प्रश्न पुस्तिका खोले बगैर इस तरफ से उत्तर शीट को बाहर निकालें ।
Without opening the Question Booklet take out answer sheet from this side.

परीक्षा का वर्ष : **2022**

CES-05

प्रश्न-पुस्तिका

अपना अनुक्रमांक सामने अंकों में बॉक्स के अन्दर लिखें

शब्दों में

प्रश्न-पुस्तिका शृंखला

A

सिविल अभियंत्रण (प्रश्न–पत्र – II)

समय : 3:00 घंटे
पूर्णांक : 360

Civil Engineering (Paper-II)

Time : 3:00 Hours
Maximum Marks : 360

प्रश्नों के उत्तर देने से पहले नीचे लिखे अनुदेशों को ध्यान से पढ़ लें ।

महत्त्वपूर्ण निर्देश

1. प्रश्न-पुस्तिका के कवर पेज पर अनुक्रमांक के अतिरिक्त कुछ न लिखें ।
2. **यदि किसी प्रश्न में किसी प्रकार की कोई मुद्रण या तथ्यात्मक त्रुटि हो तो प्रश्न के अंग्रेजी तथा हिन्दी रूपान्तरों में से अंग्रेजी रूपान्तर को मानक माना जायेगा ।**
3. **सभी प्रश्नों के अंक समान हैं ।**
4. **अभ्यर्थी अपने अनुक्रमांक, विषय-कोड एवं प्रश्न-पुस्तिका की सीरीज का अंकन OMR Sheet में निर्दिष्ट कॉलम में सही-सही करें, अन्यथा उत्तर-पत्रक का मूल्यांकन नहीं किया जायेगा और उसकी जिम्मेदारी स्वयं अभ्यर्थी की होगी ।**
5. **अभ्यर्थी रफ कार्य हेतु प्रश्न-पुस्तिका (बुकलेट) के अन्त में दिये गये पृष्ठों का ही केवल उपयोग करें । अलग से इस हेतु वर्किंग शीट उपलब्ध नहीं करायी जायेगी । अभ्यर्थी प्रश्न-पुस्तिका के अंदर रफ कार्य के अतिरिक्त कुछ भी न लिखें ।**
6. इस प्रश्न-पुस्तिका में **180 प्रश्न** हैं, प्रत्येक प्रश्न के चार वैकल्पिक उत्तर, प्रश्न के नीचे (a), (b), (c) एवं (d) दिये गये हैं । इन चारों में से केवल एक ही सही उत्तर है । जिस उत्तर को आप सही या सबसे उचित समझते हैं, उत्तर-पत्रक (ओ.एम.आर. आन्सर शीट) में उसके अक्षर वाले वृत्त को **काले अथवा नीले बॉल प्वाइंट पेन से पूरा काला/नीला कर दें ।**
7. अभ्यर्थी नॉन-प्रोग्रामेबल (Non-Programmable) कैलकुलेटर का प्रयोग कर सकते हैं ।
8. सभी प्रश्नों का उत्तर दिया जाना है और प्रत्येक प्रश्न के अंक समान हैं । आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक दिये जायेंगे ।
9. अपने उत्तर आपको अलग से दिये गये ओ.एम.आर. उत्तर-पत्रक में अंकित करने हैं । **आपको अपने सभी उत्तर केवल ओ.एम.आर. उत्तर-पत्रक पर ही देने है ।** ओ.एम.आर. उत्तर-पत्रक **(O.M.R. Answer Sheet)** के अतिरिक्त अन्य कहीं पर दिया गया उत्तर मान्य नहीं होगा ।
10. आयोग द्वारा आयोजित की जाने वाली वस्तुनिष्ठ प्रकृति की परीक्षाओं में ऋणात्मक मूल्यांकन (Negative Marking) पद्धति अपनायी जायेगी । अभ्यर्थी द्वारा प्रत्येक प्रश्न हेतु दिए गए **गलत** उत्तर के लिए या अभ्यर्थी द्वारा एक प्रश्न के एक से अधिक उत्तर देने के लिए (चाहे दिए गए उत्तर में से एक सही ही क्यों न हो), उस प्रश्न के लिए निर्धारित अंकों का **एक-चौथाई** दण्ड के रूप में काटा जाएगा । दण्ड स्वरूप प्राप्त अंकों के योग को कुल प्राप्तांक में से घटाया जाएगा ।
11. ओ.एम.आर. उत्तर-पत्रक पर कुछ लिखने के पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लें । ओ.एम.आर. उत्तर-पत्रक में वांछित सूचनाओं को अभ्यर्थी द्वारा परीक्षा प्रारम्भ होने से पूर्व भरा जाना अनिवार्य है ।
12. **ओ.एम.आर. उत्तर-पत्रक तीन प्रतियों (मूल प्रति, कार्यालय प्रति एवं अभ्यर्थी प्रति) में है । परीक्षा समाप्ति के उपरान्त ओ.एम.आर. उत्तर-पत्रक की मूल प्रति एवं कार्यालय प्रति को मूल रूप में अन्तरीक्षक (Invigilator) को वापस लौटा दें, अन्यथा की स्थिति में आयोग द्वारा नियमानुसार कार्यवाही की जाएगी । केवल ओ.एम.आर. उत्तर-पत्रक की अभ्यर्थी प्रति, अभ्यर्थी अपने साथ ले जा सकते हैं ।**
13. यदि आपने इन अनुदेशों को पढ़ लिया है, इस पृष्ठ पर अपना अनुक्रमांक अंकित कर दिया है और ओ.एम.आर. उत्तर-पत्रक पर वांछित सूचनायें भर दी हैं, तो तब तक प्रतीक्षा करें, जब तक आपको प्रश्न-पुस्तिका खोलने को नहीं कहा जाता ।
14. ओ.एम.आर. उत्तर-पत्रक (O.M.R. Answer Sheet) का मूल्यांकन ओ.एम.आर. आंसर शीट पर अंकित सीरीज कोड के आधार पर ही किया जायेगा ।
15. प्रश्न-पुस्तिका (Question Booklet) में से ओ.एम.आर. उत्तर-पत्रक (O.M.R. Answer Sheet) निकालने के पश्चात् ओ.एम.आर. उत्तर-पत्रक एवं प्रश्न-पुस्तिका के सीरीज कोड (A, B, C & D) का मिलान अवश्य कर लें, यदि ओ.एम.आर. उत्तर-पत्रक एवं प्रश्न-पुस्तिका के सीरीज कोड भिन्न-भिन्न हों, तो उसे तुरन्त अन्तरीक्षक (Invigilator) से परिवर्तित कराकर समान सीरीज कोड की ओ.एम.आर. उत्तर-पत्रक एवं प्रश्न-पुस्तिका प्राप्त कर लें । यदि उक्तानुसार कार्यवाही नहीं की जाती है, तो उसके लिए अभ्यर्थी स्वयं जिम्मेदार होगा ।

जब तक न कहा जाय इस प्रश्न-पुस्तिका को न खोलें ।

महत्त्वपूर्ण : **प्रश्न-पुस्तिका खोलने पर तुरन्त जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पेज भली-भाँति छपे हुए हैं । यदि प्रश्न-पुस्तिका पॉलिपैक्ड/सीलबंद न हों अथवा कोई अन्य कमी हो, तो अन्तरीक्षक को दिखाकर उसी सीरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें ।**

1. What should be the shape of 'STOP' sign board in India as per IRC guidelines ?

(a) octagonal with white border and red background.

(b) downward equilateral triangle with white border and red background.

(c) circular with white border and red background

(d) None of these

2. Which of the following traffic survey data is plotted by means of 'Desire lines' ?

(a) Speed and delay (b) Traffic volume

(c) Origin and destination (d) All of these

3. Traffic density is

(a) Number of vehicles in a specific direction per lane per day

(b) Number of vehicles in a specific direction per hour

(c) Number of vehicles per unit length of a lane at a given instant

(d) Maximum number of vehicles passing a given point in one hour

4. Design of horizontal and vertical alignment, super elevation and sight distance are primarily influenced by

(a) Width of the vehicle (b) Length of the vehicle

(c) Height of the vehicle (d) Design speed of the vehicle

5. If the difference in elevation of an edge of the carriage way, 9 m wide, and its crown is 15 cm, then the camber is provided at a rate

(a) 1 in 15 (b) 1 in 60 (c) 1 in 45 (d) 1 in 30

6. Maximum vehicular flow beyond which the rotary may not be functioning efficiently is

(a) 500 vehicles per hour (b) 500 vehicles per day

(c) 5000 vehicles per hour (d) 5000 vehicles per day

7. The maximum deficiency in super elevation in B.G. track that is permitted is

(a) 20 mm (b) 40 mm (c) 60 mm (d) 75 mm

8. Shape of transition curve used on railways is

(a) elliptical (b) cubic parabola (c) spiral (d) hyperbola

9. The radius of relative stiffness used in the design of cement concrete pavement DOES NOT depend on

(a) modulus of subgrade reaction (b) wheel load

(c) Poisson's ratio of concrete (d) None of these

10. Ruling gradient on a motor gauge track is 1 in 200. If the track is laid with a 5° curve, then the allowable ruling gradient on the curve would be

(a) 1 in 200 (b) 1 in 285.71 (c) 1 in 333.3 (d) 1 in 400

11. The longitudinal movement of rails on a railway track is technically known as

(a) buckling (b) hogging (c) creep (d) None of these

12. Switch angle on a railway track depends upon which of the following ?

(i) heel divergence (ii) length of tongue rail

(iii) flange way clearance (iv) throw of switch

(a) (i) and (ii) (b) (ii) and (iii) (c) (iii) and (iv) (d) (i) and (iv)

13. The Curve Lead (CL) for a 1 in 8.5 turnout taking off from a straight B.G. track (1.676 m wide) would be

(a) 28.49 m (b) 21.04 m (c) 14.24 m (d) 7.45 m

14. Considering the length of rail as 13 m and sleeper density of (M + 5), the number of sleepers required in the construction of 910 m long B.G. railway track would be

(a) 1310 (b) 1260 (c) 1170 (d) 1050

15. A section of B.G. railway track has a 4° horizontal curve and a gradient of 1 in 200. The total resistance to traction due to gradient and curvature on the track would be

(a) 0.38% of weight (b) 0.46% of weight

(c) 0.62% of weight (d) 0.66% of weight

16. In railways, a triangle formation of track is mainly provided for

(a) diverting trains from main line to branch line

(b) crossing over between parallel tracks

(c) changing direction of engines through 180°

(d) shunting wagon in yards

17. Bearing plates are used to fix

(a) flat footed rails to the wooden sleepers

(b) double headed rails to the wooden sleepers

(c) bull headed rails to the wooden sleepers

(d) None of these

18. On a railway track, "points and crossings" are used to change

(a) Gauge (b) Gradient (c) Direction (d) All of these

19. In a permanent way of a railway track, the function of ballast layer is to

(a) transfer load from sleeper to formation.
(b) provide elasticity to the track.
(c) provide drainage in the track.
(d) All of these.

20. The distance through which the toe of the tongue rail moves sideways to provide a path for the desired direction over the turnout is known as

(a) heel divergence (b) throw of the switch
(c) flangeway clearance (d) heel clerance

21. At stations, where the space is limited, the direction of a locomotive is changed using

(a) traverser (b) turn table (c) triangle (d) scotch block

22. Fish bolts used on railways track are made up of

(a) Cast iron (b) Low carbon steel (c) High carbon steel (d) Stainless steel

23. Number of fish bolts per fish plate used in Indian Railways is

(a) 2 (b) 4 (c) 5 (d) 6

24. The maximum degree of curvature on a meter gauge railway track is limited to

(a) 10° (b) 16° (c) 30° (d) 40°

25. The arrangement, where a left-hand rail of one track crosses the right-hand rail of another track or vice-versa at a small angle, is known as

(a) Acute angle crossing (b) Diamond crossing
(c) Square crossing (d) Obtuse angle crossing

26. The main function of sleeper used in railways track is

(a) to support rails
(b) to hold rails at correct gauge
(c) to distribute load from the rails to the ballast
(d) All of these

27. If the magnetic bearing of the Sun at noon in southern hemisphere is 167°, the magnetic declination at that place would be

(a) 77° N (b) 23° S (c) 13° E (d) 13° W

28. If 'Δ' is the angle of deflection at the curve and, 'T_1' and 'T_2' are the point of tangencies, then the angle between the tangent at 'T_1' and long chord 'T_1 T_2' would be

(a) $\Delta/4$ (b) $\Delta/3$ (c) $\Delta/2$ (d) Δ

29. Coning of wheels of a train wagon

(a) provide a possibility of lateral movement of wheels on rails.
(b) provide smooth running of trains on rails.
(c) reduce excessive wear of inner face of rails.
(d) All of these

30. An absence of a spherical aberration in a telescope is called
(a) Achromation (b) Chromitation (c) Alphanation (d) Ablation

31. Most important factor, out of the following, in selecting a triangulation survey station is
(a) distance between the two stations
(b) intervisibility
(c) intervisibility and well conditioned triangle
(d) accessibility and distance

32. A chain was used to measure a distance of 150 m. The designated length of the chain was 30 m. On testing, the length of the chain was found to be 30.01 m long. The actual length measured is
(a) 149.95 m (b) 150.00 m (c) 150.05 m (d) 151.00 m

33. In a survey it was found that the RL of first point is 104 m and the RL of last point is 102.5 m. If the cumulative rise is 40 m, then the cumulative fall will be
(a) 41.5 m (b) 38.5 m (c) 42.5 m (d) 37.5 m

34. Due to sag in the tape used to measure distance, the correction will be
(a) Positive
(b) Negative
(c) Sometime positive and sometime negative
(d) No correction is required

35. The sum of interior angles of a closed traverse having 'n' number of sides is equal to 720°. The number of sides in the traverse are
(a) 5 (b) 6 (c) 7 (d) 8

36. RL of a point 'A' is 100 m and the back sight reading on 'A' is 2.5 m. If the fore sight reading on point 'B' on the ceiling of the roof is 2.2 m, then the RL of point – B would be
(a) 100.3 m (b) 99.7 m (c) 95.3 m (d) 104.7 m

37. In a triangulation network, at least one line that needs to be measured accurately to calculate the site of the triangle is known as
(a) Check line (b) Tie line (c) Base line (d) Side line

38. A series of closed contour lines on a map, with values changing from lower to higher towards inside, depicts a
(a) ridge (b) hill (c) slope (d) depression

39. A triangulation station, which is located close to the main station, as it could not be located or setup instrument over it due to obstruction, is known as
(a) intermediate station (b) tie station
(c) satellite station (d) secondary station

40. The latitude and departure of a line PQ are + 78 m and – 45.1 m respectively. The whole circle bearing of the line PQ would be
(a) 30° (b) 150° (c) 120° (d) 330°

41. A road is laid in plain terrain of an urban area. Design speed is 80 km/h., radius of horizontal curve is 240 m. Minimum length of a transition curve would be

(a) 32 m (b) 42 m (c) 52 m (d) 72 m

42. A summit curve is formed at an intersection of 3° upgrade followed by a 5° downgrade. For a stopping sight distance of 128 m the length of summit curve would be

(a) 271 m (b) 298 m (c) 322 m (d) 340 m

43. The operation of revolving a plane table about its vertical axis so that all the lines on the sheet become parallel to the corresponding lines on the ground is known as

(a) Orientation (b) Levelling (c) Centering (d) Setting

44. If the whole circle bearing is 315° 20′, then its quadrantal bearing would be

(a) S 36° 30′ W (b) N 44° 40′ W (c) N 57° 24′ W (d) N 45° 40′ W

45. Radius of 1° curve of arc length 30 m would be

(a) 573 m (b) 1146 m (c) 1719 m (d) 3000 m

46. The correction for refraction as applied to levelling staff reading is given by
[d = length of sight;
R = radius of the earth]

(a) $+\frac{1}{7}\left(\frac{d^2}{2R}\right)$ (b) $-\frac{1}{7}\left(\frac{d^2}{2R}\right)$ (c) $+\frac{1}{7}\left(\frac{d^2}{R}\right)$ (d) $-\frac{1}{7}\left(\frac{d^2}{R}\right)$

47. The precipitation caused by natural rising of warmer lighter air in colder and denser surroundings is called

(a) convection precipitation (b) orographic precipitation
(c) cyclonic precipitation (d) None of these

48. S-hydrograph is used to obtain unit hydrograph of

(a) Shorter duration from longer duration
(b) Longer duration from shorter duration
(c) both (a) and (b)
(d) None of these

49. A river has an average surface width of 20 m and length 60 km. If the evaporation measured in the vicinity of river by a US Class – A Pan is 0.50 cm/day, Pan coefficient is 0.7, then the volume of water evaporated in a month of 30 days in m^3 is

(a) 180×10^3 (b) 180 (c) 12.6×10^6 (d) 126×10^3

50. For a given storm, the ratio of average rainfall depth $\bar{P}$ and highest rainfall P_0 is given by
[A = Area of catchment in km^2].

(a) k exp (–A) (b) exp $(-k A^n)$ (c) $-kA^n$ (d) a constant

51. A curve, which is composed of two arcs of different radius and both having centers on opposite side of the tangent in between, is known as

(a) simple curve (b) compound curve (c) reverse curve (d) vertical curve

52. A direct runoff hydrograph due to an isolated storm was triangular in shape with a base of 60 hr. and a peak of 100 m^3/s. If the catchment area is 500 km^2, the effective rainfall of the storm is

(a) 1.08 cm (b) 2.16 cm (c) 21.6 cm (d) 10.0 cm

53. The type of rain gauge used for measuring rain in remote hilly inaccessible area is

(a) Floating type (b) Weighing bucket type

(c) Tipping bucket type (d) Simon's rain gauge

54. Rainfall of 5 cm occurs on a catchment area of 0.01 km^2. If the run off coefficient is 0.70, then the run off from the catchment area is

(a) 35×10^5 litres (b) 50×10^5 litres (c) 35×10^4 litres (d) 50×10^4 litres

55. If the area between two isohytes of 35 cm and 45 cm is 100 km^2, and between isohytes of 45 cm and 55 cm is 300 km^2, then the average rainfall over the 400 km^2 area is

(a) 45 cm (b) 47.5 cm (c) 48 cm (d) 50 cm

56. Probability of 10 year flood to occur at least once in the next 10 years is

(a) 100 % (b) 50 % (c) 65 % (d) 35 %

57. Trap efficiency of a reservoir is a function of

(a) Capacity to outflow ratio (b) Capacity to inflow ratio

(c) Specific storage to specific yield ratio (d) Outflow to inflow ratio

58. Isopleths are imaginary lines which show

(a) equal height of land (b) atmospheric pressure at equal height

(c) equal depth of evapo-transpiration (d) equal amount of rainfall

59. If duty for crop is 864 hect/cu.m. then for a base period of 100 days the delta of the crop will be

(a) 100 cm (b) 110 cm (c) 120 cm (d) 130 cm

60. Perched aquifer is located within

(a) Confined aquifer (b) Unconfined aquifer

(c) Aquiclude (d) Floridian aquifer

61. Through DAD analysis, the maximum average depth over an area of 10^3 km^2 due to one-day storm was found to be 76.5 cm. For the same area, the maximum average depth for a 3-day storm can be expected to be

(a) < 76.5 cm

(b) = 76.5 cm

(c) > 76.5 cm

(d) greater or less than 76.5 cm depending upon type of rainfall

62. Penman's evapotranspiration equation is based on
(a) Water budget method
(b) Energy balance method only
(c) Energy balance and mass transfer method
(d) Water budget method and energy balance method

63. As a precipitation measuring device, Symon's rain gauge
(a) measures intensity of rainfall
(b) measures depth of snowfall in hilly regions
(c) measures area of rainfall covered
(d) records depth of rainfall stored

64. Infiltration index (ϕ-index) takes into account
1. loss due to evaporation
2. loss of water due to transpiration
3. loss of water due to initial absorption into soil
4. loss of water draining down to water table

Correct statements are
(a) all four are correct (b) only three are correct
(c) only two are correct (d) only one is correct

65. Applying Darcy's law in a porous media flow, Reynolds Number has to be less than one, and is defined as
(a) $\dfrac{\text{Discharge velocity} * \text{Maximum grain size}}{\text{Dynamic viscosity}}$
(b) $\dfrac{\text{Actual velocity} * \text{Average grain size}}{\text{Kinematic viscosity}}$
(c) $\dfrac{\text{Discharge velocity} * \text{Mean particle size}}{\text{Kinematic viscosity}}$
(d) $\dfrac{\text{Mass velocity} * \text{Pore size}}{\text{Dynamic viscosity}}$

66. Four rain gauge stations in a catchment area have recorded 20, 25, 22 and 15 cm of rainfall respectively. If their Theissen weights are 0.3, 0.4, 0.1 and 0.2 respectively, then the average depth of rainfall in the catchment is
(a) 19.2 cm (b) 20.2 cm (c) 21.2 cm (d) 22.2 cm

67. The method of irrigation used for orchards is
(a) free flooding (b) border flooding
(c) check flooding (d) basin flooding

68. For a standing crop, the consumptive use of water is equal to the depth of water
(a) Transpired by the crop
(b) Evaporated by the crop
(c) Transpired and evaporated by the crop
(d) Used by crop in transpiration, evaporation and also the quantity of water evaporated from adjacent soil

69. Useful storage in a dam reservoir is the volume of water stored between
(a) Minimum and average reservoir level. (b) Minimum and maximum reservoir level.
(c) Minimum and full reservoir level. (d) Full and maximum reservoir level.

70. Water application efficiency is the ratio of

(a) Flow duty and quantity duty

(b) Duty and delta

(c) Water quantity stored in root zone and water quantity delivered

(d) Duty for rabi crop and duty for Kharif crop

71. The amount of irrigation water required to meet the evapotranspiration needs of the crop during the full growth is known as

(a) effective irrigation requirement (b) consumptive use

(c) consumptive irrigation requirement (d) net irrigation requirement

72. Following data were noted from an irrigation field :

(i) Field capacity = 20%

(ii) Permanent wilting point = 10%

(iii) Permissible depletion of available soil moisture for the crop = 50%

(iv) r_d of soil = 15 kN/m^3

(v) Effective rainfall = 50 mm

The net irrigation requirement for the crop having 1 m root zone depth will be –

(a) 75 mm (b) 125 mm (c) 50 mm (d) 25 mm

73. When 8 cumec of water is supplied to a 40 hectare field for 4 hours then 216 mm water is stored in root zone. The efficiency of applied water is

(a) 65 % (b) 70 % (c) 75 % (d) 80 %

74. A river training work is generally required when the river is

(a) aggrading type (b) degrading type

(c) meandering type (d) both (a) and (b)

75. The optimum depth of Kor watering for sugarcane is about

(a) 12.0 cm (b) 16.5 cm (c) 20.0 cm (d) 24.5 cm

76. For the upstream face of an earthen dam the most adverse condition or the stability of slope is

(a) Sudden drawdown (b) Sloughing of slope

(c) Steady seepage (d) During construction

77. By providing a top width for roadways and free board in the elementary profile of a gravity dam, the resultant force for full reservoir condition will

(a) shift towards the toe (b) shift towards the heel

(c) not shift at all (d) None of these

78. A clayey soil has a field capacity of 35% and permanent wilting point of 20%. If the specific weight of the soil is 12.25 kN/m^3, then the available moisture holding capacity in 0.8 m depth of soil constituting the root zone depth of a crop is [g = 9.81 m/s^2]

(a) 15.6 cm (b) 17.5 cm (c) 20.8 cm (d) 36.4 cm

79. Seepage through foundation of an earthen dam is controlled by

(a) Rock toe (b) Drainage filter

(c) Impervious cut-off (d) Inverted filter

80. The total water pressure per meter on a gravity dam due to 20 m depth of water would be [water density = 1000 kg/m^3]

(a) 2×10^4 kg (b) 2×10^6 kg (c) 2×10^5 kg (d) 2×10^7 kg

81. The alternate name of the ridge canal is

(a) Contour canal (b) Side slope canal

(c) Watershed canal (d) None of these

82. A contour canal is defined as

(a) a canal which may frequently encounter cross-drainage works.

(b) a canal which can irrigate on both sides.

(c) a canal which is not supposed to do irrigation.

(d) None of these.

83. A shaft spillway is generally provided at

(a) inside the body of a gravity dam (b) inside the upstream reservoir

(c) inside the downstream reservoir (d) on side flanks of the main dam

84. Which one of the following is a part of a river training system ?

(a) metering flume (b) silt excluder

(c) aqueduct (d) groynes

85. Consider the statements related to phreatic line in a homogenous earth dam

1. elliptical in shape
2. an equipotential line
3. top most flow line with zero water pressure
4. approximately a parabola

The correct statements are

(a) 1, 2 and 3 (b) 2, 3 and 4 (c) 3 and 4 (d) 4 only

86. An earthen embankment is founded on a previous foundation of finite depth. A flownet analysis gives 6 flow channels and 18 equipotential drops. Head of the water lost during seepage is 6 m. Coefficient of permeability of previous strata is 4×10^{-5} m/min. Seepage loss through embankment per metre length would be

(a) 0.3456 m^3/day (b) 0.1152 m^3/day

(c) 0.0648 m^3/day (d) 0.0216 m^3/day

87. In a saddle-syphon spillway, an air vent is provided at the level of the full reservoir surface

(a) to break the syphonic action at that level.

(b) to initiate a syphonic action at that level.

(c) to prevent cavitation.

(d) to maintain ventilation inside the syphon.

88. In ordinary residential buildings, the damp proof course is provided at

(a) foundation level (b) water table level

(c) plinth level (d) floor level

89. In sanitary plumbing of a building, a two-way pipe system signifies

(a) separate soil pipe and waste pipe without vent pipe.

(b) a soil-cum-waste pipe and a ventilation pipe.

(c) separate soil and waste pipe and a common ventilation pipe.

(d) separate soil pipe and waste pipe and each with own vent pipe.

90. The most correct statement related to drip irrigation system is

(a) has high evaporation losses

(b) is not available for scattered trees and plants

(c) requires elaborate levelling of ground to be effective

(d) has high water application efficiency

91. The spacing of the drains to relieve water-logged land is directly proportional to the

(a) depth of drain below the ground surface

(b) depth of impervious strata from the drain

(c) depth of drain below the water level

(d) square root of the coefficient of permeability of the soil to be drained

92. Which one is water borne disease ?

(a) Typhoid (b) Cholera

(c) Infectious hepatitis (d) All of these

93. Drop manholes are the manholes

(a) without entry ladders (b) without manhole cover

(c) with depth more than 3.5 m (d) having drains at different levels

94. The trap used for a water closet is called

(a) gully trap (b) p-trap (c) intercepting trap (d) anti-syphon trap

95. The permissible limit of total hardness, as $CaCO_3$, in drinking water as per IS 10500 : 2012 is

(a) 250 ppm (b) 300 ppm (c) 200 ppm (d) 500 ppm

96. Maximum failures of an earthen dam occurs due to

(a) U/S face erosion due to velocity of water.

(b) Slipping of slopes being rather steep.

(c) Leakage through cavities in dam structure.

(d) Overtopping due to insufficient height or spillway capacity.

97. The preferred shape of sewer in a combined sewerage system is

(a) Circular (b) D-shape (c) Horse shoe (d) Egg shaped

98. The initial design period of a sewage treatment plant is

(a) 25 to 30 years (b) 20 to 25 years (c) 10 to 15 years (d) 5 to 10 years

99. Water distribution systems are designed with reference to

(a) average daily demand

(b) maximum daily demand and fire demand

(c) fire demand only

(d) average hourly demand

100. 'Refuse' term does not generally include

(a) excreta (b) putrescible solid waste

(c) ashes (d) non-putrescible solid waste

101. Which of the solid waste disposal method is most acceptable ecologically ?

(a) Composting (b) Sanitary landfills

(c) Pyrolysis (d) Incineration

102. No treatment to the sewage is given if dilution factor is

(a) less than 150 (b) between 150 and 300

(c) between 300 and 500 (d) more than 500

103. The correct sequence of treatment processes, given below, in a water treatment plant are

1. Filteration
2. Chlorination
3. Sedimentation
4. Coagulation
5. Flocculation

(a) 1, 2, 3, 4, 5 (b) 2, 3, 1, 5, 4 (c) 4, 5, 3, 1, 2 (d) 1, 2, 5, 3, 4

104. The minimum Dissolved Oxygen (DO) in ppm, in a river for the survival of aquatic life is

(a) 8 (b) 4 (c) 2 (d) zero

105. Waste stabilization ponds can be

(a) aerobic (b) anaerobic (c) facultative (d) any of these

106. The most efficient method of BOD removal is

(a) oxidation ditch (b) trickling filter

(c) oxidation pond (d) aerated lagoon

107. Friction factor for a pipe can be found from which of the following diagrams ?

(a) Mohr's diagram (b) Moody's diagram

(c) Reynold's diagram (d) Friction diagram

108. The solubility of oxygen in sewage as compared to its solubility in distilled water is about

(a) 80 % (b) 95 % (c) 98 % (d) 100 %

109. Between BOD and COD, the greater of the two is

(a) BOD (b) COD

(c) both are equal (d) depends on sewage quality

110. The waste water coming from kitchens, bath rooms and wash basins is known as

(a) sullage (b) domestic sewage

(c) sewage (d) drainage discharge

111. Self cleansing velocity is

(a) Maximum velocity of flow required to maintain a certain amount of solids in flow.

(b) Minimum velocity of flow required to maintain certain amounts of solids in flow.

(c) Flow velocity as would be sufficient to ensure that sewage does not remain in the sewer.

(d) Flow velocity as would be sufficient to flush out any deposited solids in the sewer.

112. Which of the following type of valve allows water to flow in one direction but prevents in reverse direction ?

(a) Sluice valve (b) Air relief valve (c) Reflux valve (d) None of these

113. Which of the following pipe is commonly used to resist corrosion from H_2S ?

(a) Asbestos cement pipe (b) RCC pipe

(c) Glazed wire pipe (d) None of these

114. If an industrial waste water with flow of 2 m^3/s and BOD concentration of 250 mg/litre joins a stream with flow of 18 m^3/s having BOD concentration of 10 mg/litre, then the BOD concentration of the stream downstream of the confluence will be [in mg/litre]

(a) 9 (b) 20 (c) 25 (d) 34

115. The standard BOD of water is taken for

(a) one day (b) three days (c) five days (d) seven days

116. Water seal is provided in

(a) wash basin (b) urinal (c) water closet (d) kitchen sink

117. The self-cleaning velocity for all sewers in India is usually

(a) Less than 1.0 m/s (b) 1.0 m/s to 1.2 m/s

(c) 1.5 m/s to 2.0 m/s (d) 3.0 m/s to 3.5 m/s

118. Five day BOD at 15 °C of the sewage of a town is 100 kg/day. If the 5-day BOD per head at 15 °C for standard sewage is 0.1 kg/day, then the population equivalent is

(a) 100 (b) 1000 (c) 5000 (d) 10000

119. Air binding phenomenon in rapid sand filters occurs due to

(a) excessive negative head (b) mud ball formation

(c) higher turbidity in the effluent (d) low temperature

120. As compared to higher pH values the contact period required for efficient chlorination at lower pH values is

(a) same (b) longer (c) smaller (d) None of these

121. Primary air pollutants are

(a) Sulphur dioxide and nitrogen oxide (b) Ozone and carbon monoxide

(c) Sulphur dioxide and ozone (d) Nitrogen oxide and ozone

122. Electrostatic precipitators are used as pollution control device for the separation of

(a) SO_2 (b) NO_x (c) hydrocarbon (d) particulate matter

123. The multiplying factor usually adopted to obtain maximum daily demand of water from the average daily demand of water is

(a) 1.5 (b) 1.8 (c) 2.0 (d) 2.7

124. 2000 m^3 of water is supplied per day to a city after treating it with Cl_2 dose of 0.60 ppm. For this purpose, the requirement of 30% bleaching powder per day would be

(a) 4 kg (b) 12 kg (c) 40 kg (d) 120 kg

125. India has been divided into biographical zones equal to

(a) 5 (b) 10 (c) 15 (d) 20

126. Sunderban is a biosphere reserve of India located in

(a) Uttarakhand (b) Odhisa (c) Greater Nicobar (d) West Bengal

127. Secondary carnivore belongs to trophic level

(a) First (b) Second (c) Third (d) Fourth

128. Commonly used hand pump is a

(a) reciprocating pump (b) centrifugal pump

(c) rotary pump (d) axial flow pump

129. Corrosion in pipe in due to

(a) dissolved oxygen in water (b) pH value of water

(c) impurities in the material (d) All of these

130. Mesosphere is the layer of atmosphere above surface of earth at approximately height as

(a) 50000 m to 85000 m (b) 10000 m to 15000 m

(c) 15000 m to 50000 m (d) above 300000 m

131. A common absorbant used in water and waste treatment is

(a) medium size sand (b) wood particles

(c) activated carbon granules (d) chlorine

132. The Sludge Volume Index (SVI) ranges between

(a) 0 to 50 ml/gr. (b) 50 to 150 ml/gr. (c) 150 to 200 ml/gr. (d) 200 to 250 ml/gr.

133. The method which is generally used for the design of water distribution system is

(a) Darcy – Weisback equation (b) Manning's equation

(c) Hardy – Cross method (d) None of these

134. Global environmental temperature is likely to increase due to

(a) soil erosion (b) water pollution

(c) use of fossil fuel (d) use of solar energy

135. For a grit chamber, if the recommended velocity of flow is 0.2 m/s and the detention time is 2 minutes, then the length of chamber is

(a) 16 m (b) 27 m (c) 14 m (d) 24 m

136. Eutrophication of water bodies is caused due to

(a) discharge of heavy metals

(b) excessive discharge of nutrients

(c) excessive discharge of suspended solids

(d) excessive discharge of chlorides

137. Thermal Power Plants, based on burning of coal, pollute atmosphere by adding to it

(a) CO_2 and CO (b) SO_2 and H_2S

(c) NO_X and SO_X (d) NO_X and SO_X and particulate matter

138. The most common used retarder in cement is

(a) Gypsum (b) Calcium Chloride
(c) Calcium Carbonate (d) None of these

139. The frog of the brick in brick masonry is kept on

(a) bottom face (b) top face (c) shorter side (d) longer side

140. In a staircase, the height of riser is 15 cm and the number of treads are 18. If the stair has two flights, the height of stair will be

(a) 2.85 m (b) 3.00 m (c) 2.70 m (d) 3.15 m

141. Hardest mineral among the following is

(a) Feldspar (b) Garnet (c) Quartz (d) Amphibole

142. Excess of silica content in clay for making bricks makes them

(a) melt on burning up (b) warp on burning
(c) brittle on burning (d) develops cracks on burning

143. Main content of wall putty are

(a) Calcium carbonate and Linseed oil (b) Magnesium sulphate and Turpentine oil
(c) Magnesium sulphate and Linseed oil (d) Calcium sulphate and Turpentine oil

144. Crushed pottery can be used to manufacture

(a) Fire bricks (b) Clay tiles (c) Stone bricks (d) Terracotta

145. Number of bricks required for one cu.m. of brick masonry is

(a) 200 (b) 400 (c) 500 (d) 600

146. In fire proof paint, the main constituent is

(a) copper powder (b) lead powder
(c) aluminium powder (d) asbestos fiber

147. To produce high alumina cement, following are fused together

(a) Gypsum, Clay, Lime stone (b) Gypsum, Bauxite, Lime stone
(c) Lime stone, Chalk (d) Bauxite, Lime stone

148. The compressive strength of concrete is higher than tensile strength, by approximately

(a) 2 times (b) 5 times (c) 10 times (d) 20 times

149. 10% of the cost of work is given to the contractor as mobilization advance

(a) when 10% of the work is completed
(b) when work at site is started
(c) before start of construction, for preparation to start the work
(d) during construction work for payment of salary to staff

150. The moisture content in a well seasoned timber is

(a) 4% to 6% (b) 10% to 12% (c) 15% to 20% (d) 25% to 30%

151. Scheduling method followed for prioritization of jobs in a project is known as

(a) Critical ratio method (b) Event flow method

(c) Short interval method (d) Slotting method

152. The estimate of expected time of completion of an activity is defined by

[Consider, t_o = optimistic time

t_p = pessimistic time

t_m = most likely time]

(a) $(t_p + t_o + 2t_m)/2$ (b) $(t_p + t_o + 3t_m)/3$

(c) $(t_p + t_o + 4t_m)/4$ (d) $(t_p + t_o + 4t_m)/6$

153. Ultimate strength to cement in cement concrete is provided by

(a) Tri calcium silicate (b) Di calcium silicate

(c) Tri calcium aluminate (d) Tetra calcium alumino ferrite

154. The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as

(a) Total float (b) Duration (c) Interfering float (d) Free float

155. The radial splits which are wider on the outside of the log towards bark and narrower towards the pith are known as

(a) Heart shakes (b) Cup shakes (c) Star shakes (d) Rind galls

156. As compared to ordinary Portland cement, high alumina cement has

(a) higher initial setting time but lower final setting time.

(b) lower initial setting time but higher final setting time.

(c) higher initial and final setting time.

(d) lower initial and final setting time

157. Type of pointing in V-shaped projection outside the wall surface is provided, is called

(a) Recessed pointing (b) Weather pointing

(c) V-pointing (d) Tuck-pointing

158. In an air conditioned building a door has to serve both purposes of opening and closing. The most suitable type of door for this purpose is

(a) Swinging door (b) Sliding door

(c) Roller shutter door (d) Revolving door

159. Which of the following is INCORRECT statement regarding project flow ?

(a) Arrow indicates activity of project in the network.

(b) Size of the arrow indicates time expected to be consumed in that activity.

(c) Tail of the arrow indicates beginning of the activity.

(d) Head of the arrow indicates the end of the activity

160. Sandstone is a

(a) Sedimentary rock (b) Metamorphic rock
(c) Igneous rock (d) Volcanic rock

161. The operation of racking out of masonry joints for about 13 mm depth and then filling them up with rich (1 : 3) cement-sand mortar is called

(a) Dressing (b) Pointing (c) Hipping (d) Surfacing

162. With the increase in moisture content the bulking of sand

(a) increases
(b) decreases
(c) first increases to a maximum value and then decreases
(d) first decreases to a minimum value and then increases

163. Which of the following stores is used for decorative work in the buildings ?

(a) Granite (b) Basalt (c) Slate (d) Diamond

164. Increasing the content of carbon in steel results in

(a) increase in tensile strength (b) reduction in tensile strength
(c) increase in ductility (d) no effect

165. Mortar usually used in masonry work is

(a) 1 : 1 (b) 1 : 2 (c) 1 : 6 (d) 1 : 10

166. Sand in mortar is used for

(a) increasing the volume of mortar (b) reducing the shrinkage of binder
(c) reducing cracks in mortar after drying (d) All of these

167. Benkelman beam deflection method is used for the design of

(a) rigid overlay on rigid pavement (b) flexible overlay on flexible pavement
(c) flexible overlay on rigid pavement (d) rigid overlay on flexible pavement

168. Vehicles are moving at a speed of 60 km/h on a road having circular horizontal curve of radius 128 m. Considering the coefficient of lateral friction as 0.15, the design super-elevation would be

(a) 0.07 (b) 0.015 (c) 0.022 (d) zero

169. Enoscope is used to determine

(a) Spot speed (b) Average speed (c) Travel time (d) None of these

170. The type of door commonly used for garages and godowns is

(a) Rolling shutter door (b) Swing door
(c) Revolving door (d) Flush door

171. The values of ruling gradient and limiting gradient in a plain terrain as per IRC guidelines are

(a) 1 in 12 and 1 in 15 (b) 1 in 15 and 1 in 12

(c) 1 in 20 and 1 in 30 (d) 1 in 30 and 1 in 20

172. Minimum length of overtaking zone, as per IRC guidelines, is equal to

(a) overtaking sight distance

(b) two times of overtaking sight distance

(c) three times of overtaking sight distance

(d) five times of overtaking sight distance

173. Two vehicles are approaching each other from opposite direction at a speed of 25 m/s on a lane. Assuming perception-reaction time of 2.5 s, coefficient of longitudinal friction as 0.50, brake efficiency as 50% and coefficient of gravitational acceleration as 10 m/s/s, the minimum distance required to avoid collision would be

(a) 153.6 m (b) 187.5 m (c) 375.0 m (d) 307.2 m

174. Number of potential conflict points on a two lane, two-way traffic roads crossing would be, without pedestrian activity

(a) 11 (b) 17 (c) 18 (d) 24

175. Which of the following tests is/are performed to test the quality of bitumen ?

(a) Penetration test (b) Flash and fire point test

(c) Loss on heating test (d) All of these

176. Select the correct statement :

(a) Psychological extra widening depends upon the number of traffic lanes.

(b) Mechanical extra widening depends upon the speed of vehicles.

(c) Psychological extra widening depends upon the length of wheel base.

(d) Mechanical extra widening depends upon the length of wheel base and the radius of curve.

177. Purpose of collision diagram is

(a) to eliminate accidents

(b) to do statistical analysis of accidents

(c) to study pattern of accidents and take remedial measures

(d) to provide assistance to accident victims

178. Tie bar in concrete pavements are provided at

(a) Transverse joint (b) Longitudinal joint

(c) Expansion joint (d) Contraction joint

179. Maximum grade compensation on a curve is given by
[R = radius of curve]

(a) 50/R (b) 75/R (c) 100/R (d) 125/R

180. Maximum number of vehicles can be parked along kerb, if the parking pattern is

(a) Parallel parking (b) 30° angle parking

(c) 45° angle parking (d) 90° angle parking

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