricity of 40mm. Find the stresses produced at extreme fibre of the column section. Take $E=200\text{Gpa}$.

Q.7 (a) The load shown in fig moves from left to right on a girder of span 10m find

the absolute max. BM for the girder.



-) The cable of a suspension bridge has a span of 50m and a central dip of 6.25m. (10)
 Each cable is stiffened by a girder hinged at ends at mid span. There is a uniform dead load of 10kN/m over the whole girder and in addition a live load of 32kN/m, 12m long. Find the maximum cable tension when the live load is situated on the half of stiffening girder with its right end over the central hinge.

Q. P.Code : 538901

[3 Hours]

[Total Marks: 80]

Question No. 1 is compulsory.

Attempt any three of the remaining.

Use of statistical table is allowed.

Using Green's theorem evaluate.

$\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = x^2\hat{i} - xy\hat{j}$ and c is the triangle having vertices $A(0,2)$, $B(2,0)$, $C(4,2)$

Use Cayley – Hamilton theorem to find $2A^4 - 5A^3 - 7A + 6I$ where $A = \begin{bmatrix} 1 & 2 \\ 2 & 2 \end{bmatrix}$

If the mean of the following distribution is 16 find m, n and variance

X	8	12	16	20	24
P (X=x)	1/8	m	n	1/4	1/12

The average of marks scored by 32 boys is 72 with standard deviation 8 while that of 36

Girls is 70 with standard deviation 6. Test at 1% level of significance whether the boys perform better than girls.

Calculate Spearman's coefficient of rank correlation from the data on height and weight of 8 students

Height (in inches)	60	62	64	66	68	70	72	74
Weight (in lbs)	92	83	101	110	128	119	137	146

It is known that the probability of an item produced by a certain machine will 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 2 (ii) exactly 2 (iii) at most 2 defective items in a consignment of 1000 packets using Poisson distribution.

Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$$

[Turnover

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

	A	B
Population		
Sample size	20	17
Sample Standard deviation	60	50

Test the hypothesis that variance of A is greater than variance of B

- (b) Using the method of Lagrange's multipliers solve the following N.L.P.P.

$$\text{Optimize } Z = 6x_1^2 + 5x_2^2$$

$$\text{Subject to } x_1 + 5x_2 = 7 \text{ and } x_1, x_2 \geq 0$$

- (c) Prove that $\vec{F} = (2xy + z)\hat{i} + (x^2 + 2yz^3)\hat{j} + (3y^2z^2 + x)\hat{k}$ is irrotational. Find the scalar potential for \vec{F} and the work done in moving an object in this field from $(1, 2, 0)$ to $(2, 2, 1)$

4. (a) In an intelligence test administered to 1000 students the average score was 42 and standard deviation was 24. Find the number of students (i) exceeding the score 54 (ii) between 30 and 54

- (b) Use Gauss's divergence theorem to evaluate $\iiint_V \nabla \cdot \vec{F} ds$ where $\vec{F} = 2x\hat{i} + xy\hat{j} + z\hat{k}$

over the region bounded by the cylinder $x^2 + y^2 = 4$, $z = 0$, $z = 6$

- (c) A sample of 400 students of undergraduates and 400 students of post graduate classes was taken to know their opinion about autonomous colleges. 290 of the undergraduate and 310 of the post graduate students favored the autonomous status. Present these facts in the form of a table and test at 5% level, that the opinion regarding Autonomous status of colleges is independent of the level of classes of students

- (a) Seven dice are thrown 729 times. How many times do you expect at least four dice to show three or five?

- (b) Use Stoke's theorem to evaluate $\oint_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ and C is the boundary of $x=0$, $y=0$ and $x^2 + y^2 = 1$ in the plane $z=0$

A chemical engineer is investigating the effect of process operating temperature X on product yield Y . The results in the following data

X	100	110	120	130	140	150	160	170	180	190
Y	45	51	54	61	66	70	74	78	85	89

Find the equation of regression line which will be enable to predict yield on the basis of

Temperature. Find also the correlation coefficient between X and Y

Ten individuals are chosen at random from a population and their heights are found to 63, 63, 64, 65, 66, 69, 69, 70, 71, 70 inches. Discuss the suggestion that the mean height of the population is 65 inches.

Show that the matrix A is derogatory and find its minimal polynomial

$$A = \begin{bmatrix} 2 & -3 & 3 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

Using the Kuhn-Tucker conditions solve the following problem

Maximize $z = 10x_1 + 10x_2 - x_1^2 - x_2^2$

Subject to $x_1 + x_2 \leq 8$

$$-x_1 + x_2 \leq 5$$

$$x_1, x_2 \geq 0$$