

**R/J/E/C EXAM.
2021
CIVIL ENGINEERING**

300520

Time : 3 hours]

[Full Marks : 100

- Note** : (i) Attempt **all** the questions.
(ii) The figures in the right-hand margin indicate full marks for the questions.

1. Answer *any ten* questions :

2×10=20

- (a) The bearing of a survey line is S 40° E and the declination is 2° E. What will be the bearing of the same survey line if the declination becomes 3° W?
- (b) State the requirements of a good foundation.
- (c) What is meant by anchorage length?
- (d) State Bernoulli's theorem.
- (e) Write down the methods of distribution of water in water supply system.
- (f) How do you quantify storm water runoff?
- (g) What is the necessity of hairpin bends in hill roads? Specify any two of their geometric design standards.
- (h) What is the purpose of providing trap in sanitary plumbing?
- (i) Define workability. What are the factors that affect the workability of concrete?
- (j) Enumerate the purpose of estimation in projects.
- (k) Differentiate between the intensity and the magnitude of an earthquake.
- (l) How is flood frequency analysis useful in flood protection?



2. Answer any **six** questions :

5×6=30

- (a) A chain having length of 20 m and weight 9 N is used at site where the following characteristics are available :

Standard pull to be applied (P_0) = 80 N

Pull applied at the site (P) = 140 N

Temperature during standardization (T_0) = 20 °C

Mean temperature in the field during measurement (T) = 45 °C

Rise in the ground surface = 300 mm

Determine the combined correction due to errors.

- (b) Name the various methods for the determination of permeability in laboratory with the soil type in which they are best suited and explain any one of them in detail.

- (c) Discuss the different types of tubewells in detail.

- (d) Water flows over a rectangular notch weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right-angled notch weir. Assuming the coefficient of discharge for the rectangular and triangular notch as 0.62 and 0.59 respectively, find out the depth over the triangular notch weir.

- (e) List out any four key differences between rapid sand filter and slow sand filter.

Design a slow sand filter for a village population of 60000 people with the following data :

(i) Water supply rate = 160 litres/head/day

(ii) Filtration rate = 2.5 litres/minute/m²

(iii) L/B ratio = 2

(iv) Maximum demand = 1.8 times of average demand

Assume only **one unit of slow sand filter** is allowed for construction at site.

- (f) Reciprocal levelling was conducted across a wide river to determine the difference in level of two points A and B. Point A is situated on one bank of the river whereas point B is situated on the other side of the river. The following results were obtained on the staff held vertically at point A and point B from level stations 1 and 2 respectively. The level station 1 was near to point A and station 2 was near to point B.

Instrument at	Staff reading on (in m)	
	A	B
1	1.485	1.725
2	1.190	1.415

- (i) If the reduced level of point B is 55.18 m above the datum, what is the reduced level of point A?
- (ii) The distance between AB is 315 m. Assuming that the atmospheric conditions remain unchanged during the two sets of the observations, calculate the combined curvature, refraction correction and the collimation error.
- (g) The unit weight of a compacted soil in the field is 17.38 kN/m^3 . The void ratio and water content of the laboratory compacted soil is 60.7% and 10.2% respectively. Find the degree of compaction in field. Take specific gravity (G) = 2.7.

3. Answer any five questions :

10×5=50

- (a) A field test conducted on a sandy soil yields the following data :

Maximum void ratio	=	1.2
Minimum void ratio	=	0.45
Relative density	=	40%
Specific gravity (G)	=	2.67

Find the dry density of the soil. If 3 m thickness of this stratum is densified to a relative density of 62%, how much thickness of the stratum will be reduced?

- (b) An overhanging beam is shown in the figure below (Fig. 1). Draw shear force and bending moment diagram.

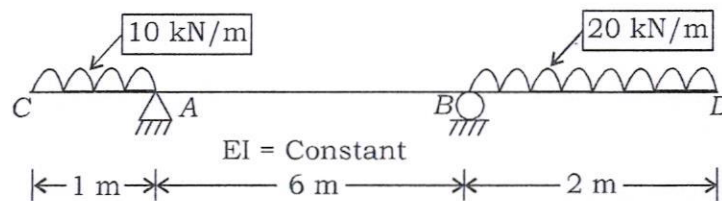


Fig. 1

- (c) An RCC beam having width 250 mm and effective depth 500 mm is reinforced with 4 bars of 16 mm diameter in tension zone. Determine the (i) depth of actual neutral axis, (ii) depth of critical neutral axis and (iii) ultimate moment of resistance. Use M20 grade of concrete and Fe415 grade of steel.
- (d) From a clear water reservoir, water is pumped to an elevated reservoir at a constant rate of 900000 liter/hr. The maximum water level at clear water reservoir and elevated reservoir will be +30.00 m and +75.00 m respectively. If the distance between source water reservoir and elevated reservoir is 1500 m, determine the diameter of the pipe by using Darcy-Weisbach formula as well as by using Hazen-Williams formula. Assume Darcy-Weisbach's friction factor as 0.04 and $C_H = 110$ in Hazen's formula.