05/AAS/E-2022-6

Serial No. 614188

Candidate's Roll Number

Question Booklet Series

Question Booklet

D

Paper—VI

CIVIL ENGINEERING

Time Allowed : 1 Hour

(Objective)

Maximum Marks : 100

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. **Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet. The Booklet contains 11 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. **You must write your Name, Roll No. and other particulars on the first page of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.**
7. You will encode your **Roll Number** and the **Question Booklet Series A, B, C or D** as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on **Page-2** of your Answer Sheet. **If you do not encode or fail to encode the correct series of your Question Booklet, your Answer Sheet will not be evaluated correctly.**
8. Questions and their responses are printed in English only in this Booklet. Each question comprises **four** responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet, there are **four** brackets—(A), (B), (C) and (D) against each question. To answer the questions you are to **mark with Black/Blue ballpoint pen** ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. **Any erasure or change is not allowed.**
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

1. Identify the correct sequence in a house water connection.

(A) Water meter, Gooseneck, Ferrule, Stopcock, Service pipe

(B) Water meter, Service pipe, Stopcock, Gooseneck, Ferrule

(C) Ferrule, Gooseneck, Service pipe, Stopcock, Water meter

(D) Ferrule, Water meter, Gooseneck, Service pipe, Stopcock

2. The mass curve method for determination of storage capacity of a reservoir uses

(A) census data and cash flow data

(B) cash flow data and water flow data

(C) water inflow data and water demand data

(D) water demand data and water wastage data

3. Identify the wrong empirical formula name for computing the peak drainage discharge.

(A) Ven Te Chow formula

(B) Nawab Jung Bahadur formula

(C) Dicken's formula

(D) Ryve's formula

4. Which of the following hydraulic formulae is ***not*** used for determining flow velocities in sewers and drains?

(A) Horton's formula

(B) Kutter's formula

(C) Crimp and Burges' formula

(D) All of the above

5. P. Trickling filter consists of a bed of crushed stone, gravel or slag of relatively large size.

Q. As sewage passes through the filtering media of the trickling filter, an organic film is formed around the particles of filtering media.

Identify the correct option.

(A) P is correct and Q is incorrect

(B) P is incorrect and Q is correct

(C) Both are incorrect

(D) Both are correct

6. Identify the correct statement or statements from practical and technical point of view.

(A) In a two-chamber septic tank, the first chamber is a grit chamber and second chamber is anaerobic chamber.

(B) In a two-storied septic tank, the top storey is the grit chamber while the other is anaerobic chamber.

(C) Modern septic tanks possess a self-cleansing property.

(D) All are wrong statements

7. The elementary profile of a concrete gravity dam is

(A) right-angled triangle

(B) isosceles triangle

(C) equilateral triangle

(D) None of the above

8. What is a culvert?

(A) A bridge with span up to 8 m

(B) A bridge of span up to 6 m

(C) A bridge of span up to 3 m

(D) None of the above

9. P. A weir is a hydraulic structure where majority or the entire ponding is achieved by a raised crest and smaller part or nil part by the shutters.

Q. A weir is a hydraulic structure that is made by constricting the width of the channel only.

R. A barrage is a hydraulic structure that is made by creating a choking condition only.

S. A barrage is a hydraulic structure where majority or the entire ponding is achieved by a shutter and smaller part or nil part by the raised crest.

Identify the correct statements in the above.

(A) P and R

(B) Q and S

(C) Q and R

(D) P and S

10. Silt excluders are constructed _____ while silt ejectors are constructed _____.

(A) on the river bed, on the diversion headworks

(B) on the river bed, on the bed of the off taken canal

(C) on the bed of the off taken canal, on the bed of the river

(D) on the bed of the off taken canal, on the river bed

11. Which of the following give a discharge that is relatively constant and fixed within limits?

(A) Non-modular modules

(B) Semi-modules

(C) Modular outlets

(D) None of the above

12. What are bed bars?

(A) They are iron rods placed on the bed of canal to ensure smooth flow in the canal

(B) They are small sediment island like deposits formed on the bed of the canal

(C) They are constructed, at suitable intervals, along an unlined canal so as to serve as permanent reference marks

(D) They are very large islands formed on the bed of rivers

13. Assuming 80% efficiency, 100 m^3/sec of design discharge, and 100 m of design head, what will be the approximate electrical power produced?

(A) 800 megawatts

(B) 8000 kilowatts

(C) 80000000 watts

(D) None of the above

14. P% of earth dam failures are due to hydraulic failures, Q% of the earth dam failures are due to seepage failures, R% of the earth dam failures are due to structural failures, where

(A) $P = 40$, $Q = 33$, $R = 25$

(B) $P = 25$, $Q = 40$, $R = 33$

(C) $P = 33$, $Q = 25$, $R = 40$

(D) $P = 40$, $Q = 25$, $R = 33$

15. Select the correct statement from the following :

(A) The canal flows below the drain in aqueduct and syphon aqueduct, and the canal flows above the drain in super passage and syphon.

(B) The drain flows below the canal in aqueduct and syphon aqueduct, and the drain flows above the canal in super passage and syphon.

(C) It is engineer's choise to let the drain flow above or below the canal in aqueduct and syphon aqueduct and also in super passage and syphon.

(D) The above statements are wrong

16. The flexibility of a module is defined as

(A) (outlet discharge)/(distributary channel discharge)

(B) (depth of water in the distributary channel)/(head acting on the outlet)

(C) (depth of water in the distributary channel)^m/(head acting on the outlet)^n

(D) (rate of change of discharge of the outlet)/(rate of change of discharge of the distributary channel)

17. Lysimeters are used to measure

(A) groundwater recharge rates

(B) evapotranspiration

(C) interception losses

(D) lake evaporation

18. What are the lower and upper limits of catchment area for applicability of the use of unit-hydrograph?

(A) 200 ha and 5000 km^2

(B) 2000 m^2 and 5000 km^2

(C) 200 ha and no upper limit

(D) None of the above

19. Which of the following meters is used in river flow measurement?

(A) Acoustic Doppler velocimeter

(B) Electromagnetic velocimeter

(C) Pygmy current meter

(D) All of the above

20. Which of the following is used for channel flow routing?

(A) Puls method

(B) Modified Puls method

(C) Goodrich method

(D) Muskingum method

21. Find the delta for a crop when its duty is 1728 hectares/cumec on the field, the base period for the crop is 240 days.

(A) 360 cm

(B) 240 cm

(C) 120 cm

(D) 60 cm

22. Blaney-Criddle formula is used for

(A) estimation of groundwater recharge

(B) reservoir evaporation

(C) Both of the above

(D) None of the above

23. If the hydraulic radius of a river is 2 m and longitudinal bed slope of the channel is 0·0001, what will be the expected smallest size of the sediment particles on the bed of the river?

(A) About 4·5 mm

(B) About 2·36 mm

(C) 1·18 mm

(D) None of the above

24. A natural river is conveying a flow of 2500 cumec. What is the expected wetted perimeter of the river cross-section?

(A) 23·75 m

(B) 2375 m

(C) 237·5 m

(D) 327·5 m

25. The mathematical expression commonly used for spacing design of tile drainage system is called

(A) V. T. Chow equation

(B) Hooghoudt equation

(C) Horton equation

(D) R. J. Garde equation

26. Groundwater flow is analysed by using

(A) Darcy's law

(B) Reynolds' law

(C) Newton's law

(D) Galerkin's principle

27. Given d_{mm} = average particle size in mm, Lacey's silt factor is calculated as

(A) $f = 1 \cdot 72\sqrt{d_{mm}}$

(B) $f = 1 \cdot 75\sqrt{d_{mm}}$

(C) $f = 1 \cdot 77\sqrt{d_{mm}}$

(D) None of the above

28. Armouring is defined as

(A) the process of strengthening the embankment of rivers

(B) the process of sand deposition on the river bed

(C) the process of bank erosion in rivers

(D) the process of transport of smaller size particles from the river bed surface leaving only the larger size particles during sediment transport

29. A general mobile-boundary channel can be considered to have which of the following degrees of freedom?

(A) Depth of flow, bed width, side slope and longitudinal slope

(B) Depth of flow, bed width, side slope and planiform

(C) Depth of flow, bed width, longitudinal slope and planiform

(D) Depth of flow, bed width, planiform and sediment grading

30. Identify the more correct statement.

(A) Alternate depth is related to specific energy equation and sequent depth is related to specific force equation.

(B) Alternate depth is related to specific force equation and sequent depth is related to specific energy equation.

(C) Alternate depth is related to total energy equation and sequent depth is related to total force equation.

(D) Alternate depth is related to total momentum equation and sequent depth is related to total energy equation.

31. Identify the correct statement.

(A) At critical flow through a channel section, the specific energy is minimum and the specific force is minimum for a given discharge.

(B) At critical flow through a channel section, the alternate depths merge to a single value but the sequent depths differ.

(C) At critical flow through a channel section, any surface disturbance wave always propagates in both upstream and downstream directions.

(D) At critical flow through a channel section, the specific force is equal to the specific energy.

32. What is the qualification of uniform flow?

(A) Slope of the energy line $\neq$ slope of the water surface = slope of the channel bed

(B) Slope of the energy line = $\propto$ and slope of the water surface = slope of the channel bed

(C) Slope of the energy line = slope of the water surface = slope of the channel bed = $\pm$ a constant

(D) Slope of the energy line = slope of the water surface = slope of the channel bed

33. For an open rectangular channel, the Froude number at critical flow is

(A) 0

(B) 0·5

(C) 1·0

(D) None of the above

34. A rectangular open channel having bed width 2 m is laid at a bed slope – 0·0009 and carries a flow of 10 cumec. What is its normal depth of flow?

(A) It needs a calculator for doing the calculations and hence one cannot answer it now

(B) Many data are missing in the problem statement

(C) The problem statement is wrong

(D) The uniform flow does not exist for the channel

35. The equation relating the pre- and post-hydraulic jump flow depths for rectangular channel is given by

(A) $\frac{y_1}{y_2} = \frac{-1+\sqrt{1+8Fr_1^2}}{2}$

(B) $\frac{y_1}{y_2} = \frac{+1+\sqrt{1+8Fr_1^2}}{2}$

(C) $\frac{y_2}{y_1} = \frac{+1+\sqrt{1+8Fr_1^2}}{2}$

(D) $\frac{y_2}{y_1} = \frac{-1+\sqrt{1+8Fr_1^2}}{2}$

Assume standard nomenclature of the terms used above.

36. The most popular form of gradually varied flow equation is expressed as

(A) $\frac{dy}{dx} = \frac{S_0 - S_f}{1-\alpha Fr^2}$

(B) $\frac{dy}{dx} = \frac{S_f - S_0}{1-\alpha Fr^2}$

(C) $\frac{dx}{dy} = \frac{S_0 - S_f}{1+\alpha Fr^2}$

(D) $\frac{dx}{dy} = \frac{S_0 - S_f}{1-\alpha Fr^2}$

Assume standard nomenclature of the terms used above.

37. Equation for critical flow by using usual terms is given by

(A) $\frac{Q^2T}{gA^3} = 1$ (B) $\frac{Q^2T}{gP^3} = 1$

(C) $\frac{Q^2P}{gA^3} = 1$ (D) $\frac{Q^2T}{gD^3} = 1$

38. The most economic cross-section is the one

(A) having minimum velocity for a given cross-section

(B) having minimum wetted perimeter for a given flow cross-sectional area

(C) Both of the above

(D) None of the above

39. Width of carriageway recommended by the IRC for two-lane road with raised kerbs is

(A) 7·0 m

(B) 7·25 m

(C) 7·5 m

(D) 7·75 m

40. While aligning a road in a hilly area with a ruling gradient of 6·5%, a horizontal curve of radius 60 m is encountered. Find the compensated gradient at the curve.

(A) 5%

(B) 5·25%

(C) 1·5%

(D) 1·25%

41. What is the PCU value of a bullock cart as per recommendation made by IRC?

(A) 7·0

(B) 8·0

(C) 3·0

(D) 4·0

42. One passage of an overloaded vehicle with 3 times the standard load will cause damage equivalent to N passages of the standard load. Here N =

(A) 81

(B) 18

(C) 36

(D) 63

43. When a circular load of radius a with uniform pressure p is applied in the surface of a homogeneous layer, the vertical stress σ_z under the centre of the load at depth z is given by

(A) $\sigma_z = p\left[1 - \frac{z^2}{(a^3 + z^3)^{2/3}}\right]$

(B) $\sigma_z = p\left[1 - \frac{z^3}{(a^2 + z^2)^{3/2}}\right]$

(C) $\sigma_z = p\left[1 - \frac{z^{1.5}}{(a^2 + z^2)^{3/4}}\right]$

(D) $\sigma_z = p\left[1 - \frac{z^2}{(a^2 + z^2)}\right]$

44. 1. Basic capacity

2. Possible capacity

3. Traffic flow

R. It is the maximum number of vehicles that can pass a given point on a lane or roadway during one hour under prevailing roadway and traffic conditions.

S. It is the number of vehicles moving in a specified direction on a given lane or roadway that passes a given point or cross-section during specified unit of time.

T. It is the maximum number of passenger cars that can pass a given point on a lane or roadway during one hour under nearly ideal roadway and traffic conditions which can possibly be attained.

Select the correct combination :

(A) 1—T, 2—S, 3—R.

(B) 1—R, 2—T, 3—S.

(C) 1—T, 2—R, 3—S.

(D) 1—R, 2—S, 3—T.

45. The following gives the penetration grades of bitumen binder and corresponding equivalent viscosity grades. Select the correct option :

Penetration grades of bitumen binder	*Equivalent viscosity grade* (A)	(B)	(C)	(D)
I. 80–100	a. VG-10	a. VG-80	a. VG-100	a. VG-90
II. 70–80	b. VG-20	b. VG-70	b. VG-80	b. VG-75
III. 60–70	c. VG-30	c. VG-60	c. VG-70	c. VG-65
IV. 30–40	d. VG-40	d. VG-30	d. VG-40	d. VG-35

46. The aggregates used for construction of BM base course shall fulfil the following properties. Select the correct option :

Property	*Options* (A)	(B)	(C)	(D)
Loss Angeles abrasion value :	<40%	<30%	<40%	<40%
Aggregate impact value :	<40%	<40%	<25%	<30%
Combined flakiness and elongation index :	<30%	<30%	<10%	<40%
Water absorption :	5% to 3%	0%	<1%	<2%

47. Given that P_s = saturation population, P_0 = population at the starting point, P = population at any time t from the starting point, K = constant, t = time in years after the starting point, the population at any time t from the starting point is computed according to the logistic curve model as

(A) $\log_e\left(\frac{P_s - P}{P}\right) - \log_e\left(\frac{P_s - P_0}{P_0}\right) = -KP_s \cdot t$

(B) $-\log_e\left(\frac{P_s - P}{P}\right) + \log_e\left(\frac{P_s - P_0}{P_0}\right) = -KP_s \cdot t$

(C) $\log_e\left(\frac{P_s - P}{P}\right) - \log_e\left(\frac{P_s - P_0}{P_0}\right) = (KP_s)^t$

(D) None of the above

48. According to the Indian Standard Code of Practices, the minimum total domestic consumption for a town or a city with full flushing system should be taken in terms of litres per head per day (l/h/d) as

(A) 135 l/h/d

(B) 170 l/h/d

(C) 235 l/h/d

(D) 200 l/h/d

49. All hand-operated pumps for lifting water from tube wells are

(A) handle pump

(B) piston pump

(C) cylinder pump

(D) reciprocating pump

50. Identify the correct statement from the following :

(A) The uniformity coefficient value for a slow sand filter varies from 2·5 to 3·3 while that for a rapid gravity filter it varies from 1·3 to 1·7.

(B) The uniformity coefficient value for a slow sand filter varies from 1·8 to 2·5 while that for a rapid gravity filter it varies from 1·3 to 1·7.

(C) The uniformity coefficient value for a slow sand filter varies from 1·5 to 2·3 while that for a rapid gravity filter it varies from 1·1 to 1·4.

(D) The uniformity coefficient value for a slow sand filter varies from 1·8 to 2·5 while that for a rapid gravity filter it varies from 1·1 to 1·4.

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