

27/AE/C/M-2022-6

Booklet Series

Candidate's Roll Number

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Serial No.

302698

Question Booklet

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 and 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.

SEAL

1. Zero hardness of water is achieved by
- ion-exchange treatment
 - excess alum and lime treatment
 - lime-soda process
 - excess lime treatment
2. IRC recommends that longitudinal stresses on the bridges should be considered as
- 20% of the live load
 - 10% of the live load
 - 40% of the live load
 - 30% of the live load
3. In disinfection, which of the following forms of chlorine is most effective in killing the pathogenic bacteria?
- NH_2Cl
 - HOCl
 - Cl
 - OCl
4. For a waste, the 5-day BOD at 20°C is found to be 200 mg/l. For the same waste, 5-day BOD at 30°C will be
- 200 mg/l
 - zero, as the bacteria cannot withstand such high temperature
 - less than 200 mg/l
 - more than 200 mg/l
5. In water treatment, slow sand filter, when compared to rapid gravity filters, produces
- equally contaminated effluent
 - Uncertain
 - less contaminated effluent
 - more contaminated effluent
6. Bitumen of grade 80/100 means
- its penetration value is 8 mm to 10 mm
 - its penetration value is 8 cm to 10 cm
 - its penetration value is 8 mm
 - its penetration value is 10 mm

7. As per IRC recommendations, the maximum spacings of expansion and contraction joint in rigid pavements are respectively

- (A) 25 m, 40 m
- (B) 140 m, 45 m
- (C) 45 cm, 4.5 m
- (D) 140 m, 4.5 m

8. The speed and delay studies on a defined section of a highway are conducted by

- (A) moving car method
- (B) enoscope
- (C) radar gun
- (D) traffic counters

9. In the revised CBR design method recommended by the IRC for the design of flexible pavement, the total thickness depends upon

- (A) CBR value of soil and number of commercial vehicles per day
- (B) CBR value of soil and cumulative standard axle load
- (C) CBR value of soil only
- (D) CBR value of soil and magnitude of wheel load

10. As per IRC, the minimum length of transition curve for a mountainous terrain road with radius of curvature 100 m and design speed of vehicle 100 kmph is

- (A) 100 m
- (B) 170 m
- (C) 270 m
- (D) 200 m

11. The weight of tracked vehicle considered for class 70R loading as per IRC is

- (A) 700 kN
- (B) 800 kN
- (C) 500 kN
- (D) 600 kN

12. The fixed type bearing used in bridges is

- (A) elastomeric bearing
- (B) RC rocker bearing
- (C) sliding plate bearing
- (D) None of the above

13. The value of the impact factor for the concrete bridge of 3 m span is

- (A) 0.7
- (B) 0.9
- (C) 0.3
- (D) 0.5

14. The minimum width of carriage-way for a two-lane bridge, other than minor village roads and national highways, is

- (A) 7.5 m
- (B) 9 m
- (C) 4.25 m
- (D) 5.5 m

15. With the increase in capacity-inflow ratio, the trap efficiency of a reservoir

- (A) remains unchanged
- (B) may increase or decrease depending upon reservoir's characteristic
- (C) increases
- (D) decreases

16. The critical shear stress, at which the incipient motion of sediment takes place, is proportional to

- (A) $d^{3/2}$
- (B) d^2
- (C) $\sqrt{d}$
- (D) d

where d is grain size.

17. Pure clayey soils are generally not preferred for the central impervious cores of zoned type of earthen dams because

- (A) clays are highly pervious
- (B) clays are susceptible to cracking
- (C) clays are highly impervious
- (D) None of the above

18. The line joining the static water levels in several wells excavated through a confined aquifer is known as

- (A) perched water table
- (B) hypsometric curve
- (C) cone of depression
- (D) piezometric surface

19. The relation between transmissibility (T) and permeability (K) for an aquifer of depth (B) is

- (A) $T = K \log B$
- (B) $T = \ln(KB)$
- (C) $K = TB$
- (D) $T = KB$

20. For the head regulator, the most severe condition of uplift pressure on the floor occurs when

- (A) the canal runs at full supply depth and the river flow is at pond level
- (B) the canal runs dry and the river flow is at pond level
- (C) the flow in the level is at flood level and canal is running at full supply depth
- (D) the canal runs dry and the river flow is at high flood level

21. Canal drops are required to



- (A) dissipate inadequate land slope
- (B) dissipate excess land slope
- (C) dissipate excess energy
- (D) None of the above

22. The soil becomes partially infertile when its pH value is about

- (A) 7
- (B) 11
- (C) zero
- (D) None of the above

23. Penman's equation is based on

- (A) energy budgeting and mass transfer
- (B) water budgeting and mass transfer
- (C) energy budgeting only
- (D) energy budgeting and water budgeting

24. The ratio of AET to PET lies between

- (A) 0 to 1.0
- (B) 0.9 to 1.0
- (C) 0 to 0.6
- (D) 0.6 to 0.9

25. A through bridge is one with

- (A) bridge flooring provided at the bottom of superstructure
- (B) bridge flooring provided at some intermediate level of superstructure
- (C) bridge flooring provided at the top of superstructure
- (D) None of the above

26. In class B train of vehicles loading, the nose to tail distance between successive trains

- (A) shall not be less than 90.0 m
- (B) shall be less than 90.0 m
- (C) shall not be less than 18.5 m
- (D) shall be less than 18 m

27. The term 'wash load' refers to

- (A) the part of suspended load comprising of particles not available in the bed material
- (B) the bed load after the fines have been washed out
- (C) the saltating part of bed material load
- (D) the suspended load during a flood

28. Tortuosity in a meandering river is

- (A) less than 1
- (B) less or greater than 1, depending upon the river
- (C) 1
- (D) greater than 1

29. A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water is not travelling upstream. This is because the flow in the canal is

- (A) steady
- (B) uniform
- (C) subcritical
- (D) supercritical

30. A culvert is designed for a peak flow Q_p on the basis of rational formula. If a storm of the same intensity as used in design but of duration twice larger occurs, then the resulting peak discharge will be

- (A) $Q_p / 2$
- (B) Q_p^2
- (C) Q_p
- (D) $2Q_p$

31. Which of the following statements is correct as per Lacey's method for design of alluvial channels?

- (A) Wetted perimeter decreases with an increase in design discharge.
- (B) Wetted perimeter increases with an increase in silt factor.
- (C) Wetted perimeter increases with an increase in design discharge.
- (D) Hydraulic radius increases with an increase in silt factor.

32. A stilling basin is the one

- (A) which is provided in head race for desilting purposes
- (B) which is used to regulate the water supply to a power plant
- (C) which is provided at the foot of a spillway for energy dissipation
- (D) None of the above

33. A penstock is 3000 m long. Pressure wave travels in it with a velocity 1500 m/s. If the turbine gates are closed uniformly and completely in 4.5 s, then it is called a

- (A) sudden closure
- (B) uniform closure
- (C) rapid closure
- (D) slow closure

34. The relationship among specific yield (S_y), specific retention (S_r) and porosity (n) of an aquifer is

- (A) $S_y = n - S_r$
- (B) $S_y = S_r + 2n$
- (C) $S_y = S_r + n$
- (D) $S_y = S_r - n$

35. The clogging of well screens and consequent reduction in pump efficiency is indicated by

- (A) low value of well losses
- (B) variable value of well losses
- (C) high value of well losses
- (D) None of the above

36. When water flows over a rectangular suppressed weir, the pressure beneath the nappe is

- (A) just equal to atmospheric
- (B) negative
- (C) very high
- (D) slightly above atmospheric

37. In a barrage, the crest level is kept

- (A) high with no gates
- (B) low with no gates
- (C) low with large gates
- (D) high with large gates

38. If the peak load for a power plant equals the plant capacity, then the ratio of capacity factor to load factor will be

- (A) > 1
- (B) < 1
- (C) 1
- (D) 0



39. When a canal flowing under pressure is carried below a natural drainage such that its FSL does not touch the underside of the supporting structure, the structure so provided, is called

- (A) superpassage
- (B) siphon-aqueduct
- (C) siphon
- (D) aqueduct

40. A channel has three reaches P, Q and R connected in series with the following properties :

Reach	Bed slope	Normal depth (in m)	Critical depth (in m)
P	0.0005	2.27	1.29
Q	0.009	0.82	1.29
R	0.005	1.17	1.29

What gradually varied flow profiles will occur?

- (A) M_1, S_1, S_3
- (B) M_1, H_2, S_2
- (C) M_2, S_1, S_3
- (D) M_2, S_2, S_3

41. At a gauging site, if Q_r is the discharge at a stage when the water surface is rising and Q_f the discharge at the same stage when the water surface is falling, then

- (A) $Q_r = Q_f$
- (B) $Q_r / Q_f = \text{constant}$
- (C) $Q_r < Q_f$
- (D) $Q_r > Q_f$

42. A river carrying a discharge of 100 cumecs has a fall of 200 m. The power available from the fall using an overall efficiency of 85% is

- (A) 66.67 MW
- (B) 166.6 kW
- (C) 266.7 MW
- (D) 166.6 MW

43. Power transmitted through pipes will be maximum when

- (A) the head due to friction = the total head at inlet of the pipe
- (B) the head due to friction = one-third the total head at inlet of the pipe
- (C) the head due to friction = half the total head at inlet of the pipe
- (D) the head due to friction = one-fourth the total head at inlet of the pipe

44. At two points 1 and 2 in a pipeline, the velocities are V and $2V$ respectively. Both the points are at the same elevation. The fluid density is ρ . The flow can be assumed to be incompressible, inviscid, steady and irrotational. The difference in pressures P_1 and P_2 at points 1 and 2 is

- (A) $2\rho V^2$
- (B) $3\rho V^2$
- (C) $0.5\rho V^2$
- (D) $1.5\rho V^2$

45. Flow net is used for the determination of
- (A) hydrostatic pressure
 - (B) exit gradient
 - (C) quantity of seepage
 - (D) All of the above
46. Total Kjeldahl nitrogen is a measure of
- (A) total ammonia nitrogen
 - (B) total inorganic and ammonia nitrogen
 - (C) total organic nitrogen
 - (D) total organic and ammonia nitrogen
47. From amongst the following sewage treatment options, the largest land requirement for a given discharge will be needed for
- (A) oxidation ditch
 - (B) oxidation pond
 - (C) trickling filter
 - (D) anaerobic pond
48. The relative stability of a sewage sample whose dissolved oxygen is same as the total oxygen required to satisfy the BOD is
- (A) infinite
 - (B) zero
 - (C) 1
 - (D) 100
49. If the duty for a crop is 864 hectares per cumec on the field and base period for this crop is 120 days, then the delta for a crop is
- (A) 864 m
 - (B) 120 m
 - (C) 120 cm
 - (D) 864 cm
50. The maximum permissible limit for fluoride content in drinking water is
- (A) 5 mg/l
 - (B) 10 mg/l
 - (C) 0.1 mg/l
 - (D) 1.5 mg/l

SPACE FOR ROUGH WORK

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