CIVIL ENGINEERING

Paper II

| Time Allowed : Three Hours | Maximum Marks : 200 |

INSTRUCTIONS

Candidates should attempt question nos. 1 and 5 which are compulsory, and any THREE of the remaining questions, selecting at least ONE question from each Section.

All questions carry equal marks.

The number of marks carried by each part/ subpart of a question is indicated against each.

Answers must be written in ENGLISH only.

If any data is considered insufficient, assume suitable value and indicate the same in your answer.

Unless otherwise indicated, symbols and notations have usual meanings.

Section 'A'

1. Answer any *four* parts of the following :

   (a) What are different types of lime ? Give their composition, source of manufacture, characteristic and use. 10

   (b) The following data refer to an exercise in trigonometrical levelling :

   Horizontal distance between P and $Q = 9290$ m

   Angle of elevation from P to $Q = 2°6'18''$

   Height of signal at $Q = 3\cdot96$ m

   Height of instrument at $P = 1\cdot25$ m

   Co-efficient of refraction $= 0\cdot07$

   $R \sin 1'' = 30\cdot88$ m, RL of $P = 396\cdot58$ m

   Find the RL of Q from these observations. 10

   (c) (i) A stretch on one of the National highways has 10 cm thick old cement concrete pavement in good condition. Due to recent increase in wheel load, a monolithic thickness of 20 cm is found to be necessary for strengthening. Find out the concrete overlay thickness necessary for unbonded condition. Use the following data :

   Co-efficient depending upon good condition $= 1$

   Co-efficients if poured directly on old pavement $= 1\cdot4,\ 1.4,$ and $\dfrac{1}{1\cdot4}$ 5

(ii) For a 12·8 m rail length of B.G. track, calculate the quantity of materials required per kilometre length of track. Assume sleeper density to be equal to $(n + u)$. Type of rail 90 R, i.e. wt = 44·7 kg/m, type of sleeper is wooden. 5

(d) (i) In a capacity study the following classified hourly lane volumes are observed in a traffic survey on a particular section of a city street under mixed traffic conditions. Using PCU equivalents as per Indian practice, convert these hourly volumes into passenger car units.

Motor cycles/Scooters	300
Auto-rickshaws	200
Passenger cars/Jeeps	150
Commercial trucks	50
Buses	50
Bicycles	100
Cycle-rickshaws	50
Hand carts	20
Horse carts	10
Truck-trailers	5

5

(ii) Write a note on highway financing in India. 5

(e) How do you define an activity and distinguish between a critical and non critical activity. Explain with example. 10

2. (a) Write about the requirements, purpose of constructing cavity walls. Give the general specifications of constructing these walls. 10

(b) Give the general description of the stabilised cement soil wall for building construction. What is the composition of soil, its characteristics, requirements of mixing water, cement, compaction, form work in constructing the walls ? 10

(c) Enumerate and describe the requirement of equipments for a high rise RCC building construction in a densely populated city. 10

(d) Write short notes on the following with examples :

(i) Crashing of an activity 5

(ii) The three phases of CPM 5

3. (a) In a triangle, station C was a church spire and hence could not be occupied. A satellite station S was selected 12 m from C and inside the triangle ABC. From S, angles $C\hat{S}A = 135°40'20''$ and $A\hat{S}B = 71°29'20''$ were measured and the lengths AC and BC were known to be approximately 2510 m and 1895 m respectively. Compute the angle $A\hat{C}B$. **10**

(b) A compound railway curve ABC is to have the radius of the arc AB 1200 m and that of BC 800 m. The intersection point V of the end straights is located and the deflection angle is observed to be $35°6'$. If the arc AB is to have a length of 400 m, calculate the tangent length VA and VC. **10**

(c) Write about steel and iron work in building construction with regard to material specifications, sections used, fabrication. finish and erection. **10**

(d) What are the different hauling equipments listing their salient features, application and limitations. **10**

4. (a) Determine the warping stresses at corner longitudinal and transverse edge region for a 20 cm thick rigid pavement with 15 m spacing transverse joints, lane width 3·6 m. The modulus of subgrade reaction (k) is 2·8 kg/cm³. Take the following values of various factors :

Thermal co-efficient of concrete 'e' =
$$8\times10^{-6} \text{ per °C.}$$

Modulus of elasticity of concrete =
$$2\cdot8\times10^5 \text{ kg/cm}^2.$$

Poisson's ratio, $\mu = 0\cdot15$.

Radius of contact area = 16 cm.

Bradbury's stress co-efficients for the given geometric condition of slab $c_x = 1\cdot03$, $c_y = 0\cdot35$.

10

(b) A train having 25 wagons weighing 20 tonnes each is to run at a speed of 60 kmph. The tractive effort of locomotive is 18 tonnes. The weight of the locomotive is 120 tonnes. Rolling resistance of locomotive and wagon are 3 kg/tonne and 2·5 kg/tonne respectively. Find out the steepest gradient of the track for these conditions.

10

(c) Determine the transition length based on permissible speed for a 3° curve with maximum permissible speed of 100 kmph on a B.G. railway track.

10

(d) (i) Give a brief account of typical mainte-
nance procedures of flexible and rigid
pavements.   5

(ii) Explain how dust nuisance is prevented
in earth roads and gravel roads.   5

Section 'B'

5. Answer any *four* parts of the following :

(a) Find the capacity of a reservoir from following
data :

Contour (in m)	200	202	204	206	208	210	212
Area (in sq. m)	2000	8000	16670	23030	30850	40350	55680

Use both, prismoidal and trapezoidal, formulae
and compare the results.   10

(b) Explain the following :

(i) Unit hydrograph and its application to
forming Flood hydrograph.   5

(ii) Function of a check-dam.   5

(c) Enumerate and discuss the common tests that should be conducted for the examination of water at laboratory attached to water treatment plant, also explain the significance of these tests.   10

(d) Discuss the variations in the sewage flow and their effects on the design of various components of a sewerage scheme.   10

(e) What is air pollution ? Discuss different primary and secondary pollutants with their effects in brief.   10

6. (a) Calculate balancing depth for a channel section having bed width = 14·00 m, side slopes = 1 : 1 in cutting and 2 : 1 in filling. The bank embankments are kept 3·5 m higher than berm level. Crest width of banks is kept 3·00 m.   10

(b) How is the capacity of a reservoir determined from mass inflow curve ? How is the safe yield from a given storage capacity determined ?   10

(c) (i) A weir is constructed across an alluvial river, with a horizontal floor of 70·0 m length and retains 5·0 m of water under full pond condition. If the downstream sleet pile is driven to a depth of 8·0 m below average bed level, calculate the exit gradient.   5

(ii) Explain following, in brief, giving two points each : 5

    1. Borrow pits

    2. Spoil banks

    3. Ridge canal

    4. Inundation canal

(d) (i) What controls do you suggest to prevent contamination of ground water in coastal areas ? Give at least four points to control the same. 5

(ii) An artisian tube-well of 20·0 cm diameter draws water from a 30·0 m thick aquifer. Its permeability is 26·0 m/day. Find the yield under a drawdown of 5·0 m at the well face. Assume radius of influence = 245·0 m. 5

7. (a) (i) What are the requirements of a good intake structure ?

(ii) Discuss various factors which govern the location of an intake. 5+5

(b) What is type I settling ? Derive an expression for type I settling. How analysis of type I settling is done ? 10

(c) (i) Discuss the use of tables and nomograms for hydraulic calculations for the design of sewers.

(ii) Determine the size of a circular sewer for a discharge of $1.5\ m^3/sec$. The sewer is running half-full. For $\dfrac{d}{D} = 0.5$, $\dfrac{q}{Q} = 0.5$. Assume $n = 0.014$ and $i = 1 : 10,000$.

4+6

(d) Discuss the working of a skimming tank with the help of a neat sketch. How are disposal of skimmings done ?

10

8. (a) (i) A saddle siphon has following data :

Full reservoir level = 435·0 m.

Level of centre of siphon outlet = 430·0 m.

Width = 4·2 m, height = 2·2 m.

Determine number of siphon units required to pass the flood safely. Siphon discharges freely into the air. Assume coefficient $c = 0.66$.

5

(ii) Describe the types of joints provided in gravity dam.

5

(b) (i) A 5·0 m wide rectangular channel carries water to a depth of 1·2 m. Channel width is reduced to 2·5 m with a hump of 0·35 m at the bottom to facilitate measurement of discharge. Calculate the discharge if surface of water in contracted section drops by 0·15 m. Assume no losses. 5

(ii) What are advantages and disadvantages of canal lining ? Mention·five points of each. 5

(c) Discuss the physical and chemical composition of Municipal solid wastes. Also give their typical values for Indian conditions. 10

(d) Discuss the need of Environmental Impact Assessment. Also discuss the Environmental Impact of thermal power plants. 10

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