ASP

2009

CIVIL ENGINEERING (Paper I) 106277

Time allowed : 3 Hours } | Maximum Marks : 200

Note :

(i) Solve one question from each section.

(ii) If more than one question 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.

(vii) Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.

SECTION - A

1. (A) What should be the value of 'θ' of the inclined plane shown in Figure 1, which   **12**
will make the motion of 900 N block down the plane to impend ? The coefficient of friction for all contact surfaces is $\frac{1}{3}$.
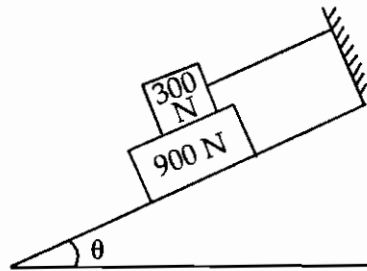

Figure 1 [Q. No. 1 (A)]

(B) A man wishes to move a wooden box of 1 m cube to a distance of 5 m with the   **11**
least amount of work. If the block weighs 1 kN and the coefficient of friction is 0.3, determine whether he should tip the box or slide it.

P.T.O.

(C)   A cord ACB, 5 m long is attached at points A and B to two vertical walls 3 m   **11**
apart as shown in Figure 2. A pulley C of negligible weight and size carries a
suspended load of 200 N and is free to roll without friction along the cord.
Determine the position of the load as defined by its horizontal distance from one
of the walls so that the system is in equilibrium. For this position determine tension
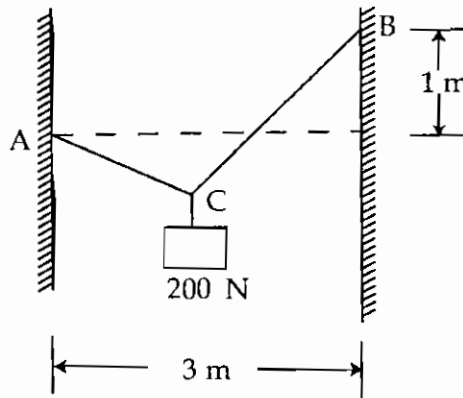in the cord.

Figure 2 [Q. No. 1 (C)]

2.   (A)   A rigid bar is fixed to the top of three posts made of steel and aluminium as   **12**
shown in Figure 3. The length of all the posts is 250 mm when no load is applied
and the temperature is 20 °C. Determine the reaction offered by each of the posts
if the horizontal bar is subjected to a uniformly distributed load of 150 KN/m
and the temperature is raised to 80 °C. The coefficients of thermal expansion of
the materials are $\alpha_{steel} = 12 \times 10^{-6}/°C$ and $\alpha_{alluminium} = 23 \times 10^{-6}/°C$.
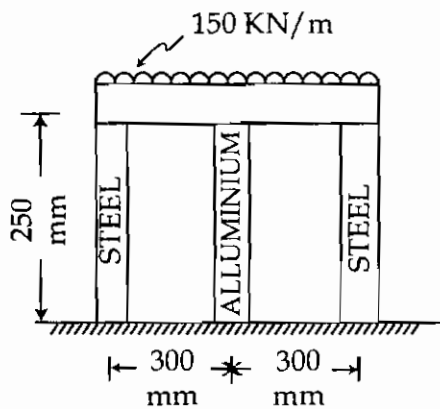
Diameter of steel bars = 40 mm

Diameter of alluminium bar = 60mm

Figure 3 [Q. No. 2 (A)]

(B)   Draw the BMD and SFD for the compound beam shown in Figure 4. Showing   **10**
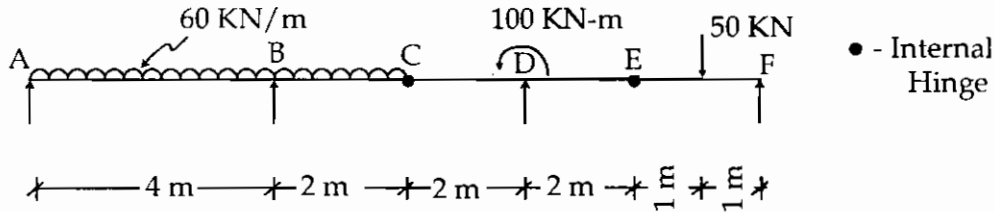salient values.

Figure 4 [Q. No. 2 (B)]

(C)   Determine the equation of the elastic curve for the cantilever beam shown in   **12**
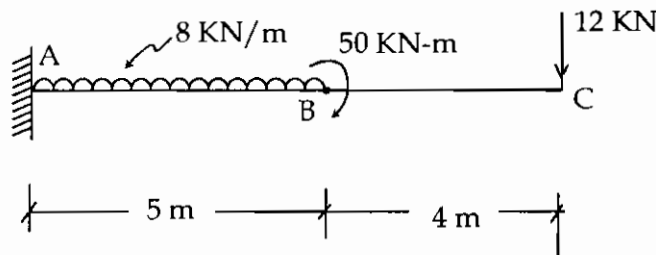Figure 5. Also find the deflection at B and C. Assume EI constant.

Figure 5 [Q. No. 2 (C)]

SECTION – B

3.   (A)   A fixed beam ACB of length 2L is fixed at A and B, AC = CB = L. While portion   **12**
AC has a moment of inertia of 2 I, portion CB has a moment of inertia of I. If the
beam is subjected to a uniformly distributed load of 'ω' per unit length over the
entire span, determine the fixed-end moments at A and B using slope-deflection
method.

(B)   A rigid portal frame ABCD has two unequal vertical legs, AB = 4m and CD = 6m   **13**
with member BC horizontal and 8m long. The supports A and D are fixed and
all the members have same moment of inertia I. The member BC carried a
uniformly distributed load of 40 KN/m and a horizontal force 'H' acts at joint C.
Find the magnitude and sense of the force 'H' such that the frame does not sway
under the given loading. Use moment - distribution method.

(C)   A two-span continuous beam ABC has simple supports at A and C and   **9**
AB = BC = L. Span AB carries a central concentrated load of 'P'. Compute the
redundant reaction at the central continuous support B if it settles by 'Δ'. Use
consistency of deformation method.

P.T.O.

4. (A) A cable is suspended between two points A and B located 50m apart horizontally. **11**
B is higher than A by 12.5 m. At the midpoint of the span AB, the cable is
9.375 m below the point A. The cable carries a uniformly distributed load over
the span. Determine the position and sag of the lowest point and curved length
of the cable.

(B) Using the Muller-Breslau principle draw the influence line diagrams for the **10**
following actions for the compound beam shown in Figure. 6 and show the salient
values.

(i)   Moment at A   (ii)   Reaction at C   (iii)   Shear force at D

(iv)   Moment at E   (v)   Vertical reaction at H
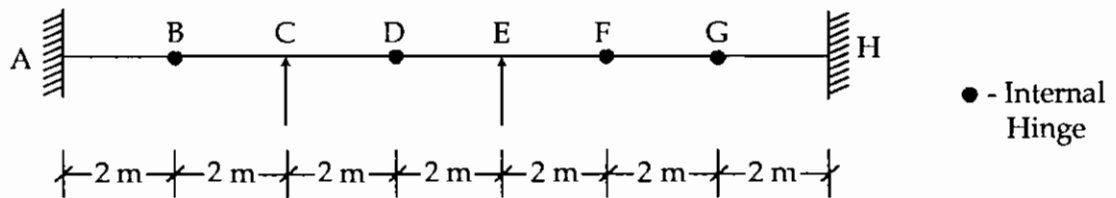

Figure 6 [Q. No. 4 (B)]

(C) Using the stiffness approach of analysis, analyse the pin-jointed truss shown in **13**
Figure 7. Axial rigidity of all the members is same.
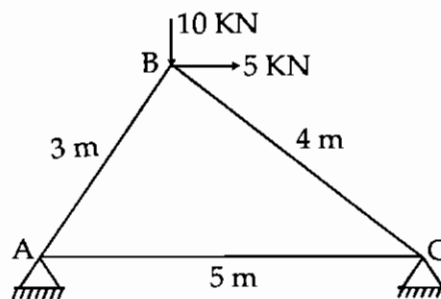

Figure 7 [Q. No. 4 (C)]

SECTION - C

5.   (A)   Calculate the shearing stress in the rivets B and C for the connection shown in   10
          Figure 8. Rivets A and B are 14 mm in diameter, while rivet C has a diameter of
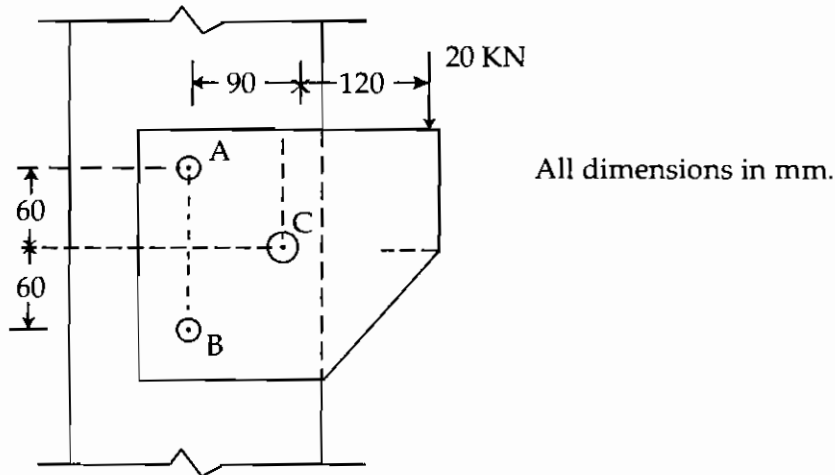   22 mm.

Figure 8 [Q. No. 5 (A)]

   (B)   A built-up column consists of ISHB 400 @ 77.4 kg/m with one 300 mm x 12mm   13
          flange plate on each side. The column carries an axial load of 2400 KN. Design
          a gussetted base for the column, if it is supported on a concrete pedestal with a
          bearing capacity of 4 N/mm^2. Relevant properties of the sections are as given
          below :

   ISHB 400 @ 77.4 kg/m   :   h = 400 mm, b = 250 mm

   ISA 150 × 115 × 15 mm   :   Root radius = 11 mm

   ISA 150 × 115 × 10 mm   :   Root radius = 11 mm

   (C)   A literally supported beam having an effective span of 8 m consists of   10
          ISMB 550 @ 103.7 kg/m and cover plate of 250 mm × 16 mm connected to each
          flange by 20 mm diameter rivets. Determine the safe uniformly distributed load
          which the beam can carry in addition to its own weight. Properties of ISMB 550
          @ 103.7 kg/m are as given below :

   $Ixx = 64893.6 \times 10^4$ mm^4, $Iyy = 1833.8 \times 10^4$ mm^4,

   $Zxx = 2359.8 \times 10^3$ mm^3, $Zyy = 193 \times 10^3$ mm^3,

   $h = 550$ mm, $b = 190$ mm, $t_f = 19.3$ mm, $t_w = 11.2$ mm,

   $a = 13211$ mm^2

P.T.O.

6. (A) A RC beam of span 3 m carries a uniformly distributed featured load of 13
120 KN/m over the span. The beam has a uniform width of 300 mm with overall
depth varying from 650 mm at support to 400 mm at the free end. The beam is
reinforced with 2 − 20 mm diameter bars on compression side and 5 − 28 mm
diameter bars on tension side at an effective cover of 50 mm. Two of the tensile
bars are curtailed at a distance of 1 m from the support. Design the shear
reinforcement assuming M20 concrete and Fe 415 steel. Design shear strength of
M20 concrete for different tensile steel are as given below.

100 As/bd	1.00	1.25	1.50	1.75
τ_c (N/mm^2)	0.62	0.67	0.72	0.75

(B) Design a circular RC column 390 mm in diameter having spiral reinforcement 10
subjected to a factored axial load of 1750 KN. The column is braced against
sidesway and has an unsupported length of 3.3 m. Use M 25 concrete and Fe 415
steel.

(C) Design an isolated footing for a RC column of size 300 mm × 350 mm carrying an 10
axial load of 750 KN. The safe bearing capacity of soil is 175 KN/m^2. The unit
weight of soil is 19.5 KN/m^3. Use M20 concrete and Fe 415 steel.

SECTION - D

7. (A) A retaining wall is to be designed to retain soil upto a height of 5.0 m above 20
ground level. Using limit state approach, design the stem assuming

(i) a cantilever type retaining wall and

(ii) counterfort type retaining wall. Comment on the suitability of each one of
them based on your design. Assume the following data.

Unit weight of horizontal backfill – 18 KN/m^3

Angle of internal friction – 30°

Depth of foundation – 1.5 m below GL.

Grade of concrete – M 20

Grade of steel – Fe 415

C/C distance of counterforts when provided − 3 m.

(B) Design a 3 - span continuous beam of a typical interior idealised plane frame of a 13
building. The frames are spaced 5.5 m apart and in a typical floor 140 mm
continuous slab is cast monolithically with the beams. The thickness of floor
finish is 40 mm. The beam has three equal spans of 6.1 m each. The floor is to
support an imposed load of 5 KN/m^2. at the service state. The unit weight of
finishing material is 20 KN/m^3. Materials to be used are M 20 grade concrete
and Fe 415 steel. Restrict the design to flexural design only.

8. 7(A) An open rectangular tank of size 3 m × 5 m in plan and 3.5 m high, resting on   **13**
        firm ground is to be used for storing water. Design the side walls of the tank
        using M 20 concrete and Fe 415 steel.

    (B) What do you understand by workability of concrete ? Discuss any three methods   **10**
        of determining workability of concrete and state the conditions under which each
        of the methods are suitable.

    (C) Write notes on   **10**

        (i)   creep and shrinkage of concrete

        (ii) Alkali-aggregate reaction.

SECTION – E

9. (A) A simply supported pre-stressed concrete beam 400 mm wide and 600 mm deep   **11**
        is loaded with a uniformly distributed load of 60 KN/m over a span of 6 m. The
        beam is pre-stressed with a parabolic tendon with an eccentricity of 100 mm at
        the ends and 200 mm at midspan. The tendon is pre-stressed with a force of
        1920 KN. Using the load balancing concept determine the extreme fibre stresses.

    (B) A post tensioned PSC beam of 30 m span is subjected to a pre-stressing force of   **14**
        2500 KN. The cable profile is parabolic with a maximum eccentricity of 200 mm
        at midspan and zero eccentricity at the ends. The beam has a cross - section of
        500 mm × 800 mm and is pre-stressed with 9 cables, one at a time, each cable
        consisting of 12 wires of 5 mm diameter. Taking $E_S = 2.1 \times 10^5$ N/mm^2,
        Ec $= 3.5 \times 10^4$ N/mm^2, $\mu = 0.3$, coefficient of wave effect $K = 15 \times 10^{-4}$ per metre
        determine the prestress loss due to

        (i) Elastic shortening

        (ii) Friction.

    (C) Write notes on :   **8**

        (i)   Anchorage stresses

        (ii) Concepts of pre-stressing

10. (A) Explain with neat sketches different types of pre-cast slab panels which are used **12**
         in pre-cast construction.

     (B) Write notes on :   **12**

         (i)   Modern erection techniques of pre-cast member.

         (ii) Design criteria for pre-cast slab panels.

         (iii) Quality control in pre-cast construction.

     (C) Discuss the design procedure of a rectangular pre-stressed concrete beam.   **9**

P.T.O.

SECTION – F

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

$x^3 - 2x^2 - 5x + 6 = 0$

(B) Write an algorithm and flow-chart for solving a set of three simultaneous equations   **14**
using Guass–elimination method.

(C) What do you understand by "Banded Matrix" ? Give examples from structural   **7**
analysis where you come across with such matrices.

12. (A) Explain Gauss-seidel iterative method. Solve the following set of equations using   **12**
Gauss-seidel method.

$$3x_1 + 4x_2 - 6x_3 = 10$$
$$6x_1 - 3x_2 + 4x_3 = 15$$
$$8x_1 + 6x_2 - 7x_3 = 25$$

(B) An overhanging beam ABC has supports at A and B and portion BC is   **12**
overhanging. AB=5 m and BC=2 m. Portion AB is subjected to a uniformly
distributed load of 20 KN/m and portion BC is subjected to uniformly distributed
load of 25 KN/m. Find the bending moment values at an equal intervals of 1 m
and determine the area under the BMD using Simpson's rule.

(C) Draw flow chart and write a computer programme for designing a simply   **9**
supported reinforced concrete beam. Use Fortran or C language.

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ASD

2009

106328   **CIVIL ENGINEERING (Paper II)**

Time allowed : 3 Hours | **| Maximum Marks : 200**

Note :

(i)   Solve one question from each section.

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SECTION - A

1. (a) State the advantages and disadvantages of plane tabling.   **10**

         (Minimum five points for each)

    (b) State and explain the applications of aerial photo interpretation.   **10**

    (c) Due to some problems with the equipment, the bearings and two sides were not   **14** taken for a closed traverse ABCDEA. From the available data compute the bearings of the two sides.

Line	AB	BC	CD	DE	EA
Length (m)	230.5	250.2	210.8	240.3	265.4
Bearing	N 36°45'E	S 82° 48'E	S 10°10'E	Missing	Missing

2. (a) What are reverse curves ? What is the necessity of providing reverse curves ?   **10** What are the disadvantages of a reverse curve ?

    (b) Explain the principle of triangulation. What are the purposes of triangulation   **10** surveys ?

P.T.O.

(c) A 50 metre long tape has been standardised at 25°C under a pull of 100 N. During the field measurements the tape was supported at two points A and B. The elevations of A and B were 110.385 m and 110.120 m with respect to a local bench mark. Elevation of A above mean sea level is 1163. 853 m. The temperature and pull during the measurement were 42°C and 150 N respectively. Find the corrected length of a tape length reduced to mean sea level.

[Consider radius of earth = 6370 KM,

Coefficient of linear thermal expansion = 11×10^{-6}/°C

Elasticity modulus of tape = 2×10^{11} N/m²]

14

SECTION - B

3. (a) What are the various ingredients of Portland cement ? Discuss the function played by each in imparting specific properties to it. **14**

(b) What are the characteristics of good brick earth ? **10**

(c) What is plastering ? What are the objectives of plastering ? **10**

4. (a) Inside dimensions of a stair in a residential structure are 2.5 m × 5.0 m and height of the room is 3.6 m. Design a dog-legged staircase with a rise of 15 centimeter. **14**

(b) Write short note on acoustical defects. **10**

(c) What are traps ? Draw neat sketches for P-trap, Q-trap and S-trap. **10**

SECTION - C

5. (a) Differentiate between load bearing structure and frame structure. **13**

(b) State the advantages of steel trusses over timber trusses. **10**

(c) State various methods used for dewatering of foundation trenches. Explain with a sketch, the well-point system. **10**

6. (a) Prepare an approximate estimate of a residential building with following details. **13**
   • RCC frame (G + 4 Storeys)
   • Plinth area (on each floor) = 500 m²
   • Plinth area rate_____ = Rs. 1,00,000 per m²
   • Cost of electrification, plumbing etc., 15% of building cost.
   • Provide 5% for contingencies and 2% for work-charged establishment of total cost.

(b)   What is an estimate ? Explain the difference between revised estimate and   **10**
supplementary estimate.

(c)   What do you mean by depreciation ? Differentiate between depreciation and   **10**
obsolescence.

SECTION - D

7.   (a)   What do you mean by consistency of soils ? State the uses of consistency limits.   **10**

     (b)   A load of 1200 kN acts as a point load at the surface of a soil mass. Determine the   **10**
stress at a point 4 m below and 3 m away from the point of action of load by
Boussinesq's formula. Compare the value with that obtained from Westergaard's
theory, considering poisson ratio $= 0$.

     (c)   Under certain loading, a layer of clay is expected to undergo full settlement of 18   **13**
centimeters. Also, it is expected to settle by 5 centimeters in the period of 2 months
of loading. Find the time required for the clay layer to settle by 10 centimeters.

$$\left[\text{for U<60\%, time factor} = \frac{\pi}{4}\left(\frac{U}{100} \right)^2 \right]$$

8.   (a)   Distinguish between consolidation and compaction. Also calculate the compactive   **10**
energy applied to soil during stand Proctor test.

     (b)   What are the limiting values of lateral earth pressure at a depth of 3 m in a uniform   **10**
sand fill with unit weight of 18 kN/m^3 and $\phi = 32°$. The ground surface is level.

         If a retaining wall with a smooth and vertical back is interposed, determine the
total active and passive thrusts which will act on the wall.

     (c)   Distinguish between :   **13**

         (i)   General shear and punching shear failures.

         (ii)   Deep foundation and shallow foundation.

         (iii)   Finite and infinite slopes and causes of failure of slopes.

SECTION - E

9. (a) What are the objectives of construction management ? State and describe the functions (like planning, organising...) of construction management. **10**

    (b) Describe the importance of safety in construction. What are the various safety measures adopted at the time of demolition of a building ? **10**

    (c) Write detailed note on quality control of following construction items : **13**

(i)	Concrete	(ii)	Steel
(iii)	Form-work	(iv)	Sanitary and water supply

10. (a) What are the principles normally adopted in storing materials ? **10**

    (b) Define and explain the following : **10**

(i)	Event	(ii)	Activity
(iii)	Dummy	(iv)	Float

    (c) State the different methods of estimating depreciation of construction equipment. **13**

    Explain double decline balance method of depreciation with the help of following example.

    Cost of equipment = Rs. 12 lakhs.

    Estimated life of equipment = 5 years.

    Estimated salvage value = Rs. 2 lakhs.

    Calculate depreciation and book value for each of the five years life.

SECTION - F

11. (a) What is fold ? With the help of neat sketches describe various parts of a fold. **10**

    (b) What are the factors of metamorphism ? Write five structures of the metamorphic rock with neat sketches. **10**

    (c) What is a dam ? Describe the types of dam and suitable rock types of site in their selection. **13**

P.T.O.

12. (a) State the advantages of circular section and horse-shoe section of tunnels. Explain   **10**
    the various parameters considered to arrive at dimensions to be given to a tunnel
    section.

    (b) Explain with the help of neat sketch the central drift method of tunnelling in   **10**
    rock. State the advantages and disadvantages of this method.

    (c) What are the requirements of ventilating system in a tunnel ? Explain the natural   **13**
    and mechanical methods of ventilation.

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ASV

2009

106352   **CIVIL ENGINEERING (Paper III)**

Time allowed : 3 Hours }   { Maximum Marks : 200

Note :

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

(ii)   *If more than one question are attempted in a section, the excess will be ignored.*

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SECTION - A

1.   (a)   Briefly explain classification of fluids based on viscosity.   **12**
             Calculate the capillary effect in mm in a glass tube 1 mm in diameter when it is immersed in water. Take surface tension of water as 0.08 N/m and angle of contact as zero. If the same tube is immersed in mercury of specific gravity 13.6 and surface tension of 0.5 N/m, angle of contact between glass and mercury 140°, what will be rise/depression in the level in the tube ?

      (b)   What is meant by stability of a floating body ? Explain with reference to its   **11**
             metacentric height.
             A vertical sluice gate 4 m wide and 2 m deep is hinged at the top. Liquid of specific gravity 1.5 stands to a height of 2 m above the top of the gate on the upstream side. On the downstream side water stands to a height of 1m above the top of the gate. Find resultant force acting on the gate and point at which the resultant force acts.

      (c)   Determine the stream function if the velocity components of a two dimensional   **11**
             incompressible fluid flow are given as :

$$u = \frac{y^3}{3} + 2x - x^2 y$$

$$\vartheta = xy^2 - 2y - \frac{x^3}{3}$$

P.T.O.

2.   (a)   Explain the energy variation in a short hydraulic jump using specific energy   **12**
equation. For a constant specific energy of 1.8 N-m/N calculate the maximum
discharge that may occur in a rectangular channel 5.0 m wide.

       (b)   What are repeating variables ? What points are important while selecting repeating   **11**
variables ? A pipe 50 mm diameter is 6 m long and the velocity of flow of water
in the pipe is 2.4 m/s. What loss of head and corresponding power would be
saved if the central 2 m length of pipe is replaced by 75 mm diameter pipe ? The
change of section is sudden. Take $f = 0.04$ for pipes of both diameters.

       (c)   What are different types of hydraulic jump. Mention uses of hydraulic jump.   **11**

             A Hydraulic type of energy dissipater is designed to have energy loss of 8.5 m.
The froude number upstream of the jump is 7.2. Find the sequent depths of flow.
What is efficiency of jump ?

SECTION - B

3.   (a)   Describe the principle of working of a tipping bucket type raingauge with a neat   **12**
sketch. What are its advantages and disadvantages ?

       (b)   Define rainguage density. Explain various methods available for the estimation   **11**
of missing precipitation records.

             Rainguage station X did not function for a part of a month during which a storm
occurred. The storm produced rainfall of 84, 70 and 96 mm at three surrounding
stations A, B, and C respectively. The normal annual rainfalls at the stations X,
A, B and C are 770, 882, 736 and 944 mm respectively. Estimate the missing
storm rainfall at station X.

       (c)   Discuss various factors affecting evapo transpiration. Explain the use of lysimeter   **11**
in measuring evapo transpiration.

4.   (a)   List the various methods of estimating flood. Describe the velocity area method   **12**
used for stream gauging. What return period you would adopt in the design of a
culvert on a drain if you are allowed to accept only 5% risk of flooding in the
25 years of expected life of the culvert.

       (b)   What is Unit Hydrograph. List the assumptions involved in the theory of Unit   **11**
Hydrograph ? What are the uses and limitations ?

       (c)   Why is recharging of ground water necessary ? Design a tube well for the following   **11**
data.

             Yield required = 0.08 cumec, thickness of confined aquifer = 30 m, radius of circle
of influence = 300 m permeability coefficient = 60 m/day, drawdown = 5 m.

SECTION - C

5. (a) Define irrigation and explain its necessity in a tropical country like India. What   **11**
        are the advantages and ill effects of assured irrigation ?

    (b) What is meant by Bandhara irrigation ? Give briefly the advantages and   **11**
        disadvantages of Bandhara irrigation.

    (c) A stream of 125 lit/s was diverted from a canal and 100 lit/s were delivered to   **11**
        the field. An area of 1.6 Hect was irrigated in 8 hours. Effective depth of root
        zone was 1.7 m. The runoff loss in the field was 420 cum. The depth of water
        penetration varied linearly from 1.7 m at the head end of the field to 1.3 m at the
        tail end. Available moisture holding capacity of the soil is 20 cm per metre depth
        of soil. Determine water conveyance water application, water storage and water
        distribution efficiencies. The irrigation was started at a moisture extraction level
        of 50% of the available moisture.

6. (a) List various causes of failures of earth dams. Explain the Swedish circle method   **11**
        of slope stability analysis.

    (b) What is the necessity of river training works ? What is meandering of rivers ?   **11**
        What are its causes ? Explain the role of cut-off in the meandering of rivers.

    (c) Differentiate between low gravity dam and a high gravity dam. How does the   **11**
        practical profile of a low gravity dam differs from that of the theoretical profile
        and why ? Discuss step by step the analytical procedure adopted for stability
        analysis of gravity dams.

SECTION - D

7. (a) State the objects of widening pavements on horizontal curves ? Explain the factors   **11**
        on which the design of widening depends.

        Calculate the extra widening required for a pavement of width 7.0 m on a
        horizontal curve of radius 250 m, if the longest wheel base of vehicle expected on
        the road is 7.0 m. Design speed is 70 kmph.

    (b) Explain the engineering surveys needed for locating a new highway. Discuss the   **11**
        special care to be taken while aligning hill roads.

    (c) Discuss briefly the different causes of traffic accidents. Explain various measures   **11**
        that may be taken to prevent accidents.

8. (a) Calculate the stresses at interior, edge and corner regions of a cement concrete   **11**
pavement using Westergaard's stress equation using the following data.

Wheel load $P = 4100$ kg.

Modulus of elasticity of cement concrete $= 3.0 \times 10^5$ kg/cm^2.

Pavement thickness $= 15$ cm.

Poissons ratio for concrete $= 0.15$

Modulus of subgrade reaction $= 3.0$ kg/cm^3.

Radius of contact area $= 15$ cm.

(b) Specify the material required for the construction of WBM roads. Write down   **11**
the construction steps for water bound macadam road.

(c) What are the advantages and disadvantages of traffic signals ? What are various   **11**
types of signals ? Explain the various traffic signal systems used for co-ordination
of signals in a road network.

SECTION - E

9. (a) What factors are taken into consideration for deciding the location of a bridge.   **11**
List various methods of subsurface investigations. Give the data needed for the
design of a bridge.

(b) Draw the sketch (plan and elevation) of a bridge showing its component parts ?   **11**
Give function of each component. Give classification of permanent bridges.

(c) What is a cofferdam ? What are the requirements of a cofferdam ? What are the   **11**
types of cofferdam ?

10. (a) Explain the various problems encountered and their remedial measures to be   **11**
taken during the well sinking.

(b) Describe with sketches the construction of superstructures of steel suspension bridge.   **11**
List the items you will inspect for the maintainance of bridges.

(c) Write short notes on :   **11**

(i) IRC Bridge loading.

(ii) Pope culvert, High level causeway.

P.T.O.

SECTION - F

11. (a) Explain three different methods of forecasting the future population of a town. **11** Explain the factors affecting the water demand.

(b) Give advantages and disadvantages of pressure filter. **11**

Design set of three rapid gravity filters for treating water at a water works, which has to supply the water to a town of population 1,00,000. The per capita demand of the town is 270 lit/day. The rate of filtration of the rapid gravity filters may be taken as 4500 lit/hour/sq. m.

(c) Explain the characteristics of following air pollutants. **11**

Natural contaminant, Aerosols, Dust, Smoke, Mist.

12. (a) What are the various methods of disinfecting water ? What are the requirements **11** of good infectants ?

(b) Write short notes on : **11**

(i) Drop manhole.

(ii) Layout of sewage treatment plant.

(c) What is air pollution ? What are effects of air pollution ? Explain in brief air **11** pollution control methods.

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