

2021

CIVIL ENGINEERING

PAPER-II

Time Allowed — 3 Hours

Full Marks — 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be given either in **English** or in **Bengali** but all answer must be in one and the same language.

All notations / symbols have their usual meanings, unless otherwise specified.

**Group-A**

Answer any four questions.

1. (a) Define water requirement of crops. How it differs to irrigation water requirement?  
(b) With a neat sketch show the trapezoidal section of a canal and label it.  
(c) Discuss the canals classified based on the source of supply.  
(d) The following readings (in units) were taken in leveling operation from stations which were completed in three settings:  
First setting 4, 6  
Second setting 3, 5, 4  
Third setting 5, 7, 9, 6  
Calculate the reduced levels of all the stations by assuming the reduced level of the starting station as 100. 4+8+8+12=32
2. (a) What is chain surveying? When chain survey is preferred?  
(b) A and B are two points 100m apart on the near bank of a river which flows east and west. The bearings of the tree on the far bank as observed from A and B are N50°E and N40°W. Determine the width of the river.  
(c) What is the expected flow in rectangular lined channel of 2.5m wide and flowing 1.5m deep with bed slope 1 in 5000 calculated by using Manning's equation? What is the expected value of Chezy's C for this flow? Assume Manning's  $n = 0.01$ .  
(d) With the necessary sketch derive the expression for steady flow of a tubewell completely penetrated in confined aquifer. 4+8+8+12=32
3. (a) Define water well, specific yield & specific retention, transmissibility & aquitard.  
(b) A 300 mm × 300 mm reinforced concrete member has to support an axial compressive load of 350 kN. If the stress in concrete is not to exceed 5 N/mm<sup>2</sup>, calculate the area of steel required. Take  $m = 18$ .

Please Turn Over

(2)

ABC(O)-CE-II/20

- (c) Differentiate primary and secondary pollutants in air. What are the sources of air pollution? Discuss in short the human health effects of air pollution.
- (d) Discuss the considerations which should be complied in designing vertical curves in designing roadways.  $8+6+(4+4+4)+6=32$
4. (a) The following are the observed fore bearings of the lines: AB,  $88^{\circ}30'$ ; BC,  $142^{\circ}15'$ ; CD,  $209^{\circ}10'$ ; DE,  $324^{\circ}45'$ . Find their back bearings.
- (b) Discuss the isohyetal method of estimating mean precipitation over an area.
- (c) Define concrete and cement. Name the different type of tests conducted in the laboratory to determine the quality of cement.
- (d) What are the important surface characteristics of pavement and which influence these characteristics?  $12+8+(2+4)+6=32$
5. (a) Compare between the flexible and rigid pavement. What are the requirements of a pavement? What are typical layers of a flexible pavement?
- (b) Determine the discharge of a canal of bed width = 2.0 m, depth of water = 1.5 m, side slope = 1.5:1 and longitudinal slope = 1 in 1000. Assume Manning's  $n = 0.04$ .
- (c) What are the functions of traffic separators? What is cross slope or camber? What is the use of it?  $(4+4+4)+12+8=32$
6. Write short notes of the following:  $4 \times 8 = 32$
- (a) Quick setting cement
  - (b) Effluent and influent stream
  - (c) Profile surveying
  - (d) Workability of concrete
  - (e) Road margins
  - (f) Oxidation ponds
  - (g) Waste incineration
  - (h) Activated sludge

### Group-B

Answer any two questions.

7. (a) What is highway planning? Why are curves used in roadway horizontal and vertical alignment?
- (b) Distinguish between (i) level line and horizontal line (ii) datum and benchmark (iii) resection and intersection method as applied in plane table survey.
- (c) Discuss the biochemical oxygen demand (BOD).
- (d) What is superelevation in a road? Describe the design consideration of it.
- (e) A city wastewater treatment plant discharging at a rate of  $1.2 \text{ m}^3/\text{s}$  having BOD of  $55.0 \text{ mg/l}$  in to a stream which has a flow of  $8.50 \text{ m}^3/\text{s}$  and the BOD of its own equal to  $5.0 \text{ mg/l}$ . Estimate the BOD of the stream at 5.0 kilometer downstream. Assume the stream velocity as  $0.2 \text{ m/s}$  and the deoxygenation constant ( $k_d$ )  $0.20/\text{day}$ .  $6+(4 \times 3)+6+8+4=36$

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8. (a) Discuss the major pollutants that contaminate water.  
 (b) Describe the different type of sight distances in roadway.  
 (c) Calculate the amount of water flowing into a aquifer extending to a length of 20 kilometer for the following data:  
 Average permeability of the aquifer = 5 m/hour  
 Average thickness of the aquifer = 20 m  
 Piezometric gradient = 10 in 1500  
 (d) Find the true horizontal distance which when measured along a 1 in 25 rising slope was found to be 754 meters.  
 (e) The rainfall intensity for the period of time of concentration of a watershed is 25 mm/h. The area of the watershed is 2.5 square kilometer and the run-off coefficient is 0.3. What is the peak run-off rate?  
 (f) Derive the expression for equivalent concrete area.  
 (g) What is a contour line? Differentiate palatable and potable water.  $8+6+4+4+4+6+4=36$
9. (a) Discuss the rational formula for estimating peak run-off rate of a watershed. What are the disadvantages of it?  
 (b) What are aggregates and all-in-aggregates? Discuss the minimum void method of proportioning concrete mix.  
 (c) What are the factors a designer should consider to develop an effective and efficient geometry in road alignment?  
 (d) What are the elements of a horizontal curve?  
 (e) What are the reasons for widening of pavement on horizontal curves?  
 (f) Discuss coagulation, flocculation, sedimentation and filtration as the process of water treatment.  
 (g) Discuss well development.  $8+(2+4)+4+4+4+6+4=36$
10. (a) What is orientation of plane tabling? Discuss the methods of orientation.  
 (b) The distance along a sloping ground were measured with 30.0 m chain were 30.7, 25.2, 17.3 and 36.8 m respectively and the corresponding slope angles were found to be  $2^\circ$ ,  $4.5^\circ$ ,  $6^\circ$ ,  $9^\circ$  respectively. It was noted afterwards that the chain was 0.02 m too short. Find the true horizontal distance.  
 (c) Define duty of water, consumptive use of crop, irrigation efficiency and wilting point.  
 (d) A canal has a bed width of 4.0 m and side slope of 2:1. What is the economic cross section of it?  
 (e) What are the advantages and the disadvantages of lined channels?  $12+8+4+6+6=36$

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