

CIVIL ENGINEERING

Paper II

(CONVENTIONAL)

Time allowed : Three Hours

Maximum Marks : 200

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions :

There are EIGHT questions in all, out of which FIVE are to be attempted.

Questions no. 1 and 5 are compulsory. Out of the remaining SIX questions, THREE are to be attempted selecting at least ONE question from each of the two Sections A and B.

Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Answer Book must be clearly struck off.

All questions carry equal marks. The number of marks carried by a question / part is indicated against it.

Answers must be written in ENGLISH only.

Unless otherwise mentioned, symbols and notations have their usual standard meanings.

Assume suitable data, if necessary and indicate the same clearly.

Next sketches may be drawn, wherever required.

SECTION A

- Q.1.** (a) What are the commonly used chemical admixtures in modern concrete construction ? Explain them briefly. 8
- (b) A two-lane State highway passing through a rolling terrain has a horizontal curve of radius equal to the ruling minimum radius. The ruling design speed is 80 kmph and length of wheel base of longest vehicle is 6.0 m. Design following geometric elements : 8
- (i) Ruling minimum radius
 - (ii) Superelevation
 - (iii) Extra widening
 - (iv) Length of transition curve
- (c) (i) The following Staff readings were taken successively with a dumpy level and was shifted after Third, Sixth and Eighth readings :
 2.228, 1.606, 0.988, 2.090, 2.864, 1.262, 0.602, 1.982, 1.044, 2.684 meters.
 Enter above readings in a level book (Tabular form) and calculate the R.L. of each point by rise and fall method. The first reading was taken on a B.M. of 432.384 m. 4

- (ii) The following bearings were observed with a prismatic compass. Calculate interior angles of a closed traverse.

4

<u>Line</u>	<u>Fore Bearing</u>
AB	60° 30'
BC	122° 00'
CD	46° 00'
DE	205° 30'
EA	300° 00'

- (d) State the importance of bonding in brick-work. Point out the differences in English bond, Single flemish bond and Double flemish bond. Illustrate your answer with suitable sketches. 8
- (e) (i) What are the different types of Levelling Staff? State the merits and demerits of each. 4
- (ii) Describe with the help of sketches the characteristics of contours. 4
- Q.2.** (a) (i) What are the objects of providing plastering and pointing to the exposed surface? With neat sketches describe the various types of pointing. 5
- (ii) What are the common causes of leakage and dampness in flat roofs and what precautions would you take in new buildings to avoid possibility of leakage? 5
- (b) Under what circumstances, is cement concrete flooring recommended? What treatment would you suggest if the cement concrete flooring is to be provided in the following situations : 5
- (i) Basement of a building to be situated in a water-logged ground
- (ii) Children ward of a modern hospital
- (iii) Bathrooms. 5
- (c) Explain the following : 5
- (i) Jack arch floor
- (ii) Double flagstone floor
- (d) (i) With the help of illustrations, explain how a traverse is balanced. 5
- (ii) What is error of closure? How is it balanced graphically? 5
- (e) List the various Earth-Work equipment. Explain their salient features, draw neat sketches of these equipment and also mention their limitations. 10
- Q.3.** (a) Explain Sight distance and factors causing restrictions to sight distance. Explain the significance of stopping, intermediate and overtaking sight distances. 10
- (b) Draw a sketch of flexible pavement cross-section showing the structural component parts. Enumerate functions and importance of each component of the pavement. 10
- (c) Two triangulation stations A and B are 60 km apart and have elevations 240 m and 340 m respectively. Find the minimum height of signal required at B so that the line of sight may not pass nearer the ground than 3.0 m. The intervening ground may be assumed to have a uniform elevation of 220 m. 10
- (d) (i) Define Water Cement Ratio and indicate its effect on strength of concrete. 5
- (ii) What are the important properties and uses of timber? How is the seasoning and prevention of timber done? 5

- Q.4.**
- (a) (i) Discuss with sketches the various methods of orienting the Plane Table. 5
 - (ii) What are the different sources of error in Plane Tabling ? How are they eliminated ? 5
 - (b) What are the functions of Railway Sleepers ? What are the materials used for Railway Sleepers ? Draw and explain sketches of a Steel Sleeper, Cast Iron Sleeper and Concrete Sleeper. 10
 - (c) The radius of a horizontal circular curve is 100 m. The design speed is 60 kmph and the design coefficient of lateral friction is 0.15. 10
 - (i) Calculate the superelevation required if full lateral friction is assumed to develop.
 - (ii) Calculate the coefficient of friction needed if no superelevation is provided.
 - (iii) Calculate the equilibrium superelevation if the pressure on inner and outer wheels should be equal.
 - (d) (i) Explain the various elements of Engineering Economics. 5
 - (ii) Differentiate between CPM (Critical Path Method) and PERT. 5

SECTION B

- Q.5.** (a) (i) A storm with 15 cm precipitation produced a direct runoff of 8.7 cm. The time distribution of the storm is as follows :
- | | | | | | | | | |
|--|-----|------|------|------|------|------|------|------|
| Time from start (hrs.) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Incremental Rainfall in each hour (cm) | 0.6 | 1.35 | 2.25 | 3.45 | 2.70 | 2.40 | 1.50 | 0.75 |
- Determine the Average Infiltration Index for the Basin. 4
- (ii) Find the time required to cover an area of Border strip of 0.15 hect, when a water source is discharging at a rate of 0.035 cumec for irrigating Rabi crops. Average depth of flow is expected to be 8.0 cm. Average infiltration rate of the soil may be taken as 6 cm/hr. 4
- (b) (i) An Artesian tubewell has a diameter of 20 cm. The thickness of aquifer is 30 m and its permeability is 36 m/day. What will be its yield under a drawdown of 4 m at the well face ? Use radius of influence as recommended by Sichardt. 4
- (ii) Following is the set of observed data for successive 15 min periods of 105 min storm in a catchment :
- | | | | | | | | |
|------------------|-----|-----|-----|-----|------|------|-----|
| Duration (min) | 15 | 30 | 45 | 60 | 75 | 90 | 105 |
| Rainfall (cm/hr) | 2.0 | 2.0 | 8.0 | 7.0 | 1.25 | 1.25 | 4.5 |
- If the value of ϕ -index is 3 cm/hr, estimate the net runoff, the total rainfall and W-index. 4
- (c) (i) Draw the schematic layout of a diversion headwork. State the function of Scouring Sluices. Divide wall and guide banks. 4
- (ii) What is peak hour demand and how does it affect the design of Water Supply Systems ? Sketch the fluctuation in water demand for Indian conditions. 4
- (d) The population of a small town for 5 decades from 1970 to 2010 is given below. Find out the population in the year 2020, 2030 and 2040 by using Arithmetic increase method, Geometric increase method and Incremental increase method. 8
- | | | | | | |
|------------|--------|--------|--------|--------|--------|
| Year | 1970 | 1980 | 1990 | 2000 | 2010 |
| Population | 25,000 | 28,000 | 34,000 | 42,000 | 47,000 |
- (e) Explain the significance of the following parameters from the point of view of water quality : 4
- (i) Nitrogen content
- (ii) B.O.D.
- (iii) Dissolved oxygen
- (iv) Chlorides
- (f) Design a septic tank for 100 users. Water allowance is 120 litres per head per day. Detention period may be taken as 8 hours. Draw a neat sketch of the septic tank, so designed. 4
- Q.6.** (a) For a river, the estimated flood peaks for two return periods at a site using Gumbel's Method are as follows :

Return period (years)	Peak flood (m ³ /sec)
100	435
50	395

What flood discharge in this river will have a return period of 1000 years ?

10

- (b) (i) Discuss various I.S. Load combinations to be considered for design of gravity dams. Suggest typical combinations. 5
- (ii) Determine the end point co-ordinates for the downstream profile of an Ogee spillway if the design head is 17 m and the slope of downstream face of the dam is 0.8 H to 1.0 V. 5
- (c) (i) Enumerate the chemicals which are used for coagulation. Discuss their comparative merits and demerits. 5
- (ii) Show that the settling velocity of a spherical particle in a liquid under condition when the Reynolds Number is less than 0.5 may be given by the expression $V_s = \frac{g}{18} (S_s - 1) \frac{d^2}{\nu}$. 5
- (d) Design suitable dimensions of a circular trickling filter unit for treating 10 million litres of sewage per day. The B.O.D. of sewage is 200 mg/litre. Also design suitable dimension for its rotary distribution system as well as under drainage system. 10
- Q.7.** (a) Design an irrigation channel based on Kennedy's theory required to carry a discharge of 45 cumecs. The value of Manning's Roughness Coefficient 'N' is 0.0225 and Critical Velocity Ratio 'm' is 1.05. The channel has a bed slope of 1 in 5000. Take the initial value of depth as 2.2 m. 10
- (b) (i) Give the classification of Energy Dissipators. State the situations in which Hydraulic Jump type stilling basins are recommended. 5
- (ii) Discuss various hydraulic failures in an Earth Dam. Suggest the suitable remedial measures for each of them. 5
- (c) With the help of neat sketches, explain the general methods of distribution of water employed in Municipal Water Supply Schemes. 10
- (d) What do you mean by Activated Sludge ? Describe with sketches the treatment of sewage by Activated Sludge process. Mention the advantages and disadvantages of this system. 10
- Q.8.** (a) Discuss the process of plotting pre jump and post jump profiles for a hydraulic structure to be designed on pervious formation. Explain the significance of these profiles. 10
- (b) (i) How is 'Basic Reservoir Data' developed from Engineering Surveys during 'Investigations for Reservoir Planning' ? Explain the significance of the data. 5
- (ii) Explain the necessity of Canal Lining. 5
- (c) (i) Enumerate the various methods, which can be used for disposal of municipal solid waste. Explain the methods with the help of neat sketches. 6
- (ii) What do you understand by the term 'Leachate' ? What problems are caused by Leachates and how are they overcome ? 4
- (d) (i) Enumerate the different major air pollutants, their characteristics, sources and health effects on human beings. 8
- (ii) What is photochemical smog and how is it formed ? 2