

OM

MBO02952

05/02/2005

2004 MPSC

omkar shendure

Nilesh Amol P.

VIL-I

2004

CIVIL ENGINEERING (Paper I)

008776

Time : allowed 3 Hours }

{ Maximum Marks : 200

N.B.

- i. Solve one question from each section.
- ii. If more than one questions are attempted in a section, the excess will be ignored.
- iii. Figures to the right indicate the number of marks for the question / sub-question.
- iv. Make suitable assumptions, if necessary and state the same.
- v. Use of log-tables, non-programmable calculators is permitted.
- vi. Use of any kind of I.S. Codes and Steel Table Codes is NOT permitted.

SECTION - A

1. (A) A bar AD of negligible weight rests against two smooth inclined planes and is subjected to forces as shown in Figure 1. Determine the angle θ made by the bar AD with the horizontal at which equilibrium exists. 13

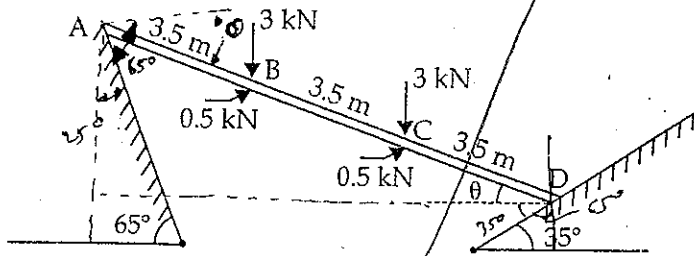


Figure 1

- (B) Two cars moving in the same direction are 250 m apart, Car A being ahead of Car B. At this instant velocity of A is 3 m/s and a uniform acceleration of 1.2 m/s², while the velocity of B is 30 m/s and a uniform retardation of 0.6 m/s². How many times do they cross. Also find when and where they cross and find the distance between them 25 seconds after starting the observation. 11

- (C) A 1 kN box is just to be pushed to the right side without tipping over, with the help of a lever AD operating under force 'W' applied to it vertically as shown in Figure 2. If the coefficient of friction at all contact surfaces is 0.2, calculate the magnitude of 'W' and width of block 'b'. Neglect the weight of lever AD. 10

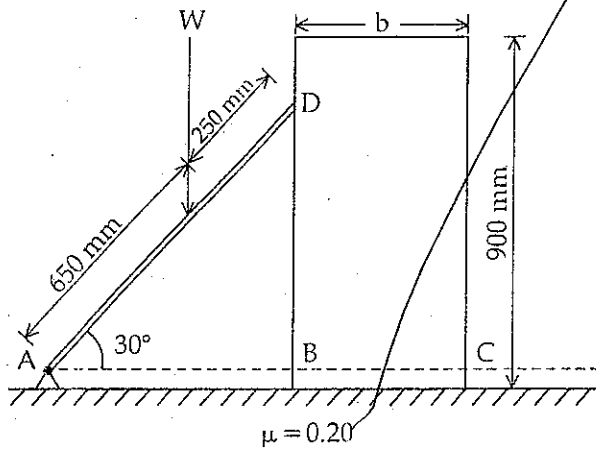


Figure 2

2. (A) A beam ABCD is supported at A, B and D and has an internal hinge at C. The beam is loaded with uniformly distributed load, point load and uniformly varying load as shown in Figure 3. Draw bending moment and shear force diagram for the beam indicating important values. Also locate the point of contraflexure, if any. 13

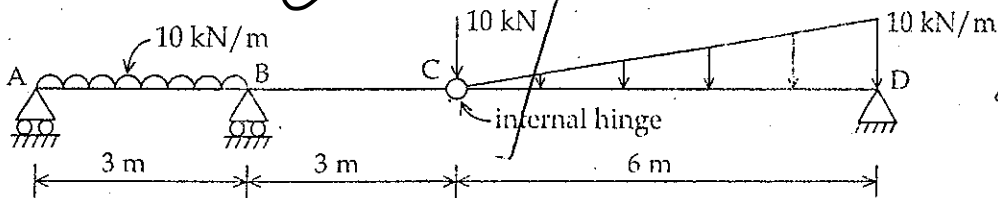


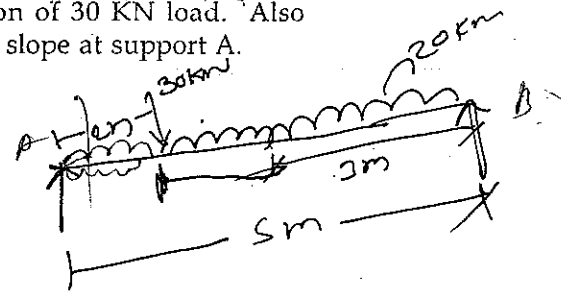
Figure 3

- (B) A hollow shaft of circular cross section is to have an inside diameter, one half of outside diameter. Shaft is to be designed to transmit 60 KW at 500 rpm. The allowable shear stress is 35 N/mm². For this shaft calculate : 11
- i. External Diameter
 - ii. Angle of relative twist in degrees between two sections 2 m apart.
 - iii. Percentage difference in the weight of hollow shaft as compared with the weight of solid shaft designed for the same conditions. Take modulus of rigidity $G = 8.4 \times 10^4$ N/mm².

VII-1
10

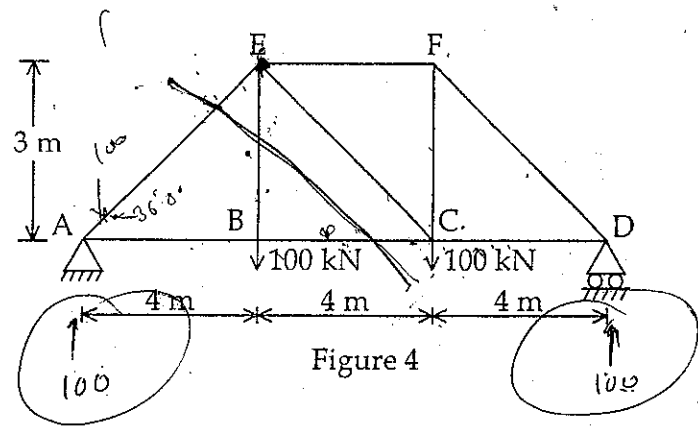
✓ (C) A beam AB, of span 5 m is simply supported at ends A and B. It is loaded by a point load of 30 kN at 2 m from left support A. An uniformly distributed load of intensity 20 kN/m is applied on 3 m length of beam from right support B. Determine the deflection at point of application of 30 kN load. Also determine the maximum deflection of beam and the slope at support A.

50m



SECTION - B

3. (A) A truss as shown in Figure 4, is loaded by two point loads of 100 kN each at point B and D. Assuming that the cross sectional areas and materials of all the members are same, calculate the forces in members BC, EC and CF by method of joints.



$100 \times 4 = 100 \times 8$
3

easy (B) Analyze the continuous beam shown in Figure 5, by the slope deflection method. Draw the shear force and bending moment diagrams. Also sketch the deflected shape of the structure.

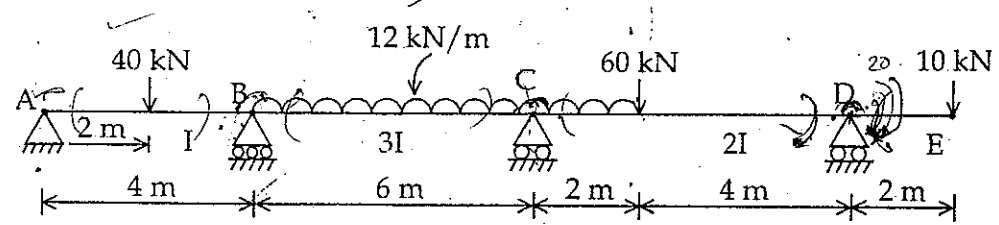


Figure 5

θ_A

θ_B

θ_C

θ_D

3

P.T.O.

[Handwritten signature]

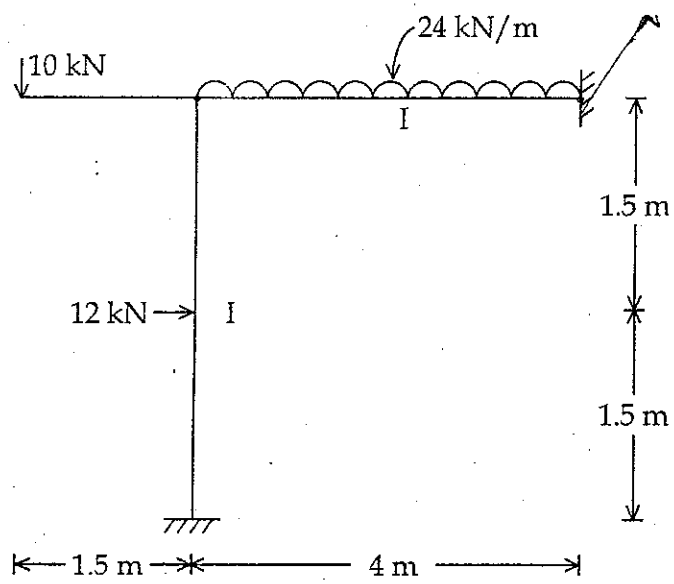
Here $M_{DC} = 10 \times 2 = 20 \text{ kNm}$

(C)

Analyze the rigid joint frame as shown in Figure 6, by moment distribution method. Also draw the bending moment diagram.

11

easy



Handwritten notes: "VIL-I", "11", "Kater", "CIP", "Buphpa"

Figure 6

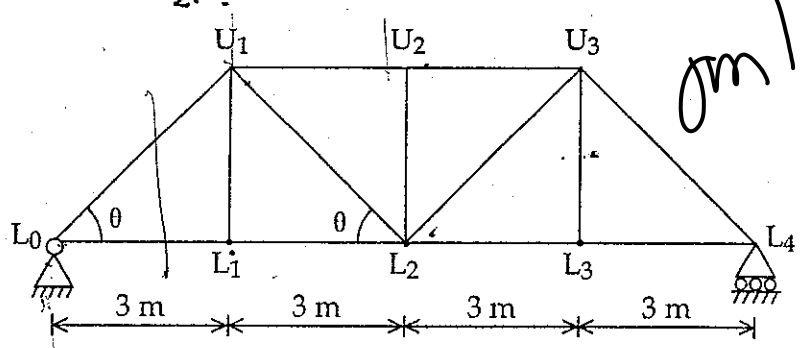
5.

4. (A) A three hinged parabolic arch has a span 10 m and carries a concentrated load of 100 kN at left quarter span. Determine the location of central hinge, so that maximum positive bending moment is same as maximum negative bending moment.

12

(B) For the Pratt truss shown in Figure 7, construct the influence line for the force in members L_0U_1 , L_0L_1 , L_1L_2 , L_1U_1 , U_1L_2 and U_1U_2 .

10



Handwritten note: "om/ami"

Figure 7

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- (C) Analyze the continuous beam ABC of uniform section by stiffness method. Also plot BMD. Take EI constant (Figure 8). 12

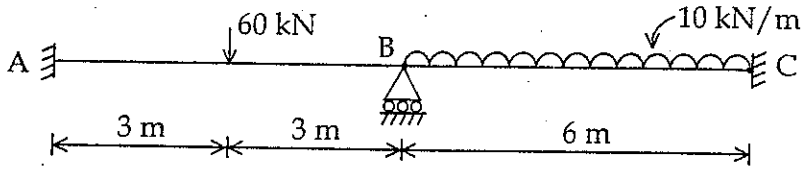
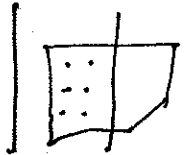


Figure 8

SECTION - C

5. (A) A bracket transmits a load of 80 kN at an eccentricity of 300 mm to a column through 10 rivets of 22 mm dia. arranged in two vertical rows 100 mm apart. The pitch of the rivets is 80 mm and the load lies in the plane of the rivets. Calculate the maximum stress in the rivets. 10



- (B) A simply supported plate girder having a span of 14 m has to support floor beams that frame at 2 m centre to centre. Each floor beam introduces a concentrated load of 100 kN on the girder. In addition the girder has to carry a u.d.l. of 18 kN/m including its own weight. Top flange of the girder is to be restrained effectively and the girder provided with vertical stiffeners. Assuming that the depth of web plate is to be 1000 mm, determine : 12

- i. The suitable thickness of web. ✓
- ii. Section of the flange at the centre of the span. ✓

f_y for steel = 250 MPa

Use 2 ISA 150 × 115 × 12 mm as flange angles with short leg vertical

For $d_1/t_w = 125$ and maximum spacing $1.5 d_1$ between stiffeners, permissible shear stress = 90 MPa

For $d_1/t_w = 130$ and maximum spacing $1.5 d_1$ between stiffeners, permissible shear stress = 88 MPa

Check for Bending Stresses not required.

~~Ans (A) & (B)~~



(C) A hall of 15 m × 6 m is to be covered by RCC slab flooring 120 mm thick resting over RS Joists spaced at an interval of 3 m centre to centre. Terrazzo flooring 20 mm thick is to be provided over RCC slab. The live load on slab is 4 kN/m². Joists are resting over 300 mm thick walls. Design the floor Joists for the permissible stresses in bending and shear are 165 MPa and 100 MPa respectively. Unit weight of RCC and finishing may be taken as 25 kN/m³. E = 2 × 10⁴ kN/cm².
 For ISLB350 @ 49.5 Kg/m, tw = 7.4 mm, I_x = 13158.3 cm⁴, Z_x = 751.9 cm³, a = 63.01 cm², h = 350 mm, h₂ = 30.85 mm
 Check for web buckling not required.

6. (A) A hall measures 6 m × 12 m having three beams spanning 6 m at spacing 3 m centre to centre. The width of rib is 225 mm and the hang of beam is 300 mm. Slab is 120 mm thick cast monolithically with beam. Use M 20 and Fe 415. Live load on floor 5 kN/m² and floor finish 1.5 kN/m². Using working stress method of design, design the T beam. Checks for shear and deflection are not required. σ_{cbc} = 5 N/mm², σ_{st} = 230 N/mm².

(B) Design a two way slab for a building roof 3 × 4.5 m. The slab is simply supported on all sides. Use M 20 and Fe 415. Use following data.
 X_{u,max} = 0.479 d, P_{t,lim} = 0.96, M_{u,lim} = 0.138 b d² f_{ck}
 For l_y/l_x = 1.5, α_x = 0.089, α_y = 0.056

(C) An RCC column of size 400 mm × 500 mm is subjected to an axial load of 750 kN and a moment of 75 kNm. Using M 20 concrete and Fe 415 steel, check whether column satisfies all conditions of un-cracked section. Take clear cover 40 mm. Assume 6 bars of 22 mm are provided as longitudinal reinforcement. Use following data. σ_{cc} = 5 N/mm², σ_{cbc} = 7 N/mm².

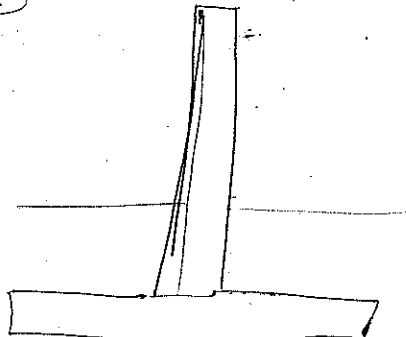
SECTION D

7. (A) Design a two flight, doglegged staircase with steps on waist slab for floor to floor height of 3.5 m. Width of flight is 1.25 m and superimposed load is 3 kN/m². Assume the staircase to be simply supported at the end of landing slabs, which span in the direction of flight. Consider weight of surface finish as 0.5 kN/m². Use concrete grade M 20 and Fe 415.

(B) Design the stem of a retaining wall to retain earth upto 5 m height above G.L. The earth is level with the top of wall. Density of soil is 18 kN/m³, angle of repose is 30°. Soil with safe bearing capacity of 250 kN/m² is available at 1 m below G.L. Use M 20 grade concrete and Fe 415 steel.

Sketch the Reinforcement in stem.

Stability calculations and checks not required.



- (C) An open square RCC tank of size $4\text{ m} \times 4\text{ m}$ (clear) in plan and depth of 3 m , to store water is to be designed. Design the side walls of the tank using M 20 grade concrete and Fe 415. Assume tank is built on firm ground. Sketch the reinforcement in wall. (10)
8. (A) What is meant by Nominal Concrete Mix. Explain the factors governing concrete Mix design. Also enlist the steps involved in IS code method of mix design. 11
- (B) List the important properties of hardened concrete. Explain the factors influencing strength of hardened concrete. 11
- (C) Enlist the different types of additives used in concrete. Explain the significance and utility of any four of them. 11

SECTION - E

9. (A) What are the different types of losses in Pre-stressed Concrete Sections. Derive equations for these losses and explain suitable remedial measures. 10
- (B) A Pre-stressed concrete T beam is to be designed to support an imposed load of 5 kN/m over an effective span of 6 m . The flange is 400 mm wide and 40 mm thick and rib is 150 mm wide and 200 mm deep. The stress in concrete must not exceed 15 MPa in compression and zero in tension at any stage. Check for the adequacy of the section provided and calculate the minimum pre-stressing force necessary and corresponding eccentricity. 12
- (C) A rectangular concrete beam of cross section 150 mm wide and 380 mm deep is simply supported over a span of 10 m and is pre-stressed by means of a symmetric parabolic cable at a distance 100 mm from the bottom of the beam at mid span and 150 mm from the top of the beam at support sections. If the force in the cable is 500 kN and modulus of elasticity of concrete is 38 kN/mm^2 , calculate :
- i. The deflection at mid span when beam is supporting its own weight.
 - ii. The concentrated load, which must be applied at mid span to restore it to the level of supports.
10. (A) Explain with neat sketches different types of Pre-cast Slab Panels which are used in Pre-cast Construction. 12
- (B) Explain the problems encountered in transportation of Pre-cast Concrete Products. Also explain erection and transportation stresses. 10

(C) Write short notes on :

- i. Quality Control in Pre-cast Concrete Construction.
- ii. Strength and Rigidity considerations in Pre-cast Concrete.

SECTION - F

11. (A) Explain Newton Raphson Method for solution of non-linear equations. Solve the following equation using this method. 12

$$f(x) = 3x^3 + 7x^2 - 4x - 10 = 0$$

(B) A beam AB of span 5 m is loaded with u.d.l of 15 KN/m over the whole span. Draw bending moment diagram showing the ordinates at every 0.5 m interval. Also calculate the area under BMD using Simpson's Rule. 10

(C) Draw flow and write a computer program for designing one-way simply supported slab. Program may be in FORTRAN or C language. 11

12. (A) Draw flow chart. Write a program for carrying out addition and multiplication of two matrices A and B of size (3 x 3) each. Prepare input file for your program. 10

(B) What are Ill-conditioned and Well-conditioned systems of equations. What are the limitations of Gauss Elimination Method. Solve following system of equations using Gauss - Elimination Method : 12

$$3x_1 + 4x_2 - 6x_3 = 10$$

$$6x_1 - 3x_2 + 4x_3 = 15$$

$$8x_1 + 6x_2 - 7x_3 = 25$$

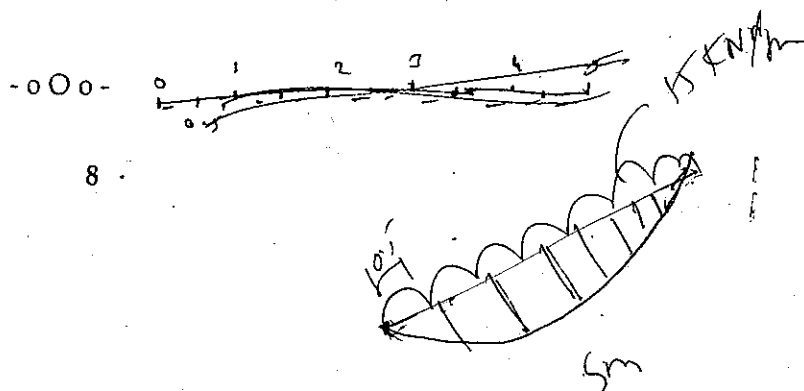
Use Gauss Elimination Method suitable for programming on computer.

(C) Explain Gauss-Seidal Iterative Method. Solve the following system of equations using Gauss-Seidal Method. 11

$$10x_1 + x_2 + x_3 = 26$$

$$x_1 + 5x_2 + x_3 = 27$$

$$-x_1 + 2x_2 + 8x_3 = 13$$



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06/02/2005

Nikam Amol P.

VII-II

2004

CIVIL ENGINEERING (Paper II)

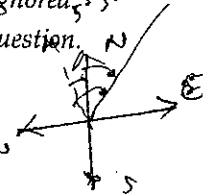
08801

Time allowed : 3 Hours

26+7+2+29 } +16+22 { Maximum Marks : 200

N.B.

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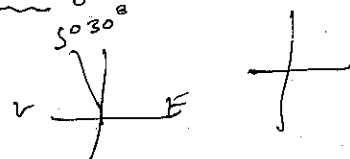


SECTION - A

1 (A) What is Resection with reference to Plane Table Surveying? Explain the "back ray" method of Resection. 8

(B) Following are the lengths and bearings of the sides of a traverse ABCD. The bearings are referred to the magnetic meridian, the value of the magnetic declination being $5^{\circ} 30' W$. Convert the observed bearings to the true bearings and find the error of closure. 20

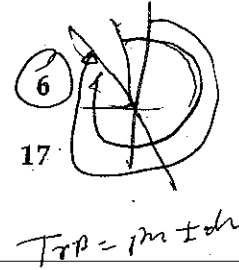
Line	Length in m	Bearing
AB	470.00	$343^{\circ} 52'$
BC	635.00	$172^{\circ} 40'$
CD	430.00	$172^{\circ} 40'$
DA	563.00	$265^{\circ} 12'$



(C) What is Reciprocal levelling? 6

2 (A) The following notes refer to a line leveled tachometrically with an anallatic tachometer, the multiplying constant being 100. Compute the reduced levels of P, Q and R and the horizontal distances PQ and QR. 17

Inst. Stn.	Ht. of axis	Staff Stn.	Vertical angle	Hair readings	Remarks
P	1.50	BM	$-6^{\circ} 12'$	0.963, 1.515, 2.067	RL of BM = 460.650
P	1.50	Q	$+7^{\circ} 5'$	0.819, 1.341, 1.863	Staff held
Q	1.60	R	$+12^{\circ} 27'$	1.860, 2.446, 3.030	Vertically



(B) What is a Reverse or a Serpentine curve? Where are they used? 7

(C) What is Geodetic Surveying? What is triangulation? Classify the triangulation systems. 10

Types of Contract:-

- ↳ item rate
- ↳ lumpsum
- ↳ labour based contract
- ↳ cost + profit contract
- ↳ cost + % of profit contract
- ↳ ~~...~~

6
5
4
3
2
1

Specification:-

material, mixing, proportion, compaction,
curing details, mode of measurement

Necessity:-

- (i) conflict
- (ii) Payment mode
- (iii) Drawing no detail
- (iv) stand regard
- (v) owner pt of view
- (vi) specification guideline to work any
- (vii) act as legal document
- (viii) for uniformity of work
- (ix) helpful to engineer in their decision
- (x) specification all other detail, information, quantity, number, etc.

SECTION - B

3. (A) What are the desirable characteristics of a good building stone? Give a few of these characteristics for Basalt. 8
2. (B) What are the chemical components of good brick earth? What are the harmful ingredients in Brick Earth? 14
- Describe the manufacture of cement by wet process. 12
4. (A) What is vertical transportation? What are dumbwaiters and vertical conveyors? 8
- (B) What are the sources or causes of Dampness in a Structure? What is the effect of dampness? List the methods of preventing dampness. 16
- (C) What are the functional requirements of a Ventilation System. 10

SECTION - C

5. (A) What are the types of shallow foundations? 12
- (B) What are the defects in brick masonry construction? Compare brick and stone masonry. 13
- (C) What are the characteristics of a good paint? 8
6. (A) What is a Specification? What is the necessity of writing specifications in Civil Engineering works? 10
10. (B) List the various types of contracts. Write the advantages and disadvantages of an Item rate Contract and Lumpsum Contract. 15
5. (C) What is the purpose of rate analysis? What are the factors to be considered in rate analysis? 8

SECTION - D

7. (A) Draw the Casagrande's Plasticity Chart. How is it used to classify fine grained and organic soils. 8

(B) What is pre consolidation pressure? Explain the procedure of obtaining pre consolidation pressure by Casagrande's Method. 13

(C) Define 12

- i. Critical void ratio
- ii. Dilatancy
- iii. Liquefaction
- iv. Quick sand phenomenon

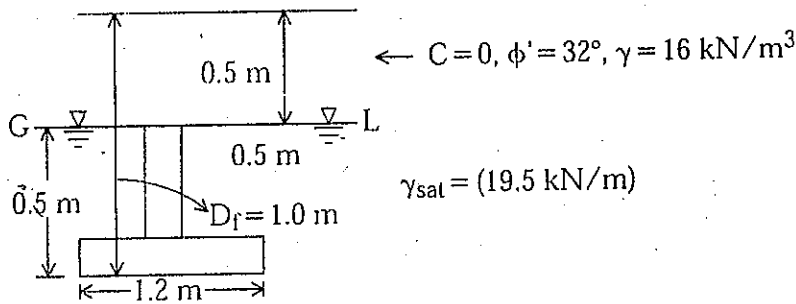
8 (A) A square footing is shown below. Determine the safe gross load (FS of 3.0) 15 that the footing can carry. Use the following equations for bearing capacity factors and shape factors.

15

$$N_q = e^{\pi \tan \phi} \tan^2 \left(45 + \frac{\phi'}{2} \right)$$

$$N_c = (N_q - 1) \cot \phi'$$

$$N_\gamma = (N_q - 1) \tan (1.4 \phi')$$



Shape factors

$$\xi_{qs} = \xi_{\gamma s} = 1 + (0.1) \frac{B}{L} \tan^2 \left(45 + \frac{\phi'}{2} \right)$$

depth factors

$$\zeta_{qd} = \zeta_{\gamma d} = 1 + (0.1) \times \left(\frac{D_f}{B} \right) \tan \left(45 + \frac{\phi'}{2} \right)$$

(B) Define 9

- i. Active Pressure
- ii. Passive Pressure
- iii. Earth Pressure at rest in a retaining structure.

7 (C) What is a flow net? What are its uses? 9

SECTION - E

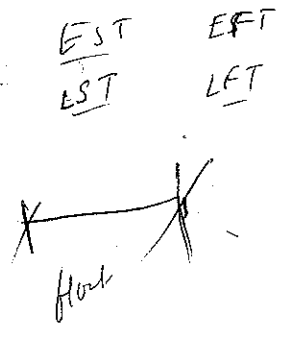
Actual performance of tasks over
VII-II

- 9. (A) In the Critical Path Method, define Activity, Event, Dummy Activity, Total Float and Free Float. 10
- 7
- 16 (B) What are the advantages of using a CPM network in execution of a project? 10
- 6
- 3 (C) What are the principles normally adopted in storing materials. 13
- 10. (A) Show the typical layout of Ready Mix Plant, keeping in mind the functionality and efficiency. 11
- (B) List the methods of compaction of soils. Describe the utility of the sleep foot roller. 11
- (C) What is Depreciation? List the methods of determining depreciation. Explain the Straight Line method. 11

SECTION - F

- 11. (A) Explain the engineering importance of faults. 12
- (B) Describe the geological features of limestones, clearly indicating the composition Texture, types and formation. 10
- (C) Define Richter Scale. Classify Earthquakes on the basis of depth of focus, cause of origin, intensity and magnitude. 11
- 12 (A) What are the advantages and disadvantages of tunnels and open cuts? 10
- 6 (B) What are the objectives of ventilating a tunnel? What is mechanical ventilation? Describe in detail. 11
- 8 (C) What are the objectives of tunnel lining? List the materials used for lining. 12

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ok msc
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350
260

150 ✓
170 ✓
113 ✓
120 ✓

Nikam Amer P.

06/02/2005 VII-III

2004

CIVIL ENGINEERING (Paper III)

008792

Time allowed : 3 Hours }

{ Maximum Marks : 200

N.B.

31+20+18 for 113
+8 = 113

- i. Solve one question from each section.
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SECTION - A

11 1. (A)

Define Newtonian and Non-Newtonian fluids.

12

The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m/sec. requires a force of 98.1 N to maintain the speed. Determine :

- i. The dynamic viscosity of oil in poise, and
- ii. The kinematic viscosity of the oil in stokes if specific gravity of the oil is 0.95.

Bansal

11 1. (B)

When will centre of pressure and centre of gravity of an immersed plane surface coincide ?

11

A tank contains water upto a height of 0.5 m above the base. An immiscible liquid of specific gravity 0.8 is filled on the top of water upto 1 m height. Calculate :

- i. Total pressure on one side of the tank,
- ii. Position of centre of pressure for one side of the tank, which is 2 m wide.

Bansal

8 1. (C)

State types of fluid flows.

11

A 45° reducing bend is connected in a pipeline, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm² and rate of flow of water is 600 litres/sec.

2. (A) Define economical section of a channel.

12

A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and slope of bed is 1 in 1500. The area of the section is 40 m². Find the dimensions of the section if it is most economical. Determine the discharge of most economical section if C = 50.

(B) Describe Buckingham's π -theorem for dimensional analysis.
 In the model test of a spillway the discharge and velocity of flow over the model were $2 \text{ m}^3/\text{sec}$. and 1.5 m/sec . respectively. Calculate the velocity and discharge over the prototype which is 36 times the model size.

11

(C) What is Syphon ? On what principle it works ?
 A pipe of diameter 0.4 m and of length 2000 m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1000 m and diameter 300 mm run in parallel. These parallel pipes are connected to another reservoir, which is having level of water 10 m below the water level of the above reservoir. Determine the total discharge if co-efficient of friction $f = 0.015$. Neglect minor losses.

11

SECTION - B

3. (A) What is infiltration ? What are the factors affecting infiltration capacity ? Describe working of infiltrometer with neat sketch.

12

3 (B) Define precipitation. Explain in brief types of precipitation.

11

(C) Explain step by step the method of construction of unit hydrograph from a storm of unit duration. Mention basic assumptions in the theory of unit hydrograph.

11

4. (A) What are the characteristics of the drainage basin ? Explain in brief computations of runoff.

12

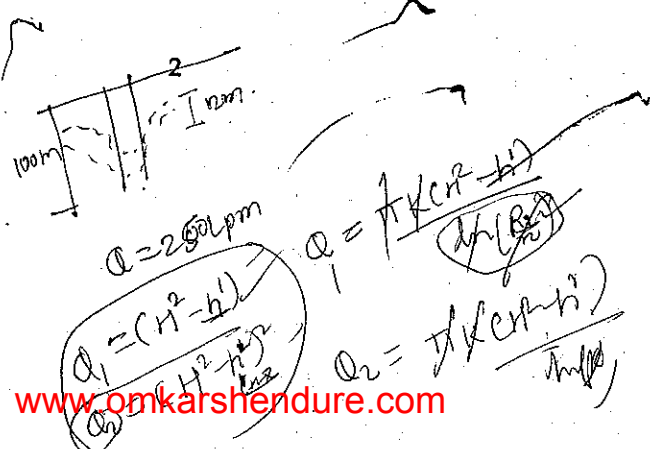
(B) State various methods of estimating the design flood of a catchment Explain the flood estimation by statistical or probability methods.

11

(C) What is meant by artificial recharge of ground water ?

11

A well penetrates into an unconfined aquifer having a saturated depth of 100 metres. The discharge is 250 litres per minute at 12 metres drawdown. Assuming equilibrium flow conditions and a homogeneous aquifer, estimate the discharge at 18 metres drawdown. The distance from the well where the drawdown influences are not appreciable may be taken to be equal for both the cases.



(A) 1
 5
 (B) 7
 6
 (A) 5
 (B) 7
 (C) 7
 (A) 7
 (B) 7
 (C) 7
 8

- (A) What are the various factors to be considered in pavement design ? 11
Design the pavement section by triaxial test method using the following data :

Wheel load = 4100 kg.

Radius of contact area = 15 cm.

Traffic co-efficient $X = 1.5$

Rainfall co-efficient $Y = 0.9$

Design deflection $\Delta = 0.25$ cm.

E-Value of sub-grade soil $E_s = 100$ kg/cm².

E-Value of base course material $E_b = 400$ kg/cm².

E-Value of 7.5 cm thick bituminous concrete

Surface course = $E_c = 1000$ kg/cm².

Assume the pavement consist of single layer of base course material.

- (B) Explain the fundamental principles of bituminous mix design. What are the steps in the Marshall Method of design ? Discuss. 11

- (C) What are different vehicular characteristics which affect the road design ? 11

The average normal flow of traffic on cross roads A and B during design period are 400 and 250 pcu per hour; the saturations flow values on these roads are estimated as 1250 and 1000 pcu per hour respectively. The all-red time required for pedestrian crossing is 12 secs. Design two phase traffic signal by Webster's Method.

SECTION - E

- (A) What is a bridge ? Explain the factors to be considered while selecting the site for a proposed bridge. 11

- (B) Explain in brief the determination of maximum flood discharge of a river by direct method. 11

- (C) Explain the following terms : 11

i. Waterway

ii. Afflux

iii. Economic Span

iv. Scour

10. (A) What are the various forces, loads and stresses which are to be considered in the design of a bridge? How do the secondary stresses develop in concrete structures and steel structures? 11
- (B) What are the Erection Methods? Describe in brief Launching Method of erection. 11
- (C) Discuss the various techniques adopted to strengthen the bridge substructure and superstructure. 11

SECTION - F

11. (A) What are the common sources of water for a water supply scheme? State the factors that govern the final selection. Explain with the help of a sketch the utility of a mass curve. 11

7

(B) State the methods of carrying refuse. Explain in brief Water Carriage System. 11

(B)

(C) Define "Ecology". What are the objectives of ecological study? Give a schematic representation of the structure of an ecosystem. 11

12. (A) State different impurities that may be present in water. Briefly describe how you will remove these impurities and make the water potable. 11

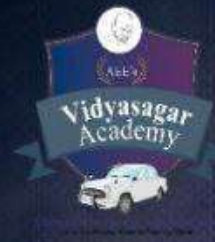
(B) Explain the following terms : 11

- i. Self purification of natural water
- ii. Disposal of land treatment
- iii. Characteristics of industrial wastes.
- iv. Rural sanitation.

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(C) Define air pollution. What are the effects of air pollution? Discuss in brief control of air pollution. 11

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