2013

CIVIL ENGINEERING (Paper - I)

Time allowed : 3 Hours] **[Maximum Marks : 200**

Note :

(i) *Solve any one question from each section.*

(ii) *Do not reproduce any question. Write only the question number against the answer.*

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(iv) *Figures to the right indicate the marks for the questions.*

(v) *Assume suitable data if necessary and state it clearly.*

(vi) *Use of Non-programmable calculators is permitted.*

(vii) *Use of I.S. Codes and Steel Tables is* ***not*** *permitted.*

(viii) *Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer books otherwise they will be penalised.*

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SECTION - A

1. (a) A reinforced concrete column is 230×300 mm in size. It is reinforced with six bars of 16 mm diameter. The column is subjected to 800 kN load. Determine the stresses in concrete and steel. Take modular ratio $m = 13$. **10**

(b) A rectangular section for a beam is to be cut out of a log of wood 600 mm in diameter. Determine the dimensions of the strongest section. **10**

(c) A simply supported beam of span 'L' carries two equal point loads 'P' at quarter points from ends. Using conjugate beam method calculate central deflection. Flexural rigidity of beam is EI. **10**

(d) Compare the load carrying capacity of columns with both ends hinged. **10**

(i) Solid square section 40×40 cms.

(ii) Hollow square section with 50 cms outer side and 30 cms inner side. Use Rankine's formula. Take $\sigma_c = 50$ MPa, $\alpha = \frac{1}{750}$.

Length of columns is 3.6 m.

P.T.O.

2. (a) Using slope deflection equations analyse the portal frame shown in the figure 1. Draw B.M.D. **10**

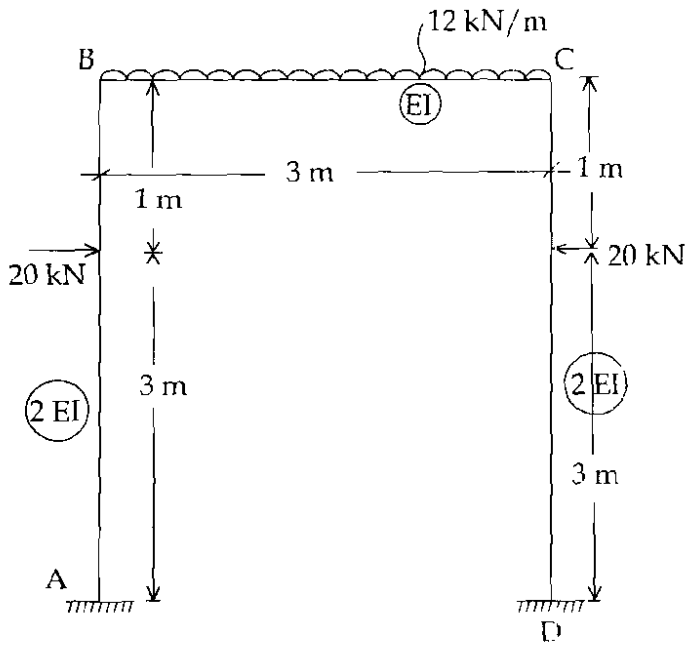

Figure - 1

(b) Determine the forces in all the members of the truss shown in figure. 2. Diagonal members c/s area = 3000 mm^2. Horizontal and vertical members c/s area = 2000 mm^2. **10**

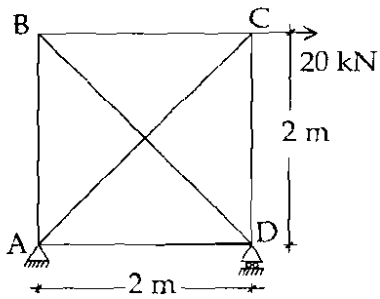

Figure - 2

(c) Find the support moments for the continuous beam ABCD if the support 'B' sinks by 1 cm. Take E = 200 kN/mm^2 I = 800 cm^4. Refer fig. 3. **10**

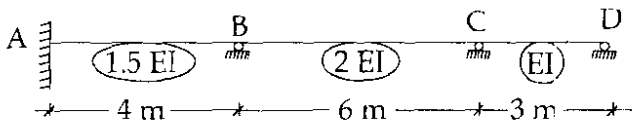

Figure - 3

(d) Find the deflection of the free end of cantilever beam ABC. Refer fig. 4. Take EI = 60000 kN. m^2. **10**

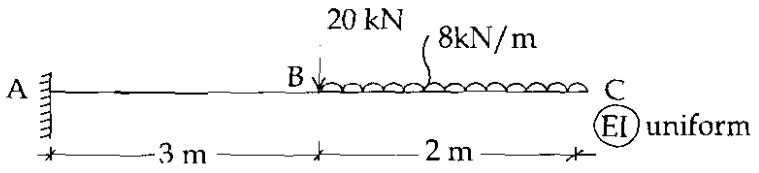

Figure - 4

SECTION - B

3. (a) A beam AD of span 7.5 m is fixed at A and roller supported at D and has an internal hinge at C at a distance of 3 m from D. Construct influence lines for : **10**

(i) Reaction at D, R_D

(ii) Shear at section B, at distance 3 m from A, SF_B

(iii) Moment at A, M_A

(b) A two span continuous beam ABC is fixed at A and simply supported at B and C, such that AB = 4 m, BC = 3 m. It is subjected to uniformly distributed load of intensity 60 kN/m over entire span AB and downward concentrated load of 100 kN at midpoint of span BC. Analyse the beam by using stiffness matrix method. Assume EI is constant throughout the beam. **10**

(c) A laterally supported built up beam consisting of ISMB 400@ 61.5 kg/m and plates of 200 mm × 10 mm each connected to flange, is simply supported over a span of 4 m. The beam is subjected to a factored column load of 400 kN at centre of span. Load is transferred through base plate of 200 mm length and 10 mm thick. Check the beam for web buckling and web crippling. Take $f_y = 250$ MPa. For ISMB 400 : $t_w = 8.9$ mm, $t_f = 16$ mm, $Z_p = 1176.18 \times 10^3$ mm^3, root radius R = 14 mm. **10**

P.T.O.

(d) Design a welded plate girder to carry a superimposed load of 50 kN/m and two concentrated loads of 200 kN each at one-third points of the span. The effective span of the plate girder is 24 m. Assume that the girder is laterally supported throughout its length. Use the tension field method. Take $f_y = 250$ MPa. (Connections need not be designed) **10**

4. (a) A three hinged parabolic arch, hinged at the springings and crown has a span of 20 m. The central rise of the arch is 4 m. It is loaded with a uniformly distributed load of intensity 2 kN/m on the left 8 m length. Calculate the Normal thrust, Radial shear and Bending Moment at 4 m from the left hand hinge. **10**

(b) The towers of a 120 m suspension bridge are of unequal height. One is 15 m and the other 5 m above the lowest point of the cable, which is immediately above the inner pin of a three hinged stiffening girder hinged at the towers. Find the maximum tension in the cable due to a point load of 100 kN crossing the bridge. **10**

(c) A bracket transmits a load of 100 kN at an eccentricity of 200 mm to a column through 8 bolts of 24 mm diameter arranged in two vertical rows 80 mm apart. The pitch of the bolts is 80 mm and the load lies in the plane of the bolts. Calculate the maximum stress in the bolts. **10**

(d) Design a gusseted base for a beam-column ISSC 250@60.3 kg/m to transfer a factored axial compression of 750 kN and a factored bending moment of 75 kNm. The base rests on M30 grade concrete pedestal. Take $f_y = 250$ MPa. **10**

SECTION - C

5. (a) A doubly reinforced rectangular beam is 240 mm wide and 500 mm deep. If the limiting stresses in concrete and steel are 5 N/mm^2 and 230 N/mm^2 respectively. Determine the steel reinforcement for bending moment of 80 kNm. Assume that steel is burried on both faces with its centre 40 mm from either face. Take $m = 19$. Use working stress method. **10**

(b) Design a simply supported slab on masonry walls to the following requirements, using limit state method **10**

- Clear span = 2.5 m
- Live load = 3000 N/m^2
- Use M15 concrete and Fe 250 steel

Also draw plan and section showing reinforcement details.

(c) Design a square footing to carry a column load of 1100 kN from A 400 mm square column. The bearing capacity of soil is 100 kN/m^2. Use M15 concrete and Fe 415 steel. Use limit state method. Show reinforcement details. **10**

(d) Design a RCC short column to the following parameters using limit state method. **10**

(i) Axial load = 1200 kN.

(ii) Grade of concrete = M20.

(iii) Length of column = 1.85 m.

(iv) Grade of steel Fe 250.

Sketch the reinforcement details.

6. (a) Design a dog-legged stair case for a building in which the vertical distance between the floors is 3.6 m. The stair hall measures 2.5 m × 5 m. The live load may be taken as 2500 N/m^2. Use M20 grade concrete and Fe 415 steel. Sketch reinforcement details. **10**

(b) Design a circular tank with flexible base for capacity of 4 lakh litres. The depth of water is to be 4 m, including free board of 200 mm. Use M20 grade concrete Sketch reinforcement details. **10**

P.T.O.

(c) Check the stability of a counterfort retaining wall to retain 7 m high embankment above ground level. The foundation is to be taken 1 m deep, where the safe bearing capacity of soil may be taken as 180 kN/m^2. The top of earth retained is horizontal and soil weighs 18 kN/m^3 with an angle of friction $\phi = 30^\circ$, coefficient of friction between concrete and soil may be taken as 0.5. Use M20 grade concrete and Fe 415 steel. **10**

(d) A reinforced concrete beam AB of rectangular section is fixed at A and B. Span = 8 m. The beam carries ultimate udl of 24 kN/m. Design the beam by limit state method with 30% re-distribution of moment. Use M20 grade concrete and Fe 415 steel. Draw BMD envelopes. **10**

SECTION - D

7. (a) Explain the various post-tensioning systems based on wedge action with neat sketches. **10**

(b) Define 'workability', and briefly explain the factors affecting the workability of fresh concrete. **10**

(c) A rectangular concrete beam, 300 mm × 900 mm with an overhang BC of 2 m is simply supported at A and B over a span of 8 m. It supports a live load in addition to its self-weight of intensity 3.52 kN/m over the whole span of 10 m. Determine the profile of the prestressing cable with an effective force of 500 kN which can balance the dead and live loads on the beam. Sketch the profile of the cable along the length of the beam. **10**

(d) Explain, how the water cement ratio, ratio of cement to aggregate and maximum size of aggregate influence the strength of concrete. **10**

8. (a) List and explain the various types of loss of prestress in pretensioned and post-tensioned members. **10**

(b) Enlist the various non-destructive methods of testing the hardened concrete. Explain in detail the pulse velocity method. **10**

(c) The end block of a post - tensioned prestressed concrete beam, 300 mm wide and 300 mm deep, is subjected to a concentric anchorage force of 832.8 kN by a Freyssinet anchorage of area 11720 mm^2. Design and detail the anchorage reinforcement for the end block. **10**

(d) Enlist various methods of concrete mix design and briefly explain any two of them. **10**

SECTION - E

9. (a) Find the roots of the equation. **10**

$f(x) = x^2 - 3x + 2$

in the vicinity of $x = 0$ using Newton - Raphson Method.

(b) Compute the integral **10**

$$\int_0^{\pi/2} \sqrt{\sin x}\, dx$$

by applying Simpson's one third rule for n = 4 with an accuracy of five decimal places.

(c) Write an algorithm and flow-chart for solving a set of three simultaneous equations using Gauss - Jordan Method. **10**

(d) Solve the following equations by Relaxation Method. **10**

$10x - 2y - 2z = -6$

$-x + 10y - z = -7$

$-x - y + 10z = -8$

P.T.O.

10. (a) Using Trapezoidal Rule evaluate the integral **10**

$$I = \int_a^b (x^3 + 1)\, dx$$

for the intervals (1, 2) and (1, 1.5). Also estimate true error in each case with respect to exact answer.

(b) Perform five iterations of the bisection method to obtain the smallest positive root of the equation. **10**

$f(x) = \cos x - xe^x = 0$

(c) Draw flow chart for the computation of moment of resistance of R.C.C. beam. Take width of the beam 'b', effective depth of beam 'd', permissible stress in concrete is 'σ cbc', permissible stress in steel 'σst' and area of tensile steel is 'Ast'. Width and depth of beam are in 'MM', permissible stresses are in 'MPa' and Area of steel is in '$mm^{2'}$ (Use Working Stress Method). **10**

(d) Write a programme in 'C' or Fortran language to solve the set of simultaneous equations using Gauss - Elimination Method. **10**

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2013

CIVIL ENGINEERING (Paper - II)

Time allowed : 3 Hours] **[Maximum Marks : 200**

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SECTION - A

1. (a) Explain use of tape to measure distance AB on sloping ground, as indirect method. **10**
In chaining an area containing a pond two points C and D were selected on either side of chain station A such that A, C, D lie on a line. The point B which is on the other side of pond is on the chain line AB. If distances AC, AD, BC and BD are 35 m, 45 m, 100 m and 95 m respectively, determine the length of chain line AB and the angles which the inclined line CD makes with the chain line AB.

(b) Why declination at a place does not remain constant ? **10**
The true bearing of T as observed from station A was 358° and magnetic bearing of the same was 8°. FB of lines AB, AC and AD was found to be 290°, 340° and 30° respectively. Find the true forebearing of lines AB, AC and AD.

P.T.O.

(c) Explain any five tests that you will perform to assess a plane table in perfect adjustment for accurate work. What adjustment will you recommend if the plane table is not in adjustment ? **10**

(d) Prove that, the area of the traverse is equal to the algebraic sum of the products of the total latitude of each point and algebraic sum of the departures of the lines meeting at that point. **10**

2. (a) A dumpy level was set up midway between two pegs 80 m apart. The readings on the staff at the two pegs were 3.2 and 3.015 m respectively. The instrument was then moved by 20 m ahead of the second peg in line with two pegs. The respective staff readings were 2.825 and 2.69 m. Calculate the staff readings on the two pegs to provide horizontal line of sight. **10**

(b) To determine the gradient between two points A and B, a tacheometer was set up at another station C and following data was observed keeping staff vertical. **10**

Staff at	Vertical angle	Stadia readings
A	+4° 20'	1.3, 1.61, 1.92
B	+10' 40"	1.1, 1.41, 1.72

If the horizontal angle ACB is 35° 20' determine average gradient between A and B

K = 100 ; C = 0

(c) A horizontal curve is to be set. Devise a suitable solution under following situations : **10**

(i) The point of intersection is not accessible

(ii) Both tangent point and point of tangency are not accessible.

(d) Explain the relation between height of the station above a datum and the distance of the station from the point of tangency in case of geodetic surveying. **10**

The elevations of two triangulation stations A and B 100 km apart are 180 m and 450 m respectively. The intervening obstruction situated at C 75 km from A has an elevation of 259 m. Ascertain if A and B are intervisible. If not then by how much should B be raised so that the line of sight must nowhere be less than 3 m above the surface of the ground, assuming A as the ground station.

SECTION - B

3. (a) Explain the following vibrators used for compaction of concrete **10**

(i) Internal vibrators

(ii) External or form vibrators

(iii) Surface vibrators

(iv) Table vibrators

(b) Discuss the structural shapes of common rolled steel sections used for construction with examples [Figure for each shape is expected]. **10**

(c) State the reasons for artificial seasoning of timber. **10**

Explain any four methods of artificial seasoning from the following methods :

(i) Water seasoning

(ii) Seasoning by boiling or steaming

(iii) Kiln or hot air seasoning

(iv) Chemical or Salt seasoning

(v) Electrical seasoning

(vi) Smoke drying

(vii) Charring or scorching

(d) State the essential and other ingredients of a paint or oilpaint. Discuss the essential ingredients. **10**

P.T.O.

4. (a) (i) Give the distances of building line and control lines for ribbon development along approaches specified by National Building Code for National Highway, State Highway, Major district Road, Other district Road and village road. 5

(ii) Enlist the different principles of planning. Explain "Aspect" principle for different units of a residential building. 5

(b) Explain with a sketch 10

(i) Grease Trap

(ii) Intercepting trap

(c) Discuss the general principles and factors in Acoustical design of a Cinema Hall. 10

(d) Explain the general measures of fire safety that have been recommended in buildings 10

(i) Alarm system

(ii) Fire Extinguishing Arrangements

(iii) Escape Route (means of escape)

SECTION - C

5. (a) Explain with neat sketches different types of Ashlar masonry. 10

(b) Explain in brief the factors that affect the selection of flooring material. 10

(c) Briefly describe, with neat sketches, the various types of pointing. 10

(d) What are the different causes of dampness in a building ? Enlist different methods of prevention of dampness in a building. 10

6. (a) State purpose of rate analysis and explain in brief factors affecting rate analysis. 10

(b) Explain briefly the situations when lowest tender is rejected. 10

(c) What is meant by a 'Contract'? What are the essentials of valid contract ? 10

(d) Explain constant percentage method to calculate depreciation. Find out book value of a construction equipment after 5 years costing Rs. 80,000/-. Assume life as 8 years and the salvage value Rs. 8000/-. Use constant percentage method. 10

SECTION - D

7. (a) Define voids ratio, porosity, degree of saturation with respect to soil mass. **10**

Derive the equation $es_r = \omega G$

(b) Enlist the assumptions made by Boussinesq in his theory for the problem of stress distribution in soils due to a concentrated load. **10**

And with a neat sketch explain stress isobar and its significance.

(c) Explain the following terms in connection with shear tests on soil sample **10**

(i) Undrained test

(ii) Consolidated undrained test

(iii) Drained test

A cylinder of soil fails under an axial vertical stress of 160 kN/m^2, when it is laterally unconfined. The failure plane makes an angle of 50° with the horizontal. Calculate the value of cohesion and the angle of internal friction of the soil.

(d) Define optimum moisture content. What is the effect of increase in compactive effort on optimum moisture content for a given soil. Explain it with a neat sketch. **10**

A cohesive soil yields a maximum dry density of 18 kN/m^3 at an OMC of 18% during a standard proctor test. If the value of G is 2.7, what is the degree of saturation ?

8. (a) State any five assumptions made in Terzaghi's theory of consolidation. **10**

An undisturbed sample of clay 24 mm thick consolidated 50% in 22 minutes when tested in laboratory with double drainage. The clay layer from which the sample was obtained, is 5 m thick in the field. How much time will it take to consolidate 50% with double drainage ?

(b) Distinguish between active earth pressure and passive earth pressure. **10**

A 5 m high retaining wall has a granular backfill with a level top. The retaining wall face makes an angle of 85° with the base. Soil parameters r, ϕ and δ are 16 kN/m^3, 35° and 10° respectively. Using Columb's method obtain active thrust on the wall.

P.T.O.

(c) State the characteristics of bearing capacity failures namely general, local and punching shear failure, with neat sketches. 10

(d) Define critical depth of a slope.

A long natural slope of cohesionless soil is inclined at 13° to the horizontal. If $\phi = 30°$ determine the factor of safety of the slope. 10

SECTION - E

9. (a) A construction equipment was purchased in Rs.12000/- (Rs. Twelve thousand). Assuming its salvage value at the end of 6 years to be Rs.3000/-, determine amount of depreciation for each year by 10

(i) Straight line method

(ii) Constant percentage method.

[show the answer in the following format]

Format

Age in years	Book value at the end of year	Depreciation	Total depreciation
0			
1			
2			
3			
4			

(b) Discuss the advantages of following hammers used as a pile driving equipment 10

(i) Drop hammer

(ii) Single acting steam hammer

(iii) Double acting steam hammer

(iv) Diesel hammer

(v) Hydraulic Hammer

(c) While submitting a proposal for construction of a building, service plan is also to be submitted to the local authorities. **10**
Which points are to be submitted in this service plan ? Explain each point.

(d) A project consists of following activities. **10**

Activity	Preceded by	Duration (days)
A	Nil	4
B	A	8
C	A	6
D	C	8
E	C	4
F	E	12
G	E	8
H	A	2
J	H	8
K	F	6
L	G, K	4
M	D, J, L	4
N	B	4
O	M, N	4

(i) Draw the network.

(ii) Find out critical path and project duration.

(iii) Calculate Free Float and Independent Float for non critical activities.

P.T.O.

10. (a) Explain the safety measures to be adopted on worksite for demolition of a building. **10**

(b) A PERT project consists of following activities with their duration. **10**

Activity	Optimistic time	Pessimistic time	Most likely time
	in days (to)	in days (tp)	in days (tm)
1-2	6	18	9
1-3	5	17	8
2-4	4	22	7
3-4	4	16	7
2-5	4	10	7
3-5	2	8	5
4-5	4	22	10

Find out the probability of completion of project in 37 days

[For Z = 1, probability 84.13%

For Z = 2, probability 97.72%]

(c) Describe the stages of inspection and quality control for **10**

(i) Earthwork

(ii) Masonry

(iii) Reinforcement in RCC

(d) Who is the father of scientific management ? State and explain salient features of scientific management. **10**

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2013

CIVIL ENGINEERING (Paper - III)

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SECTION - A

1. (a) Differentiate between cohesion and adhesion by giving one example for each. **10**

Two capillary tubes of diameter 1.50 mm and 3 mm are dipped in oil of surface tension 0.036 N/m and specific weight 9300 N/m^3. Find the difference of oil levels in the two tubes. Assume contact angle of 25°.

(b) List and briefly explain the limitations of Bernoulli's theorem. **10**

The diameter of a vertical tapering pipe at sections A and B, 1.5 m apart are 150 mm and 75 mm respectively. Section A is higher than section B. For a certain discharge of water down the pipe, the pressure head at B is greater than pressure head at A by 0.5 m and the loss of head between the two sections is h_L. When the same quantity of water flows up the pipe the pressure head at B is greater than pressure head at A by 0.8 m and the loss of head between the sections is found to be $2h_L$. Find the value of this discharge . What is the value of h_L ?

P.T.O.

(c) Explain the significance of Reynold's Number in pipe flow. **10**

A spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 60 cm width. The prototype is 15 metres high and maximum head on spillway is expected to be 1.5 m. If the flow over a model at a particular head is 12 litres per second, what flow per metre length of the prototype is expected ?

(d) List the criteria on which turbines are classified. Also differentiate between reaction and impulse turbine. **10**

A centrifugal pump delivers water against the net head of 14.5 metres and at a design speed of 1000 rpm. The vanes are carried back at an angle of 30° along the periphery. The impeller diameter is 300 mm and the outlet width is 50 mm. Determine the discharge of the pump if the manometric efficiency is 95%.

2. (a) Explain the conditions required for stable, unstable and neutral equilibrium of a floating body. **10**

The velocity components in a two dimensional flow field for an incompressible fluid are as follows.

$$u = \frac{y^3}{3} + 2x - x^2 y, \qquad v = xy^2 - 2y - \frac{x^3}{3}$$

Obtain an expression for the stream function ψ.

(b) Explain the concept of 'Most economical channel section'. State the conditions required for rectangular and trapezoidal channel sections to be most economical. **10**

Water flows through 150 mm diameter pipe AB 400 m long. The point B is 20 m above A. The discharge through the pipe is 0.02 m^3/sec from A to B. Find the pressure at A if the pressure at B is 200 kPa. Take f = 0.006.

(c) What is the cause of boundary layer separation ? Briefly explain any one method of avoiding boundary layer separation **10**

A 400 mm diameter concrete pipe 4100 m long conveys water at the rate of 10000 m^3 per day. If the pipeline is gradually closed by a valve at the downstream end in an interval of 15 seconds, show that there is a risk of pipe burst. Assume test pressure of concrete pipe as 25 m of water.

(d) With a neat sketch show the general layout and section of a high head hydroelectric power house. Also name the components. **10**

A single acting reciprocating pump, with one cylinder has the following characteristics : Diameter of cylinder 20 cm, stroke length 40 cm, discharge 6 litre/sec, suction head 4 m, delivery head 20 m, rpm 30.

Find the energy required to drive the pump.

SECTION - B

3. (a) Enumerate the different types of rain gauges and describe with a neat sketch the construction and function of the non-recording type of rain gauge. **10**

(b) What is meant by 'stream gauging' ? Describe the velocity area method used for stream gauging. **10**

(c) A loam soil has a field capacity of 25 percent and wilting coefficient of 10 percent. The dry unit weight of soil is 1.5 g/cc. If the root zone depth is 60 cm, determine the storage capacity of the soil. Irrigation water is applied when moisture content falls to 15 percent. If the water application efficiency is 75 percent, determine the water depth required to be applied in the field. **10**

(d) A 0.5 m diameter gravity well is being pumped at a steady rate of 1500 lit/minute. The drawdown of 6 m and 2 m was observed in nearby test wells at distances of 6 m and 16 m from the well being pumped after a steady state is reached. Assume the well to be fully penetrating. The bottom of the well is 100 m below the undisturbed ground water table. Assuming that all observed points lie on Dupuit's curve compute the drawdown in the well being pumped. **10**

4. (a) What are the different types of cross drainage works that are necessary on a canal alignment ? State briefly the conditions under which each one is used. **10**

(b) What are the different methods of reducing seepage in earth dams ? Explain with sketches. **10**

P.T.O.

(c) The average rainfall values over a catchment in three successive 2-hour intervals are 3, 5 and 2 cm, respectively. The ϕ index for the catchment is taken as 0.2 cm/hour. The 2 hour unit hydrograph ordinates are given in table below. **10**

Time in Hrs.	0	2	4	6	8	10	12	14	16
Discharge m^3/sec	0	10	40	70	50	20	10	6	0

Base flow can be taken as 7 m^3/sec at the beginning of the storm linearly increasing to 9 m^3/sec at 10 Hrs. after the beginning and then linearly decreasing to 8 m^3/sec at 4 Hrs. after the end of direct run off. Compute the resultant flood hydrograph.

(d) What are the principal causes and effects of water logging in a canal irrigated farm ? What precautions will you adopt to prevent water logging ? **10**

SECTION - C

5. (a) Discuss the method of conducting CBR test in a laboratory. How will you apply the correction to load penetration curve ? What will be the effect of lateral confinement on CBR value ? **10**

(b) Write short notes on :

(i) Equivalent single wheel load **5**

(ii) Equivalent load factor **5**

(c) Why extra widening needs to be provided on a horizontal curve ? **10**

Calculate the total width of pavement on horizontal curve for National Highway in plain area with a ruling minimum radius. Use following data for the design :

Design speed = 100 km/hr

Pavement width on straight portion = 7.0 m

Number of lanes = 2.

Wheel base of truck = 6.10 m.

Ruling minimum radius = 360 m

(d) What is camber ? Discuss different types of camber and its limiting value for different Road types. **10**

6. (a) Discuss the classification of subgrade soils as per revised PRA system of soil classification. **10**

(b) Design the flexible pavement section as per IRC-37-2001 for 1300 commercial vehicles per day. The rate of growth of traffic is 8% and three year's are required for construction of pavement after last count. **10**

Assume CBR value of subgrade soil = 5%

Lane distribution factor = 0.75

Traffic intensity msa	CBR = 5%			
	total pavement thickness	Pavement composition		
		BC (mm)	DBM (mm)	Granular Base and Subbase
10	660	40	70	
20	690	40	100	Base = 250 mm
30	710	40	120	
50	730	40	140	Subbase = 300 mm
100	750	50	150	
150	770	50	170	

(c) What is super elevation ? Why is it required to provide on horizontal curve ? Derive the expression for equilibrium super elevation. **10**

(d) The speeds of overtaking and overtaken vehicle are 80 km/hr and 50 km/hr respectively on two lane road. If the acceleration of overtaking vehicle is 3.6 km/hr/sec. Calculate **10**

(i) Safe overtaking sight distance

(ii) Minimum length of overtaking zone

(iii) Desirable length of overtaking zone

(iv) Draw a neat sketch showing overtaking zone and position of sign post.

P.T.O.

SECTION - D

7. (a) What are various characteristics of an ideal site for a bridge across a river. The maximum flood discharge under a bridge is 4775 m^3/s. If the normal width and waterway are 960 and 900 m respectively. Find out the scour depth and afflux. The bridge is located in a moderate bend and the Lacey's silt factor is 1.0 velocity of approach is 2 m/s and coefficient of discharge C = 0.9, K=1.5. **10**

(b) Enlist the various loads, forces and stresses considered while designing bridges. Explain briefly the traffic aspects of highway bridges. **10**

(c) Explain briefly with neat sketches various shapes of tunnel. **10**

(d) What are the various methods of tunnelling in soft ground ? Explain with neat sketches. **10**

8. (a) Define Afflux and write Merriman's and Molesworth's formula for determination of afflux. **10**

The catchment area of a river is 12000 ha. The length of the catchment area is 24 kms and the fall in level from critical point to the bridge is 168 mts. The soil of the catchment is loamy with light covered vegetation cover. Find the peak runoff to design a bridge, if the severest storm yielded 20 cm of rain in 5 hrs. Coefficient for losses due to absorption and rainfall are 0.4 and 0.7 respectively.

(b) Explain various methods of erection of steel girder bridges with neat sketches. **10**

(c) What do you mean by ventilation of tunnel ? Explain various methods of tunnel ventilation **10**

(d) What is mucking ? Enlist the equipment used for this purpose. Explain various types of permanent drainage systems in tunnel. **10**

SECTION - E

9. (a) Draw a neat sketch and explain Tube settler. What are the advantages of tube settler over plain sedimentation. **10**

Design tube settler module of square cross section for following data :

(i) Average output required from tube settler = 250 m^3/hr.

(ii) Loss of water in desludging = 2% of output required.

(iii) Cross section of square tubes = 50 mm × 50 mm

(iv) Length of tubes = 1 m

(v) Angle of inclination of tubes = 60%

(b) (i) Explain the following sewer appurtenances with a neat sketch **6**

(A) Inverted Syphon

(B) Drop Manhole

(ii) Calculate the diameter and discharge of a circular sewer which is half full and laid down at a gradient 1 in 400 running with velocity of 1.9 m/s (Take n = 0.012) **4**

(c) What is activated sludge process for waste water treatment ? What are the modifications of Activated Sludge Process. **10**

The average operating data for a conventional activated sludge treatment is as follows :

(i) Sewage Flow = 50,000 m^3/day

(ii) Volume of aeration tank = 16,000 m^3

(iii) Influent BOD = 250 mg/lt

(iv) Effluent BOD = 30 mg/lt

(v) MLSS conc. = 2500 mg/lt

(vi) Effluent suspended solids = 40 mg/lt

(vii) Waste sludge suspended solids = 12,000 mg/lt

(viii) Quantity of waste sludge = 250 m^3/day

Determine :

(A) Aeration period in hours.

(B) F/M Ratio

(C) Percentage efficiency of BOD removal

(D) Sludge age.

P.T.O.

(d) (i) What is meant by primary and secondary pollutants in Air pollution. 5

Give the examples of these pollutants.

(ii) Explain Ambient Air Quality standards with respect to noise as per the Noise Pollution Rules, 2000. Also explain various terms in it. 5

10. (a) What is meant by disinfection ? 10

Enlist the various methods of disinfection. Explain chlorine as a disinfectant with the reactions.

What is Breakpoint chlorination ? Explain breakpoint chlorination with graph.

(b) Explain with a neat sketch D.O. Sag curve. State the equation to find out critical D.O.deficit in the stream. Explain the various terms in the equation. 10

A stream is having a flow of 1 m^3/sec and BOD 4 mg/lt is saturated with D.O. It receives an effluent discharge of 0.25 m^3/sec having BOD 20 mg/lt and D.O. 4 mg/lt. If the average velocity of flow is 0.15 m/sec. Calculate D.O. deficit at points 20 km and 40 km downstream. Assume that the temperature is 20°C throughout and BOD is measured at 5 days. Take rate constants for effluent and stream as 0.12 and 0.30 per day respectively.

Saturation D.O. at 20°C is 9.17 mg/lt.

(c) (i) What is meant by Inversion ? 5

What are the various types of inversions, occurring in nature ?

(ii) Draw a neat sketch and explain the working of electrostatic precipitator. 5

(d) What are the various methods of Landfilling of Municipal Solid Waste ? 10

Explain these methods.

What are the various ways to avoid ground water contamination due to leachate coming out from landfill site.

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