

CIVIL ENGINEERING (Paper II)

Time Allowed : Three Hours

Maximum Marks : 300

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.

SECTION 'A'

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|-----------|--|----|
| 1. (a)(i) | Which building block/s you will like to use for a sound and thermal proofing of a studio and why? | 3 |
| (a)(ii) | Natural/Mechanical/A.C. – Which circulation and cooling system is best suited for our country and why? | 3 |
| (a)(iii) | Which sampling procedure/principle you would recommend for quality control of R.C.C. work of a mass housing project and why? Serial/Grid/random? | 3 |
| (a)(iv) | Resource allocation and levelling will completely upset and change the optimum time schedule as obtained by crashing of network based on costs only. Comment. | 3 |
| (b)(i) | Which cement will you recommend for – mass concrete – low permeability concrete – high strength concrete? | 3 |
| (b)(ii) | Which type of cement concrete you will recommend for ‘blast resistance purpose’ and why? | 2 |
| (b)(iii) | Illustrate briefly one estimation method for one bedroom house. | 5 |
| (b)(iv) | Which compaction and consolidation equipment you recommend for quick construction of a high rise building and why? | 2 |
| (c)(i) | Briefly discuss factors contributing to the ownership cost of a heavy construction equipment. | 3 |
| (c)(ii) | Briefly elaborate the factors contributing to the rental value of a heavy construction equipment. | 3 |
| (c)(iii) | Explain the functions of ‘spurs’ in river regulation. Also state the parameters on which design of spur depends. | 6 |
| (d) | During a particular stage of growth of a crop, consumptive use of water is 3.2 mm/day. Determine the interval between irrigations and depth of water to be applied when the amount of water available in the soil is (i) 35% (ii) 75% and (iii) 0% of the maximum depth of available water in the root zone which is 100 mm. Assume irrigation efficiency to be 60%. | 12 |
| (e) | Explain the impact of flood wave on river water levels and flood travel time and explain the terms ‘prism storage’, ‘wedge storage’ and ‘Negative wedge storage’ with a suitable sketch. Also write an equation for flood routing where storage is expressed as a function of inflow and outflow in the river reach. | 12 |

2. (a) A small CPM network has the following data. Establish the optimum schedule for (i) minimum cost, and (ii) minimum duration if the indirect cost is ₹ 3000 per day and all normal total direct cost is ₹ 2,00,000 only.

Activity	Following	Preceding	Duration, days – Normal	Duration, days – Minimum	Time cost curve slope in ₹/day
A	D & E	–	8	6	2000
B	F	–	12	8	1500
C	–	–	20	19	2500
D	–	A	10	9	3000
E	F	A	5	3	1000
F	–	B & E	10	9	2200

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- (b)(i) A part of the network is drawn as follows: Tabulate the dependencies as shown. If actually Z depends on B & Y and R depends on Y & Q only is there any error? If yes name this error, and redraw the corrected network.

[Figure: Part of an arrow network in three horizontal chains of activities (duration written below each arrow): top chain A (10) → node → B (5) → node → C (6); middle chain X (4) → node → Y (10) → node → Z (5); bottom chain P (7) → node → Q (11) → node → R (12). Dummy D_1 (dashed, duration 0) runs from the node at the end of B (start of C) down to the node at the end of Y (start of Z); dummy D_2 (dashed, duration 0) runs from the node at the end of Y (start of Z) down to the node at the end of Q (start of R)]

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- (b)(ii) State and explain factors which influence the silting of reservoirs. How this affects the useful life of reservoir? Also explain the terms 'live storage', 'dead storage' and 'effective storage' in this context.

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- (c) Annual flood data of a river for 30 years yielded mean annual discharge of 30000 m³/s and a standard deviation of 15000 m³/sec. For a proposed bridge on this river, it is decided to have an acceptable risk of 10% and service life of 50 years. 1. Estimate the flood discharge for design of bridge. 2. If the actual flood value adopted in the design is 1,18,000 m³/sec, what is the safety margin for maximum flood discharge? (Given that Reduced mean and Standard deviation for Gumbel distribution for 30 years are 0.5380 and 1.119 respectively.)

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3. (a)(i) Compare and contrast the – self compacting concrete and – harsh concrete. Where each is used? Comment on the workability.

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- (a)(ii) List different type of stone masonry. Explain the purpose of through stones in random rubble masonry. What is the stitching of distressed big stone blocks? Discuss.

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- (b)(i) The following data is given for two power shovels. Identify the proper choice. Interest rate 10%.

	A (₹ lacs)	B (₹ lacs)
Initial cost	2.5	3.0
Annual costs	0.5	0.3
Salvage	.25	.5
Useful life	5 years	5 years
Annual quality gain	Nil	.2

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- (b)(ii) Explain and differentiate between unit hydrograph (UH) and Instantaneous unit hydrograph. Also explain the computational steps for deriving 2h UH from a 6h UH.

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- (c) What are the conditions based on which the effective length of the spillway is decided? What are the various methods adopted in energy dissipation below a spillway? Explain the most suitable energy dissipation arrangements that you would recommend for each of the following conditions. (i) When Jump Height Curve (JHC) is always above Tail Water Curve (TWC). (ii) When JHC and TWC nearly coincide, and (iii) When JHC is always below TWC.

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4. (a)(i) Sketch a drag line and explain function of each part.

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- (a)(ii) List the different ingredients of a brick making clay and function of each part.

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- (b)(i) Which tests on timber are carried out, both along the grains and across the grains. List the normal defects in timber with sketches. **10**
- (b)(ii) Explain briefly the functions, location (with/without sketch) and design considerations of the following: (i) Undersluices (ii) Fall **10**
- (c)(i) What are the various causes of seepage and percolation losses from a canal? **5**
- (c)(ii) Explain the term “Hydraulically Efficient Channel Section”. Prove that the most efficient trapezoidal section is one half of a regular Hexagon. **15**

SECTION 'B'

5. (a) Describe the Boussinesq approach of stress distribution for one layer theory and Burmister approach of stress distribution for two layer theory in a flexible pavement. **12**
- (b) List human factors governing road user behaviour. Discuss briefly. **12**
- (c) A fixed time 2-phase signal is to be provided at an intersection having a North-South and an East-West road where only straight ahead traffic is permitted. The design hour flows from various arms and the saturation flows for these arms are given in the following Table:

	North	South	East	West
Design hour flow (q) in PCU's/hour	800	400	750	1000
Saturation flow (s) in PCU's/hour	2400	2000	3000	3000

Calculate the optimum cycle time and green times for the minimum overall delay. The inter-green time should be minimum necessary for efficient operation. The time lost per phase due to starting delay can be assumed to be 2 seconds. The value of amber period is 2 seconds. Sketch the timing diagram for each phase. **12**

- (d)(i) Discuss any two methods for predicting population with their relative advantages and disadvantages. **6**
- (d)(ii) What are waterborne diseases? Also discuss their control measures. **6**
- (e)(i) Explain breakpoint chlorination and super chlorination. **2**
- (e)(ii) Determine amount of bleaching powder required annually in a water treatment plant treating 10 million litre per day of water if 0.2 ppm of chlorine dose is required. Available bleaching powder contains 30 per cent of available chlorine. **10**
6. (a)(i) Define probability density function (pdf) and cumulative density function (cdf). Draw pdf and cdf for a Normal Distribution. **10**
- (a)(ii) Define Running speed, Time Mean speed and Space Mean speed. Explain method of measuring spot speed using Enoscope. **10**
- (b)(i) Explain different types of road signs with examples and sketches. **12**
- (b)(ii) Explain sequential transportation planning process. **8**
- (c)(i) Design the spacing and size of the dowel bars at an expansion joint of concrete pavement of thickness 20 cm. Given the radius of relative stiffness of 90 cm, design wheel load 4000 kg, load capacity of dowel system is 40 per cent of design wheel load. Joint width is 3.0 cm and the permissible stress in shear, bending and the bearing stress in dowel bars are 1000, 1500 and 100 kg/cm² respectively. **10**
- (c)(ii) Design the length and spacing of tie bars given the pavement thickness is 20 cm and the width of the road is 7.0 m with one longitudinal joint. The unit weight of concrete is 2400 kg/m³, the coefficient of friction is 1.5, allowable working tensile stress in steel is 1750 kg/cm², and the bond stress of deformed bars is 24.6 kg/cm². **10**

7.	(a)(i)	Explain egg shaped sewer section with their relative advantages with circular section.	5
	(a)(ii)	Design a sewer for a newly developed town having population of 50,000. The sewer is to be designed for 3 times of dry weather flow when running full. Also find velocity of flow. Available slope for the sewer to be laid is 1 in 700. Assume Manning's coefficient $n=0.01$.	15
	(b)(i)	Explain significance of BOD/COD ratio. How it helps in deciding type of treatment to be given to waste water.	5
	(b)(ii)	A combined sewer system is serving 20,000 persons having BOD, 70 gm per capita and 50,000 litres industrial effluent per day having BOD 450 mg/l. If average standard BOD of domestic sewage is 0.08 kg/day/person, find the population equivalent of sewage.	15
	(c)(i)	Explain working of skimming tanks for removing oil and grease.	5
	(c)(ii)	What are stabilisation ponds? Design an oxidation pond for treating sewage from a town having population of 15,000. Sewage contribution per capita per day is 120 l and BODs 200 mg/l. The town is located in hot climate.	15
8.	(a)(i)	Write short notes on cant deficiency and negative superelevation in Railway track.	8
	(a)(ii)	The ruling gradient has been fixed as 1 in 250 on a section of a B.G. track. What should be compensated gradient when 500 m radius horizontal curve is also to be introduced on a ruling gradient?	8
	(a)(iii)	Explain road camber and its necessity. Which road surface would need sleeper cross slope – concrete or bituminous?	4
	(b)(i)	Explain the terms garbage and rubbish. How these are different than ashes?	5
	(b)(ii)	Discuss composting for disposal of solid wastes. Also explain methods adopted for composting in rural areas in India.	15
	(c)(i)	Discuss the status of monitoring and control of air pollution in India.	10
	(c)(ii)	What are the sources of particulate matter in the environment? Discuss the control of particulate matters in Industries.	10