

CIVIL ENGINEERING (Paper II)

Time Allowed : Three Hours

Maximum Marks : 250

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.

Candidate has to attempt FIVE questions in all.

Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.

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

Wherever any assumptions are made for answering a question, they must be clearly indicated.

Word limit in questions, wherever specified, should be adhered to.

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.

SECTION 'A'

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|----|----------|--|----|
| 1. | (a) | What are the constituents of a good brick earth? Discuss the properties of a first class brick. Describe the tests to be performed to check the quality of bricks. | 10 |
| | (b) | A national highway with dual 2-lane carriageway is to be constructed in the year 2017 for a design life of 25 years. However, traffic count reveals that only 2000 commercial vehicles (summation of both directions) are plying per day in the year 2015 and annual rate of increase in commercial vehicles is 5%. Hence, from economical reasons, it was decided to construct new flexible pavement for this national highway in stages initially for a period of 15 years. Determine the traffic for which this new flexible pavement is to be designed assuming vehicle damage factor as 4.8. Assume any other data suitably, if required. | 10 |
| | (c)(i) | Explain various uses of a contour map in Civil Engineering projects. | 5 |
| | (c)(ii) | An aerial photograph was taken from a flying height of 15 km above m.s.l. A straight portion of a canal measures 20 cm on this photograph, whereas it is 10 km on the ground. If the height of the terrain is 5000 m above m.s.l., compute the focal length of camera lens used for taking the photograph. | 5 |
| | (d) | What are the basic requirements to be considered for construction of a railway track to achieve higher speeds and better riding quality? Sketch a typical cross-section of a BG railway track for double line on curve in cutting section. | 10 |
| | (e) | Define PERT and discuss its significance. Explain different time estimates used in PERT. | 10 |
| 2. | (a) | What is meant by proportioning of concrete? Discuss its properties. Describe different methods of proportioning concrete. | 15 |
| | (b) | Answer the following: | |
| | (b)(i) | Differentiate between open-graded and dense-graded bituminous construction. | 5 |
| | (b)(ii) | What are the general requirements of a bituminous mix? | 5 |
| | (b)(iii) | Write the purpose of tie bars and dowel bars in joints of cement concrete pavement. | 5 |
| | (c) | What are the different types of machinery required at civil construction project? Discuss the factors which influence the performance of an earth-moving machinery. | 20 |
| 3. | (a) | Enumerate the tests to which a stone should be subjected for making it fit for building construction purposes. What is meant by dressing of stone? What are the advantages of | 15 |

quarry dressing?

- (b) From the following data of a traverse, compute the length CD, if traverse stations A, D and E are in a straight line:

Line	Length (in m)	Bearing
AB	110	83° 12'
BC	165	30° 41'
CD	—	346° 06'
DE	212	16° 18'

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- (c) Answer the following:

- (c)(i) Briefly explain the weaving angle and weaving length with reference to traffic rotary. 10

- (c)(ii) What are the various factors to be considered in the design of traffic islands for channelized intersections? Briefly explain, with the help of sketch, how speed of vehicles can be controlled by using traffic islands at intersections. 10

4. (a) What do you mean by scheduling of a Civil Engineering project? What are the advantages of scheduling? Discuss the classification of scheduling. 15

- (b) Using the following details of trains running on a 3° main BG curve track, determine (i) equilibrium cant for equilibrium speed and (ii) length of transition curve to be adopted:

Speed (in km/hr)	No. of trains	Speed (in km/hr)	No. of trains
75	3	55	12
65	6	45	18

Assume— (1) maximum permissible speed on the curve as 80 km/hr; (2) allowable cant deficiency as 7.5 cm; (3) weighted average may be used as the equilibrium speed of trains.

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- (c) The following data were entered in a level book, where some entries were omitted (marked with ×). Find out the missing data and apply checks:

Station	BS (in m)	IS (in m)	FS (in m)	Rise (in m)	Fall (in m)	RL (in m)	Remarks
1	2.285					232.460	BM 1
2	1.650		×	0.020			
3		2.105			×		
4	×		1.960	×			
5	2.050		1.925		0.300		
6		×		×		232.255	BM 2
7	1.690		×	0.340			
8	2.865		2.100		×		
9			×	×		233.425	BM 3

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SECTION 'B'

5. (a) List the methods available for estimation of runoff in catchments. In detail, explain the rational method used for estimation of runoff in urban catchments. 10

- (b) Define duty and delta. Derive a relationship between duty and delta. Using this relation, find delta for a crop with base period of 100 days. The duty of the crop is 432 ha/cumec. 10

- (c) Explaining the objectives of river training, discuss the methods used for river training. 10

- (d) A town with population of 1 lakh is supplied with 150 lpcd of water. The chlorine required for disinfection was found to be 0.28 mg/l and residual chlorine required was 0.2 mg/l. Estimate the chlorine dose and quantity of bleaching powder required per year (in kg/year), if available chlorine in bleaching powder is 30%. 10

- (e) Explain the importance of COD/BOD ratio while designing the treatment options for COD/BOD ratio of 1, 3 and 6, and justify the selection of treatment units. 10

6. (a) A 20 cm well penetrates 30 m below the static water level. Water is pumped at the rate of 1800 lpm, and the drawdown in the wells is observed as 1.2 m and 0.6 m. The observation wells are 12 m and 36 m from the well. Determine— (i) the transmissibility of the aquifer; (ii) the drawdown in the pumped well taking R as 300 m; (iii) the specific capacity of the well. 15
- (b) Describe the methods used for determining mean depth of precipitation in catchments when point rainfall data are available. 15
- (c) The following data are collected to determine irrigation requirement. The water application efficiency is 65% and consumptive use coefficient in the growing season is 0.8. Find evapotranspiration and irrigation requirement: 20
- | Month | Mean monthly temp. (in °C) | Monthly % sunshine (in hr) | Effective rainfall (in cm) |
|----------|----------------------------|----------------------------|----------------------------|
| November | 18 | 7.20 | 2.6 |
| December | 15 | 7.15 | 2.8 |
| January | 13.5 | 7.30 | 3.5 |
| February | 14.5 | 7.10 | 2.0 |
7. (a) Design and sketch the shape of an ogee spillway using the data given below: Upstream head of water, $H = 20$ m; Shape of upstream face = 1 : 1.5 (H : V); $k = 1.939$, $n = 1.81$ 15
- (b) Design the water main to supply water from reservoir to a city with a population of 5 lakhs. Assume per capita demand as 270 lpd and peak factor as 1.8. Also, find the hydraulic gradient at which the main is to be laid. Take, velocity of flow as 1.2 m/s and $C_H = 110$. 15
- (c) Using the data pertaining to Activated Sludge Process (ASP) given below, determine— (i) efficiency; (ii) volume of aerator; (iii) hydraulic retention time (HRT); (iv) volumetric loading. Wastewater flow = 20 MLD; BOD in settled wastewater = 200 mg/l; Effluent BOD required = 15 mg/l; F/M ratio = 0.2; MLSS = 3000 mg/l 20
8. (a) 5% diluted wastewater was subjected to BOD test and the following observations are recorded: DO of water used for dilution = 3.6 mg/l; DO of wastewater sample = 0.8 mg/l; DO in sample after 5 days = 0.7 mg/l; $k_{20} = 0.12/\text{day}$. Determine— (i) BOD of wastewater; (ii) ultimate BOD. 15
- (b) Describing the major categories of pollutants generated by thermal power plants, discuss the environmental impacts of thermal power plants. 15
- (c) With the help of flow diagram, explain various elements involved in municipal solid waste management. 20