GRM

2011

101200

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 question number against the answer.*

(iii) *Number of optional questions up to the prescribed number in the order in which questions have been solved, will only be assessed and excess answers of the question/s will not be assessed.*

(iv)   *Figures to the right indicate the number of 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 Table, is **not** permitted.*

(viii) *Candidate should not write roll number, any name (including his/her own), signature, address or any indication of his/her identity any where inside the answer book otherwise the candidate will be penalised.*

SECTION - A

1.   (a)   A beam ABCD supported at B and C has over hangs AB and CD. The shear   **10**
             force diagram for the beam is shown in Figure 1. Determine the loading diagram
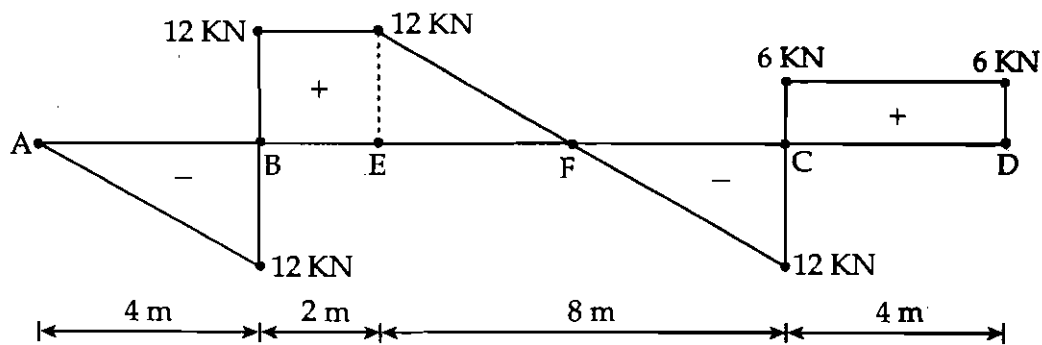   with couple at pt. F and the bending moment diagram.

Figure 1

P.T.O.

(b) A circular steel bar ABCD, rigidly fixed at A and D is subjected to loads of 50 KN **10** and 100 KN at B and C as shown in Figure 2, Find the loads shared by each part of the bar and displacements of the points B and C. Take E for steel as 200 GPa.
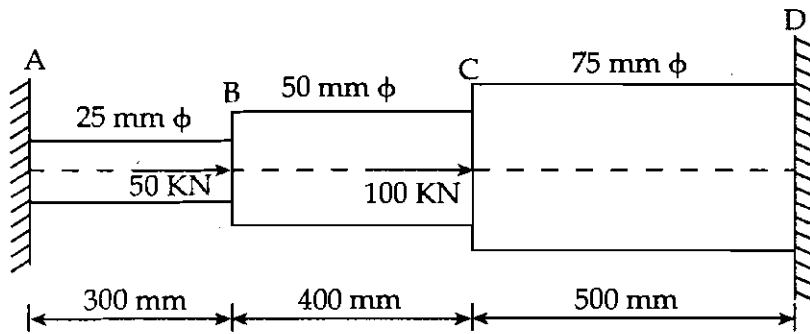

Figure 2

(c) Analyse the continous beam loaded as shown in Figure 3, by the slope deflection **10** method. Support B sinks by 10 mm. Take $E = 2 \times 10^5$ N/mm^2, $I = 16 \times 10^7$ mm^4. Sketch the bending moment and shear force diagrams.
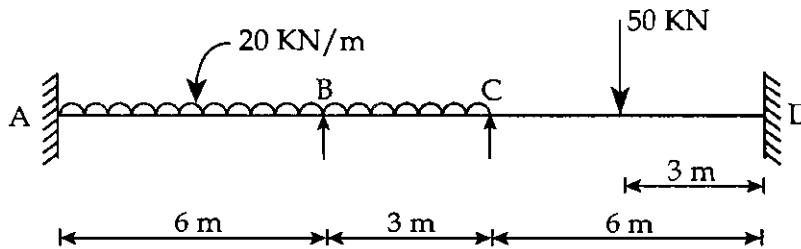

Figure 3

(d) Draw the shear force and bending moment diagrams for the continuous beam **10** shown in Figure 4. Using theorem of three moments.
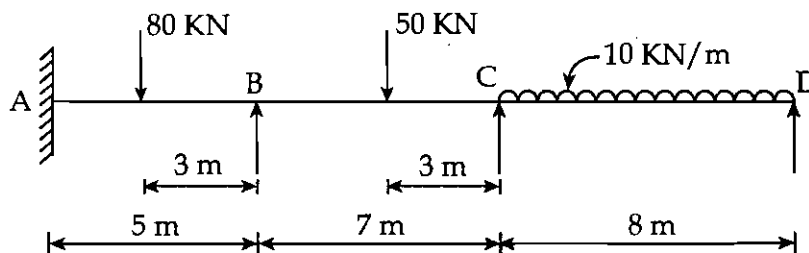

Figure 4

2.   (a)   The cross-section of cast iron beam is shown in Figure 5. The top flange is in   **10**
          compression and bottom flange is in tension. Permissible stress in tension is
          30 N/mm^2 and it's value in compression is 90 N/mm^2. Determine how much
          concentrated load beam can carry at center of 5 m span. Given ends of beam are
          simply supported.
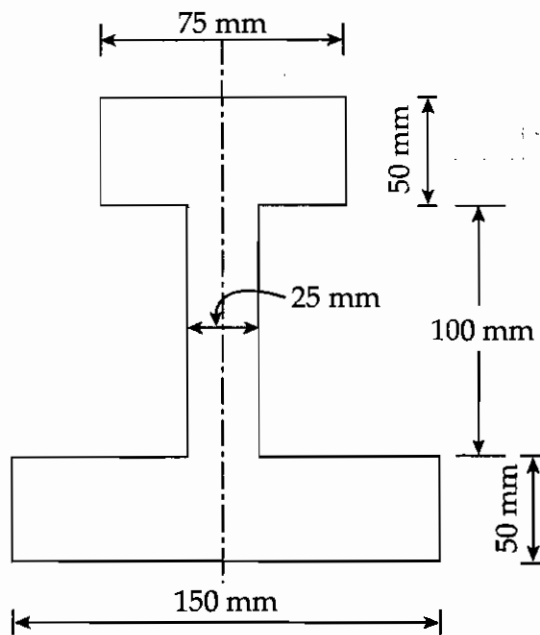

Figure 5

   (b)   A shaft composed of segments AC, CD and DB is fastened to rigid supports and   **10**
          loaded as shown in Figure 6, for bronze G = 35 GPa, Aluminium G = 28 GPa and
          for steel G = 83 GPa. Determine the maximum shearing stress developed in each
          segment. T_C = 300 N.M and T_D = 700 N.M.

Figure 6

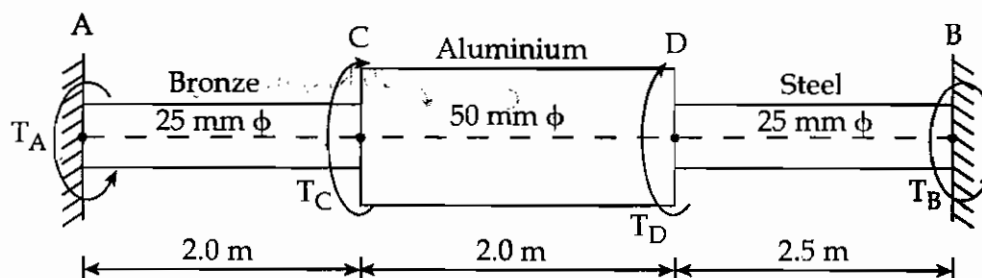**P.T.O.**

(c)   Analyse the loaded frame shown in Figure 7, by moment distribution method   **10**
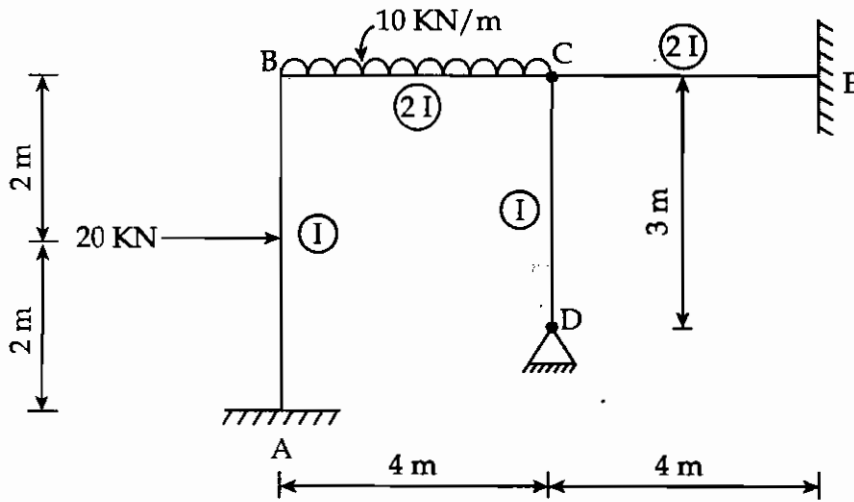and draw the bending moment diagram.

Figure 7

(d)   Find the vertical deflection of point 'C' of the loaded truss shown in figure 8. The   **10**
cross-sectional area of members CD and DE are each 2500 mm^2 and those of
other members are each 1250 mm^2. Take E = 200 KN/mm^2.
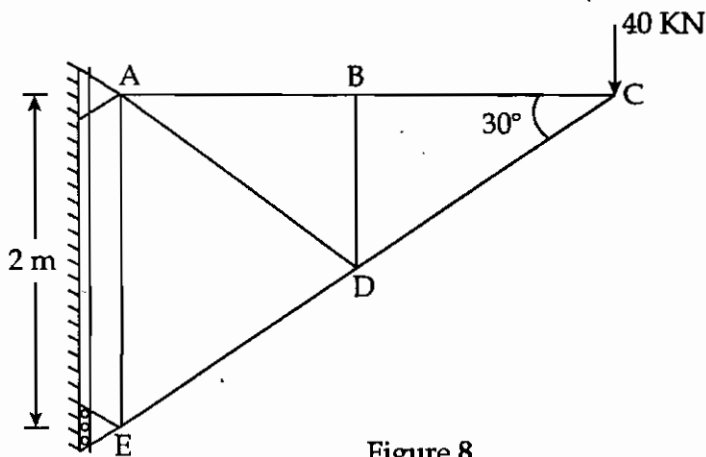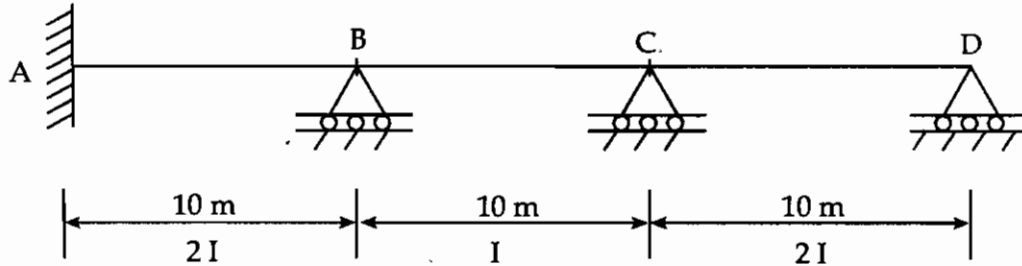

Figure 8

SECTION – B

3. (a) Calculate the flexural stiffness at point D of the three - span continuous beam **10**
ABCD shown in figure.

    (b) A suspension cable hangs between two points A and B separated horizontally by **10**
90 m and with point B 15 m above A. The lowest point of the cable is 3 m below
A. The cable supports a stiffening girder weighing 7.5 KN/m which is hinged
vertically below A, B and the lowest point of the cable. Calculate the maximum
tension which occurs in the cable when 200 KN wheel load crosses the girder
from A to B.

    (c) An ISMB 500 @ 852.5 N/m transmits an end reaction of 300 KN and bending **10**
moment of 150 KN^{-m}, under factored loads, to the flange of a column
ISHB 300 @ 576.8 N/m. Design a welded connection.

    (d) A column ISHB 350 @ 661.2 N/m carries an axial compressive factored load of **10**
1700 KN. Design a suitable bolted gusset base. The base rests on M15 grade
concrete pedestal. Use 24 mm diameter bolts of grade 4.6 for making the
connections.

4. (a) A bean ABC is supported at A, B and C and has an internal hinge at D at a distance **10**
of 4 m from A. AB = 8 m, and BC = 12 m. Draw the influence lines for :
      (i)   Reaction at A R_a
      (ii)   Reaction at B R_b
      (iii)   Reaction at C R_c

    (b) A parabolic arched rib, 30 m span, is hinged at the crown and springings and has **10**
a central rise of 5 m. A moving load of 15 KN/m longer than the span, rolls over
the arch from left to right. Calculate the maximum positive and negative bending
moment at the section 9 m from the left hand hinge.

    (c) Design a welded plate girder of 20 m span using the tension field action for the **10**
following factored forces :
      (i)   Maximum moment - 5000 KN^{-m}.
      (ii)   Maximum shear force - 900 KN.
    The girder is laterally restrained connections need not be designed.

    (d) Design a column of effective length 5.90 m. It is subjected to a factored axial **10**
compressive load of 2000 KN. Provide two channels back to back connected
with battens by site welded connection. Use steel of grade Fe 410.

                                                      P.T.O.

SECTION – C

5. (a) A singly Reinforced Concrete beam 230 mm wide and 400 mm effective depth. **10**
Using M20 and Fe 415 and using L.S.M.
  (i) Calculate Mumax and Astmax for balanced design
  (ii) If depth of N.A. is limited to 0.35d. What will be values of Mu and Ast
  (iii) If the section is reinforced with 0.4% steel, determine the depth of N.A. and calculate Mu.

  (b) A R.C. beam section of size 230 mm wide × 500 mm deep has 4 Nos 20 mm bars **10**
in tension zone and 2 Nos 16 mm bars in compression zone. The effective span of beam is 5.5 m and clear cover to both reinforcement is 30 mm. Find safe working load the beam can carry by W.S.M. Use M20 and Fe415 take $\sigma_{abc} = 7$ N/mm^2 and m = 13.33.

  (c) A Reinforced Concrete beam has a support section with a width of 300 mm and **10**
effective depth 600 mm. The support section is reinforced with 3 Nos of 20 mm dia. bars at an effective depth of 600 mm. 8 mm dia. 2 legged stirrups are provided at spacing of 200 mm as a shear Reinforcement near support. Estimate the shear strength of support section. Using M20 and Fe500 steel. Assuming $\tau_c = 0.48$ N/mm^2. Using L.S.M.

  (d) Design a slab of size 3m × 7.8m using M20 and Fe 415 for flexture. Assuming **10**
M.F = 1.5 and $\tau_c = 0.36$ N/mm^2 K = 1.3, LL = 3.5 KN/m^2 and F.F = 1.0 KN/m^2. Take all necessary checks as per L.S.M. using $\tau_{bd} = 1.2$ N/mm^2.

6. (a) Check the stability of Retaining wall to retain the earth 4m high. The top surface **10**
is horizontal behind the wall. The soil has unit weight of 17 KN/m^3 and Angle of internal friction $\phi = 30°$. The material under the wall base is same as above with S.B.C of soil = 150 KN/m^2 and $\mu = 0.55$ use M20 and Fe 415.

  (b) Design a open React. water tank fixed at base on firm ground with capacity **10**
1.5 lakh liters. Assuming depth of water in tank as 3.5m provide free board of 0.2m. Use M25 and Fe 415 steel. Use Approximate Method of design. Design long wall, short wall and base slab.

  (c) Design one of the flight of stair of a school building spanning between landing **10**
beams to suit the following data :
  (i) Type of stair case – Waist slab type
  (ii) No. of steps in a flight = 12
  (iii) Tread = 300 mm
  (iv) Riser = 160 mm
  (v) Width of landing beam = 400 mm
  (vi) Material – M20 and Fe 415

  (d) A Reinforced Concrete beam ABC of rectangular section is simply supported at **10**
A and C and continuous over support B. Span AB = 5m and BC = 4m. The beam carries a D.L. of 20 KN/m including self weight and L.L = 12 KN/m. Design the continuous beam by L.S.M. with 10% redistribution of moment. Use M20 and Fe 415. Draw B.M.D. envelops.

SECTION – D

7. (a) Discuss the various properties of concrete in both fresh and hardened state, which   **10**
        affect the strength of concrete.

    (b) Explain :   **10**

         (i)   Characteristic strength of concrete

         (ii) Stress-strain behaviour of concrete. How the stress-strain behaviour is
               idealised to define the design strength of concrete ?

    (c) Explain the three basic concepts of pre-stressing. Discuss why high-strength   **10**
         materials are required to be used in pre-stressed concrete.

    (d) A post-tensioned pre-stressed concrete beam of span 30 m is subjected to a   **10**
         pre-stressing force of 2500 KN at transfer. The profile of the cable is parabolic
         with zero eccentricity at supports and 200 mm at mid-span. The beam has a
         cross-section of 500 mm × 800 mm and is prestressed with 9 cables, one at a time,
         each cable consisting of 12 wires of 5 mm diameter. Determine the loss of prestress
         due to :

         (i)   elastic shortening   (ii)   friction

         Assume $Es = 2.1 \times 10^5 \ N/mm^2$, $Ec = 3.5 \times 10^4 \ N/mm^2$, Coefficient of friction $= 0.3$,
         Coefficient for length effect $= 15 \times 10^{-4}$ per metre.

8. (a) List at least four methods of mix design of concrete. Explain in detail the IS code   **10**
         method of mix design.

    (b) Explain the following with neat sketches :   **10**

         (i)   Shuttering for a rectangular column

         (ii) Shuttering for beam and slab floor

    (c) Explain different types of post-tensioning systems with the help of neat sketches.   **10**

    (d) A pretensioned unsymmetrical I-section has a top flange of 300 mm × 150 mm   **10**
         and a bottom flange of 250 mm × 200 mm. The rib is 150 mm thick and 350 mm
         deep. The beam is prestressed by a straight cable with an eccentricity of 150 mm
         and carries a prestressing force of 400 KN. The beam is simply supported over a
         span of 10 m, and is subjected to a live load of 5 KN/m. Draw the stress distribution
         diagram at mid-span section for :

         (i)   self weight and prestressing force

         (ii) self weight, prestressing force and live load.

P.T.O.

SECTION – E

9. (a) Using Newton-Raphson method, find root of the following non-linear equation **10** with trial value of 5.

$$x^2 - 5x + 4 = 0$$

(b) Evaluate $\int_1^7 \frac{1}{x}\, dx$ by Simpson's three - eighths rule and compare the value with **10** the exact value of $\log_e 7$ of the integral.

(c) Find the positive root of the equation $\cos x - 1.3x = 0$ correct to four decimal places **10** using bi-section method.

(d) Solve the following set of equations by using Gauss - Jordon method. **10**

$$0.732x_1 - 5.421x_2 + 1.013x_3 = 4.256$$
$$3.491x_1 + 2.203x_2 + 0.782x_3 = -7.113$$
$$0.961x_1 - 1.523x_2 + 4.265x_3 = 3.727.$$

10. (a) Solve the following quadratic equation by accelerated iteration method starting **10** with any convenient initial value.

$$x^2 + 2x - 2 = 0$$

(b) Write computer program for designing of laterally supported beam as per **10** IS : 800. The program should be useful to handle the following load types :

(i) Point load

(ii) Uniformly varying load

(iii) Uniformly distributed load

(iv) Combinations of above three

Use Fortran or C-language.

(c) Develop an algorithm and flowchart to design R.C.C. column subjected to axial **10** load and uniaxial bending moment.

(d) Write computer program in Fortran or C-language for designing flanged beam as **10** per IS : 456. Data such as flange thickness, Web Width, overall depth and area of steel is to be given for particular B.M. and S.F. value.

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HRM

2011

CIVIL ENGINEERING (Paper - II)

1052

Time allowed : 3 Hours }   { Maximum Marks : 200

Note :

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

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SECTION - "A"

1.   (a)   Discuss the temporary adjustment of Transit Theodolite. How would you measure   **10**
          the horizontal angle by repetition method ?

     (b)   Determine the gradient from point 'P' to point 'Q' from the following observations   **10**
          made with a tacheometer fitted with an anallactic lens. The constant of instrument
          was 100 and staff was held vertically.

inst. station	staff station	Bearing	Vertical Angle	Staff readings		
				b	m	T
P	A	130	10°32′	1.36	1.915	2.470
	B	220	5°6′	1.065	1.885	2.705

     (c)   Two straight lines 'AB' and 'BC' are intersected by a line 'D$_1$D$_2$'. The $\angle$ B D$_1$D$_2$ **10**
          and $\angle$ B D$_2$D$_1$ are 40° 30′ and 36° 24′ respectively. The radius of first arc is
          600 m. and that of second arc is 800 m. If the chainage at point of intersection
          point 'B' is 8248. 10m. Calculate the chainage of Tangent Points and point's of
          compound curve.

                                                                                        P.T.O.

(d) The following consecutive readings were taken with dumpy level and 4m leveling **10** staff on a continuously sloping ground at a common interval of 30 m.

The elevation of point A was 520.45 m. make up a level book and apply usual checks. Also determine the gradient of line AB. The staff readings are as follows.

Staff reading on A = 0.585, 0.936, 1.953, 2.846, 3.644, 3.938, 0.962, 1.035, 1.689, 2.534, 3.844, 0.956, 1.579.

Staff reading on B = 3.016.

2. (a) The table gives the latitude and departure of sides of closed Traverse ABCDA. **10** Calculate the independent co-ordinate of each station and the area of closed Traverse ABCDA.

Side	Latitude		Departure	
	N	S	E	W
AB	214.8		124.0	
BC		245.10	205.70	
CD		155.90		90.00
DA	186.20			239.70

(b) Discuss the advantages and disadvantages of plane table surveying. **10**

(c) What do you mean by local attraction. Following bearings were observed on a **10** closed Compass Traverse. Calculate the interior angle and correct it for observational error taking the bearing of line BC as correct. Find the corrected bearing of remaining sides of the closed traverse :

Line	F.B.	B.B.
AB	191° 15′	10° 15′
BC	120° 45′	300° 45′
CD	339° 5′	169° 00′
DE	339° 35′	160° 40′
EA	296° 00′	115° 00′

(d) An Instrument set up at 'P' and angle of depression to a vane 2m above the foot **10** of the staff held at 'Q' was 5° 36′. The horizontal distance between 'P' and 'Q' was known to be 3000m. Determine the R.L. of staff station 'Q' given that staff reading on a B.M. of elevation 456.050 was 2.865 m.

SECTION – "B"

3. (a) Give account of any three standard sizes for 23 cm bricks as prescribed by PWD **10**
         in India along with mould sizes.
         What is effect of presence of oxide of iron and alkali in brick earth on brick after
         burning ?

    (b) How is lime classified ? State suitability of each for application like masonry and **10**
         plastering with reasons.

    (c) Compare Granite, Basalt, lime stone, and Laterite on the basis of suitability for **10**
         construction type, geological classification, structure, and requirement of
         seasoning.
                                                                                              10
    (d) Explain various steps involved in preparation of surface of new wood work for
         painting, with reasons.

4. (a) How is built environment different from natural environment ? Why is an **10**
         integrated approach essential in building planning ?
                                                                                      10
    (b) Explain essential climatic considerations in building planning with suitable
         examples.

    (c) Explain lighting and ventilation requirements for habitable room, sanitary annexe **10**
         (WC and Bath), Stairway, and basement as per building bye laws.

    (d) What are precautionary measures to avoid acoustical defects in an auditorium. **10**
         Also explain use of Sabine's expression to work out ORT for an auditorium.

SECTION – "C"

5. (a) Describe the procedure for empirical design of shallow stepped foundation for **10**
         load bearing wall.

    (b) Explain in brief the points to be observed in supervising brick work. **10**

    (c) Enlist and explain the contract documents. **10**

    (d) Find out the book value, after 40 years, of an asset costing Rs. 4.0 lakhs, **10**
         assuming 100 years as life of the asset and the salvage value of
         Rs. 20,000/-. What would be the book value after 30 years of life if the salvage
         value is nil ? (Assume straight line depreciation).

6. (a) Explain the difficulties faced and precautions to be taken for foundations of **10**
         buildings in black cotton soils.

    (b) Draw a roof plan for pitched roof and explain the components and technical **10**
         terms in pitched roof.

(d) A construction project consists of 10 activities as shown below :   **10**

Activity	Duration	Activities which immediately	
		Precede	Follow
A	8 days	NIL	A, B
B	8 days	NIL	E
C	8 days	A	F
D	10 days	A	G, H
E	8 days	B	G, H
F	8 days	C	I
G	10 days	E, D	I
H	8 days	E, D	J
I	8 days	F, G	NIL
J	8 days	H	NIL

Draw Network diagram and find out all critical activities. Also show activity wise float in tabular form.

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(c) Compare in detail the item rate contract and percentage rate contract.   **10**

(d) Prepare an approximate estimate for a G + 3 RCC framed structure. The built up **10** area on ground floor is 500 m², and on every successive floor it is reduced by 10% of ground floor built up area. The built up area rate for ground floor is Rs. 10,000/- per square meter, and for every higher floor there is a hike of Rs. 1000/- in this rate. Cost of electrification and plumbing is 15% of building cost. Provide 5% of total cost for contingencies and work - charged establishment.

SECTION – "D"

7. (a) Draw a neat sketch of plasticity chart suggested by IS 1498 and explain how it is **10** used to classify soils.

(b) List out assumptions made by Boussinesq for stresses induced in a soil mass due **10** to concentrated point load and write Boussinesq equation for stress due to point load in a soil mass. Give meaning of all the terms in the equation.

(c) Define optimum moisture content and explain how the compaction of soil is **10** controlled in the field. Also list out the factors which affect compaction.

(d) Explain plate load test with a neat sketch and explain what are its limitations.   **10**

8. (a) A retaining wall 4 m high, has a smooth vertical back. The backfill has a horizontal **10** surface in level with the top of the wall. There is uniformly distributed surcharge load of 36 KN/m² intensity over the backfill. The unit weight of the backfill is 18 KN/m², its angle of shearing resistance is 30° and cohesion is zero. Determine the magnitude and point of application of active earth pressure per metre length of the wall.

(b) An undisturbed sample of soil has a volume of 100 cm³ and mass 190 g. On oven **10** drying for 24 hours, the mass is reduced to 160 g. If the specific gravity of soil particles is 2.68, determine the water content, voids ratio and degree of saturation of the soil.

(c) With necessary sketches explain sand replacement method to find field density of **10** soil in the field.

(d) A normally consolidated clay stratum of 3 m thickness has two permeable layers **10** at its top and bottom. The liquid limit and the initial void ratio of the clay are 36% and 0.82 respectively, while the initial overburden pressure at the middle of the clay layer is 2 kg/cm². Due to the construction of a new building this pressure increases by 1.5 kg/cm². Compute the probable consolidation settlement of the building.

P.T.O.

SECTION - "E"

9. (a) What is meant by Scientific management ? How are the methods of Scientific management adopted for the construction jobs ? **10**

   (b) A construction project carries out seven activities as shown below : **10**

Activity	Dependancy	Duration
A	Initial Activity	5 days
B	Initial Activity	5 days
C	Depends upon Activity A	5 days
D	Depends upon Activity B	10 days
E	Depends upon Activity B	5 days
F	Depends upon C and D	10 days
G	Depends upon Activity E	10 days

   Calculate EST, EFT, LST, LFT, by drawing Network diagram. Also show critical path.

   (c) (i) Using the straight line method of depreciation, determine the annual cost of depreciation for a tractor whose initial cost is Rs. 17,50,000/- if the assumed life is 7 years with an Estimated Salvage Value of Rs. 22,000/- **5**

   (ii) Explain in brief the causes of Accidents. **5**

   (d) What do you mean by Store Management ? What principles are normally adopted to store construction material ? **10**

10. (a) Draw a neat sketch showing the basic parts of "Drag line." **10**

    (b) What are the important features of ABC Analysis ? **10**

    (c) Define : **10**

    (i) Accident Cost

    (ii) Injury frequency rate

    (iii) Injury Severity rate

    (iv) Safety equipments in construction industry

P.T.O.

2011
CIVIL ENGINEERING (Paper - III)

01052

Time allowed : 3 Hours | | Maximum Marks : 200

Note :

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SECTION - A

1. (a) Define and briefly explain Newton's Law of Viscosity. Also differentiate between   **10** kinematic and dynamic viscosity.

The surface tension of water in contact with air at 20°C is given as 0.0716 N/m. The pressure inside a droplet of water is to be 0.0147 N/cm^2 greater than the outside pressure. Calculate the diameter of droplet of water.

(b) Explain the condition of equilibrium for a floating body and submerged body.   **10**

The velocity vector in a fluid flow is given by, $V = 2x^3 i - 5x^2y i + 4 tk$. Find the velocity and acceleration of a fluid particle (1, 2, 3) at time $t = 1$.

(c) What do you understand by most economical section of a channel. Also derive   **10** the conditions for rectangular channel of most economical section.

A syphon of diameter 150 mm connects two reservoirs having a difference in elevation of 15 m. The length of the syphon is 400 m and summit is 4 m above the water level in the upper reservoir. The length of the pipe from upper reservoir to summit is 80 m. Determine the discharge through syphon. Also determine the pressure at summit, consider coefficient of friction as 0.020 and neglect minor losses.

P.T.O.

(d) Describe the functions of main components of Pelton turbine with neat sketch.   **10**

   Find the power required to drive a centrifugal pump which delivers 0.04 cubic metre per second of water to a height of 20 m through a 15 cm diameter pipe and 100 m long. The overall efficiency of the pump is 70%. Consider coefficient of friction as 0.06.

2. (a) Explain the phenomenon of capillarity and obtain an expression for capillary rise of a liquid.   **10**

   A rectangular tank 4 m long, 1.5 m wide contains water upto a height of 2 m. Calculate the force due to water pressure on the base of the tank. Also find the direction of this force and depth of centre of pressure from free surface.

   (b) Distinguish between following :   **10**

   (i)   Uniform flow and non uniform flow

   (ii) Steady flow and unsteady flow

   (iii) Rotational flow and irrotational flow

   What are the limitations of Bernoulli's theorem ? Water is flowing through a pipe having diameters 20 cm and 15 cm at sections 1 and 2 respectively. The discharge through the pipe is 0.04 cumec. The section 1 is 6 m above datum line and section 2 is 3 m above datum. If pressure at section 1 is 29.43 N/cm^2, what is the pressure at section 2 ?

   (c) A rectangular channel carries water at the rate of 0.5 cumec when bed slope is 1 in 3000. Find the most economical dimension of the channel if C is 60.   **10**

   List any three dimensionless numbers. Also explain their significances for fluid flow problems.

   (d) Describe the working of reciprocating pump with a neat sketch.   **10**

   Draw a typical layout of hydroelectric power house and name the components.

SECTION – B

3. (a) Explain the terms infiltration and infiltration capacity. In a 10 Hr storm rainfall occurred over a catchment the rainfall depths are as given below :   **10**

Hours	1	2	3	4	5	6	7	8	9	10
Depth cm/hr	1.0	1.5	5.0	6.0	10.5	8.5	9.0	7.0	1.5	1.5

Surface runoff resulting from the storm is equivalent to 20 cm of depth over the catchment. Determine the average infiltration and average rate of infiltration.

10. (a) Give the advantages and disadvantages of 'Dead end,' and 'Grid-iron' layout of   **10**
distribution system.

Explain the necessity, location and working of non return value with neat sketch.

(b) (i) Calculate the velocity of flow and discharge flowing in a sewer of circular   **10**
section having diameter 1.0 m laid at a gradient of 1 in 500. Use Mannings
formula taking N = 0.012. Assume that sewer is running half full.

(ii) Determine the BOD reaction rate (K) and ultimate BOD (L) by, 'Least square
method,' from the given data :

Time 't' days	2	4	6	8	10
BOD y mg/lit	11	18	22	24	26

(c) Write short note on Anaerobic digestion process. Design an oxidation pond for   **10**
the following data :

(i) Location   = 24° Latitude

(ii) Elevation   = 900 m above MSL

(iii) Mean monthly temperature   = 30°C max and 10°C min

(iv) Population to be served   = 8000

(v) Sewage flow   = 160 lpcd

(vi) Desired treated effluent BOD_S = 30 mg/lit

(vii) Pond Removal Constant   = 0.1/d

(viii) Areal BOD loading at 24° latitude = 225 kg/ha/day

(d) Explain the different sources of air pollution and classify them. Explain the various   **10**
techniques of noise pollution control. Give the Ambient air quality standards.

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(b)   A 60 cm diameter well is being pumped at a rate of 1360 lit/min, measurements **10** in the nearby test well were made at the same time as follows.

At a distance of 6 m from the well being pumped, the drawdown was 6 m and at 15 m the drawdown was 1.5 m. The bottom of the well is 90 m below the ground water table. Find the coefficient of permeability. If all the observation points were on the Dupuit's curve what was the drawdown in the well during pumping. What is the specific capacity of the well ?

(c)   What are the different ways by which a concrete gravity dam may fail, and how **10** will you ensure its safety against each type of failure.

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

4.   (a)   What is evaporation ? What factors control the process of evaporation ? Explain **10** with sketch the method of measurement of evaporation with ISI standard pan.

(b)   Find the ordinates of a storm hydrograph resulting from a 3 hour storm with **10** rainfall of 2.0, 6.75 and 3.75 cm during subsequent 3 hour intervals. The ordinates of unit hydrograph are as given below :

Hours	3	6	9	12	15	18
U H ordinates (cumecs)	0	110	365	500	390	310

Hours	21	24	3	6	9	12
U H ordinates (cumecs)	250	235	175	130	95	65

Hours	15	18	21	24
U H ordinates (cumecs)	40	22	10	0

Assume an initial loss of 5 mm, infiltration index of 2.5 mm/hour and baseflow of 10 cumecs.

(c) Explain the importance of rivers and necessity of controlling them. Explain high water training, low water training and mean water training.   **10**

(d) What are the advantages of tile drains ? What are the different methods of aligning tile drains.   **10**

SECTION – C

5. (a) Explain the various factors controlling the alignment of roads. Give the details of the drawings to be prepared in a highway project.   **10**

(b) A National Highway passing through rolling terrain in heavy rainfall area has a horizontal curve of radius 500 m. Design the length of transition curve. Assume Design speed = 80 Kmph., pavement width = 7.0 m, rate of change of centrifugal acceleration 0.52 and allowable rate of introduction of superelevation 1 in 150. Pavement to be rotated about inner edge. Two lanes pavement and wheel base 6.0 m.   **10**

(c) What is a traffic rotary ? Explain with a sketch. What are its advantages and limitations with reference to traffic conditions in India ?   **10**

(d) Enlist the various plants and equipments used in the construction of cement concrete road. Enumerate the steps in the construction of cement concrete pavement.   **10**

6. (a) Explain the various factors on which the stopping sight distance depends. Explain total reaction time and the PIEV theory.   **10**

(b) Explain the various factors that influence night visibility on roads. What are the various factors to be considered in the design of road lighting.   **10**

(c) Discuss the IRC recommendations for the CBR method of design of pavements. The CBR value of a subgrade soil is 8 percent, calculate the total thickness of pavement using design formula developed by US corps of Engineers. Assume 3175 kg wheel load and tyre pressure 5 kg/cm^2.   **10**

(d) Explain various types of failures in rigid pavements, what are its causes ?   **10**

SECTION – D

7. (a) Enumerate the various loads and forces acting on bridge.   **10**

     Calculate the normal depth of scour in a river with alluvial bed when design discharge is 900 m^3/sec. The river bed consists of coarse sand with size of particle as 0.73 mm. Also, determine the maximum depth of scour when a bridge is to be constructed in a straight reach.

(b) What are the various erection methods for construction of superstructure of concrete and steel girder bridges ? Describe in brief the side slewing method.   **10**

(c) Explain how will you decide the size and shape of a tunnel.   **10**

(d) What are the various methods of tunnelling in hard strata ? Describe in brief the process of tunnelling by TBM (Tunnel Boring Machine).   **10**

P.T.O.

8. (a) Which factors will you consider for selection of a site for bridge construction ? **10**

   The river has a slope of 1 in 700. The hydraulic mean depth for the channel is 2.8 m and the Chezy's coefficient is 30. Width of stream at HFL is 300 m and linear waterway under the bridge is 270 m. Assuming coefficient of discharge through bridge as 0.7, calculate the afflux.

   (b) What are the various methods of strengthening the steel and concrete girder bridges ? Explain in brief any two methods, through main steps. **10**

   (c) Give the sequence of operations of tunnelling by conventional drill and blast method in hard strata. Describe in brief each step. **10**

   (d) Explain the necessity of ventilation during and after construction of tunnel. How is it achieved ? **10**

   What are the various methods of drainage during construction of tunnel ?

SECTION - E

9. (a) Compare surface water and ground water as a source of drinking water. **10**

   Draw a typical flow diagram of water treatment plant for a town having population 2 lakh with water supply rate of 200 lpcd, with 'river' as source of water, also comment on changes to be made in flow diagram if source becomes 'dam reservoir', instead of river.

   (b) (i) Compare slow sand filter with rapid sand filter with reference to : **10**
   - (1) Filtration rate
   - (2) Coagulation
   - (3) Efficiency
   - (4) Economy
   - (5) Loss of head
   - (6) Period of cleaning
   - (7) Method of cleaning
   - (8) Flexibility in operation

   (ii) Determine the size of flocculation tank, power requirement and area of blades of paddle for a flow 300000 litres/hour at 20°C.

   Given data t = 20 minutes, Ave. G value = 40/sec, paddle speed = 4.5 rpm Velocity ratio = 0.25.

   (c) Explain the term 'Activated sludge process'. Explain the modifications : **10**
   - (i) Topered aeration and
   - (ii) Extended aeration

   (d) Explain the various factors affecting composting process, and also discuss the mechanical compost plant used for municipal solid waste. **10**

P.T.O.