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CIVIL ENGINEERING

Paper II

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.

Question Nos. **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 sequential 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 Question-cum-Answer Booklet 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.

Neat sketches may be drawn, wherever required.

SECTION 'A'

- 1.(a) What is workability of concrete? 2
What is the effect of the following on the workability of fresh concrete?
(i) Size of aggregate
(ii) Cement content
(iii) Water to cement ratio
(iv) Entrained air 2×4=8
- 1.(b) In the context of functional planning of buildings, explain
(i) Aspect
(ii) Privacy
(iii) Circulation
(iv) Prospect
(v) Roominess 2×5=10
- 1.(c) (i) Differentiate between 'Reciprocal levelling' and 'Profile levelling'. 5
(ii) Differentiate between 'outer signal' and 'home signal'. 5
- 1.(d) (i) What are the purposes of evaluation of pavements? 5
(ii) What are the objectives of economic evaluation of highway projects? 5
- 2.(a) A construction project consists of 8 major activities. Their interdependency is given below. Draw the network and determine the time for completion of the project. Also mention duration for each path.
(i) Activities *A*, *B* and *E* can start concurrently. (Starting of the project)
(ii) Activities *C* and *D* are concurrent and depend on the completion of *A* and *B*.
(iii) Activities *F* and *G* are concurrent and can start after completion of *C*.
(iv) Activity *H* depends on the completion of *C*, *E* and *F*.
(v) Project ends with the completion of *G* and *H*.
Time needed for each activity is
A – 4 weeks
B – 3 weeks
C – 5 weeks
D – 2 weeks
E – 4 weeks
F – 3 weeks
G – 4 weeks
H – 2 weeks 10

2.(b) What is a Composite Masonry ? List out various types of composite masonry and state their application. 10

2.(c) Compute the correct interior angles of a closed compass traverse $PQRSTP$ using the following data :

<i>Line</i>	<i>F.B.</i>	<i>B.B.</i>
PQ	$65^{\circ}45'$	$245^{\circ}00'$
QR	$105^{\circ}15'$	$285^{\circ}45'$
RS	$155^{\circ}45'$	$335^{\circ}45'$
ST	$215^{\circ}30'$	$36^{\circ}15'$
TP	$295^{\circ}00'$	$115^{\circ}45'$

Assume that the observed bearing of line RS to be correct, determine the correct bearing of all other lines. Also correct the interior angles for observational errors. 10

2.(d) (i) Briefly explain how contour maps can be used to determine reservoir capacity. 5

(ii) What are the important points to be considered in the design of marshalling yard ? 5

3.(a) What is a Dragline ? Give a typical sketch of it. Mention the factors that influence output of the Dragline. 10

3.(b) The details of two schemes related to cost and benefit is presented. Taking rate of interest as 10% suggest the most economical proposal.

<i>Scheme</i>	<i>Initial cost (Rs.)</i>	<i>Running cost per year (Rs.)</i>	<i>Annual benefit (Rs.)</i>	<i>Life in years</i>
A	10 lacs	1.0 lac	2 lac after 2 years	10
B	14 lacs	1.2 lac	2.4 lac after 3 years	15

3.(c) A new B.G. Railway track is to be constructed as per the following details :

Degree of curve = 5°

Ruling gradient at curve section = 1 in 180

Average speed of train at curve section = 50 kmph

Determine (i) actual ruling gradient for the section 5

(ii) equilibrium cant 5

Assume data suitably, if found missing.

- 3.(d) (i) Determine the radius of relative stiffness of a rigid concrete pavement using the following data :
- (i) Modulus of elasticity of concrete = 3.0×10^5 kg/cm²
 - (ii) Thickness of pavement slab = 20 cm
 - (iii) Poisson's ratio = 0.15
 - (iv) Wheel load = 4100 kg
 - (v) Pressure applied to the plate load test at 1.25 mm displacement = 0.375 kg/cm² 5
- (ii) What are the requirements for good drainage while designing and constructing the roads ? 5

4.(a) For a major construction 1.50 million tons of stone aggregate is required. The temporary road costs Rs. 60 lacs. Hauling charge of stone is Rs. 10 per tonne of truck. Cost of belt conveyor is Rs. 70 lacs. Its salvage value is 20% of the original cost of belt conveyor. Maintenance cost is 30% depreciated value and electric power cost is 60% original cost. Suggest the best alternative for trucks or belt conveyor. 10

- 4.(b) List out different quality tests to be done for
- (i) Cement
 - (ii) Fine aggregate
 - (iii) Coarse aggregate
 - (iv) Fresh concrete
 - (v) Hardened concrete 2×5=10

- 4.(c) (i) What are the obligatory points to be considered for selecting the road alignments ? 5
- (ii) Briefly explain the functions of base course and surface course in flexible pavements. 5

4.(d) The following data is provided for a 2-phase traffic signal to be installed at a right angled intersection of two roads PQ and RS. The turning traffic is not substantial at the intersection.

Parameter	Road approach P	Road approach Q	Road approach R	Road approach S
Width of road	3.50 m	3.50 m	7.0 m	7.0 m
Saturation flow (PCU/hr)	1875	1875	3675	3675
Traffic volume (PCU/hr)	550	450	1150	1450

Determine (i) optimum cycle length (ii) distribute green time on two roads *PQ* and *RS*. Assume total time lost during total cycle as 12 seconds. Assume any other data suitably, if found missing. 10

SECTION 'B'

5.(a) Three wells *A*, *B* and *C*, tap the same horizontal aquifer. The distances $AB = 1200$ m and $BC = 1000$ m. The Well *B* is exactly south of Well *A* and Well *C* lies to the west of Well *B*. Following are the ground surface elevation and depth of water below the ground surface in the three wells :

<i>Well</i>	<i>Surface Elevation</i> (metres above datum)	<i>Depth of water table</i> (m)
<i>A</i>	200.00	11.00
<i>B</i>	197.00	7.00
<i>C</i>	202.00	14.00

Determine the direction of ground water flow in the aquifer in the area *ABC* of the wells. 10

5.(b) Describe the basic types of dams, on the basis of the type and materials of construction and principle of function. 10

5.(c) (i) Describe any three methods of estimating the future population of a town with their relative advantages and disadvantages. 5

(ii) Discuss variation in water demand and their effects on the design of various components of water supply schemes. 5

5.(d) What is hardness of water? How it is measured in the laboratory? Discuss Lime-soda process for removing hardness. 10

6.(a) Discuss the principle of recuperation test of an open-well and derive equation for the specific capacity K_s per unit Well area.

Design the bottom diameter of a dug Well in fine sand region, to obtain 10 litres/second of yield, under depression head of 2.5 m. The value of K_s = specific capacity per unit area may be taken as 0.6/hour. 10

6.(b) Compute the average discharge requirement and peak demand for the following :

<i>Crop</i>	<i>Area</i> (hectare)	<i>Total</i> <i>depth</i> (cm)	<i>Base</i> <i>period</i> (days)	<i>Average</i> <i>duty</i> (ha/cumec)	<i>Kor</i> <i>period</i> (weeks)	<i>Kor</i> <i>depth</i> (cm)
Wheat	4000	37.5	140	3200	4	13.5
Rice	2000	120.0	120	864	2.5	19.0

10

- 6.(c) Explain the importance of BOD test in waste water treatment. Differentiate BOD and COD. Also explain the use of population equivalent in municipal sewage treatment. 10
- 6.(d) (i) Explain self cleansing velocity and non-scouring velocity and their importance in the design of sewers. 5
- (ii) Define and explain hydraulically equivalent section connected to sewer designs. 5
- 7.(a) Explain briefly the tracer method of flow measurement. A 25 g/litre of a fluorescent tracer, was discharged into a stream at a constant rate of 10 cm³/second. The background concentration of the dye in the stream water was found to be zero. At a downstream section sufficiently far away, the dye was found to reach an equilibrium concentration of 5 parts per Billion. Estimate the stream discharge. 10
- 7.(b) What is meant by 'water logging'? What are the principal causes and effects of water logging in a canal irrigated farm? 10
- 7.(c) What is activated sludge? Explain the working of the activated sludge plant. Discuss its advantages and disadvantages. 10
- 7.(d) What are various methods used for disposal of municipal solid wastes? Explain any two widely adopted methods for municipal solid waste disposal in India. 10
- 8.(a) Describe 'furrow irrigation' and 'sprinkler irrigation'. Which one is preferred in India and why? 10
- 8.(b) What are the 'canal falls'? Where are they located? List different types of falls. 10
- 8.(c) Differentiate between the primary and secondary air pollutants. Describe the harmful effects of important air pollutants on materials as well as on aquatic life. 10
- 8.(d) Explain the various sources of radioactivity in the environment. How are radioactive wastes generated in the production of nuclear power? How are these wastes disposed off? 10
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