Engg Services Exam, 2011

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

T.B.C. : P–RSR–L–PRB **Test Booklet Series**

Serial No. 21905

A

TEST BOOKLET

CIVIL ENGINEERING

Paper—II

Time Allowed : Two Hours ***Maximum Marks : 200***

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES ***NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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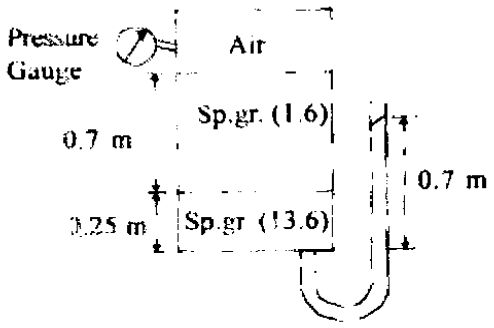
1. Singing of telephone wires in the wind occurs due to :
   (a) Vibrations caused by birds as they sit on, or get off, the wires
   (b) Tensioning at the ends
   (c) Magnus effect
   (d) Generation of Karman Vortex street

2. Which one of the following statements is correct ?
   (a) Local atmospheric pressure is always lesser than standard atmospheric pressure
   (b) Local atmospheric pressure depends upon the elevation of the locality only
   (c) Standard atmospheric pressure is the mean atmospheric pressure at sea level
   (d) A barometer reads the difference between local, and standard atmospheric, pressures

3.



In the above figure the pressure gauge will record a gauge pressure equivalent to :
   (a) 6.12 m of water
   (b) 1.21 m of mercury
   (c) 0.5 bar
   (d) 34,000 Pa

4. The movement of air mass in the case of Tornado can be described as :
   (a) Forced vortex throughout
   (b) Free vortex throughout
   (c) Forced vortex at the core and free vortex outside
   (d) Free vortex at the core and forced vortex outside

5. Match List-I with List-II and select the correct answer using the code given below the lists :

	List-I		*List-II*
A.	Specific gravity	1	$M^0L^{-2}T^{-1}$
B.	Coefficient of viscosity	2	$M^0L^{-1}T^0$
C.	Kinematic viscosity	3	$ML^{-1}T^{-1}$
D.	Stress	4	$ML^{-1}T^{-2}$

Code :

	A	B	C	D
(a)	2	3	1	4
(b)	4	3	1	2
(c)	2	1	3	4
(d)	4	1	3	2

6. Match List-I with List-II and select the correct answer using the code given below the lists :

	List-I		*List-II*
A.	Rehbock formula	1.	Sutro weir
B.	Francis formula	2.	Rectangular supressed weir
C.	A special trapezoidal weir	3	Broad-crested weir
D.	Linear proportional weir	4	Cippolletti weir
		5	Rectangular contracted weir

Code :

	A	B	C	D
(a)	2	3	4	1
(b)	5	3	4	2
(c)	2	5	4	1
(d)	1	5	3	2

7. Poise has the unit of
   (a) Dyne-cm/s^2
   (b) Dyne-cm/s
   (c) Dyne-s/cm
   (d) Dyne-s/cm^2

(Contd.)

8. Consider the following statements :
   1. There is no flow across a streamline
   2. Streamline spacing varies directly with velocity at the section
   3. Streamlines do not cross
   4. In steady flow, streamline pattern does not change with time

   Which of these statements in respect of stream flow pattern are correct ?
   (a) 1, 2, 3 and 4
   (b) 1 and 2 only
   (c) 1, 3 and 4 only
   (d) 2, 3 and 4 only

9. A fire hose has a nozzle attached to it, and the nozzle discharges a jet of water into the atmosphere at a velocity of 20 m/s. This causes the joint of the nozzle with the hose to be in :
   (a) Tension
   (b) A state of zero stress
   (c) Compression
   (d) Bending stress

10. The absolute percentage error in the computed discharge over a rectangular weir corresponding to an absolute error of 1.5% in the measurement of head over the sill of the weir would be :
   (a) 1.5
   (b) 2.25
   (c) 2.5
   (d) 3.75

11. The terminal velocity of a sphere settling in a viscous fluid varies as :
   (a) The Reynolds number
   (b) The square of its diameter
   (c) Directly proportional to the viscosity of the fluid
   (d) Its diameter

12. Distorted models are needed for :
   1. Rivers
   2. Dams across wide rivers
   3. Harbours
   (a) 1 and 2 only
   (b) 2 and 3 only
   (c) 1 and 3 only
   (d) 1, 2 and 3

13. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Sudden closure of a sluice gate	1. Uniform flow
B. Hydraulic jump in a stilling basin	2. Rapidly varied flow
C. Spreading of irrigation water in a field	3. Unsteady flow
D. Flow in a main irrigation canal	4. Spatially varied flow

Code :

	A	B	C	D
(a)	1	2	4	3
(b)	3	2	4	1
(c)	1	4	2	3
(d)	3	4	2	1

14. Which one of the following statements is correct ?
   (a) For water at 100° Celsius at sea level, the vapour pressure is equal to atmospheric pressure.
   (b) Surface energy (or tension) is caused by the force of adhesion between liquid molecules
   (c) Viscosity of a fluid is the property exhibited by it both in static and in dynamic conditions
   (d) Air is 50,000 times more compressible than water

(Contd.)

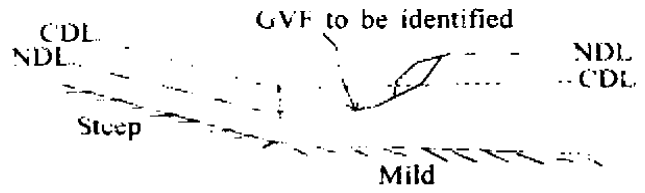
15. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Uniform flow	1. Flow through a water supply pipe
B. Laminar flow	2. Flow through a straight tube of uniform diameter and uniform roughness
C. Turbulent flow	3. Flow above the drainhole of a wash basin
D. Irrotational flow	4. Flow of blood in veins and arteries

Code :

	A	B	C	D
(a)	3	1	4	2
(b)	2	1	4	3
(c)	3	4	1	2
(d)	2	4	1	3

16.



The water surface profile in the flow situation as shown in the figure is :

(a) S3
(b) M3
(c) S2
(d) M1

17. Consider the following devices :
1. Orifice
2. Borda's mouthpiece running free
3. Bell-mouthed orifice
4. External mouthpiece

What is the correct sequence of these devices by decreasing magnitude of coefficient of discharge ?

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

18. Two identical pumps, each capable of delivering 0.2 cumec, against a head of 30 m, are connected in parallel. The resulting discharge is :

(a) 0.4 cumec against a head of 30 m
(b) 0.4 cumec against a head of 60 m
(c) 0.2 cumec against a head of 30 m
(d) 0.2 cumec against a head of 60 m

19. For attaining maximum efficiency, a Francis turbine runner is so designed as to result in radial discharge at exit. This is done by :

(a) Providing runner vane angle at inlet as 90°
(b) Providing guide vane angle at inlet as 90°
(c) Providing runner vane angle at exit as 90°
(d) Designing for absolute velocity at outlet to be inclined at 90° to direction of vane there

20. Assume that water vaporizes at an absolute pressure of 1.5 m, barometric pressure head is 9.5 m and cavitation coefficient is 0.1. A turbine operates under a head of 40 m. The safe height of the runner above the tail water level, in meters, is :

(a) 6
(b) 4
(c) 3
(d) 2

(Contd.)

21. A rail which is tapered to a toe at one end and has a heel at the other end is called as :
    (a) Stock rail
    (b) Tongue rail
    (c) Wing rail
    (d) Lead rail

22. A stilling well is required when the stage measurement is made by employing :
    (a) Bubble gauge
    (b) Float gauge recorder
    (c) Vertical staff gauge
    (d) Inclined staff gauge

23. Consider the following statements.
    Morphological characteristics of a river are represented by :
    1. Changes in the river form
    2. Changes in the characteristics of the river bed as a result of variation of discharge in the river
    3. No changes in the river plan form
    4. No changes in the river bed form

    Which of these statements are correct ?
    (a) 1 and 2
    (b) 1 and 3
    (c) 2 and 3
    (d) 3 and 4

24. Consider the following statements.
    In case of flood routing in a river channel by Muskingum method, the coefficient x represents :
    1. A dimensionless constant indicating the relative importance of inflow and outflow in determining storage
    2. A storage constant having the dimension of time
    3. In natural channels, x usually varies between 0.1 and 0.3
    4. When the values of x equals 0.5, there exists the influence of both inflow and outflow on storage

    Which of these statements are correct ?
    (a) 1, 2, 3 and 4
    (b) 1, 3 and 4 only
    (c) 1, 2 and 3 only
    (d) 2, 3 and 4 only

25. Consider the following situation in a flow mass curve study when demand line drawn from a ridge in the mass curve does not intersect the mass curve again. This means that :
    (a) The storage is not adequate
    (b) The demand cannot be met by the inflow as the reservoir will not refill
    (c) The reservoir was not full at the beginning
    (d) The reservoir is wasting water by spill

26. Consider the following zones :
    1. Saturation zone
    2. Capillary zone
    3. Intermediate zone
    4. Soilwater zone

    Which of these does ***not*** relate to the zone of aeration in the soil profile ?
    (a) 1 and 2
    (b) 2 and 3
    (c) 4 only
    (d) 1 only

27. An invar tape, 50 m in length, standardized at 20°C temperature and 10 kg pull, is used to measure a base line. The correction per tape length, if at the time of measurement the temperature was 30°C and the coefficient of linear expansion of the tape was 1×10^{-6} per °C, will be :
    (a) 0.0200 m
    (b) 0.0050 m
    (c) 0.0005 m
    (d) 0.0001 m

28. A constant centre (in plan-view) arch dam is best suited for :
    (a) A V-shaped gorge
    (b) A U-shaped gorge
    (c) Both U- and V- shaped gorges
    (d) Multi-peaked gorges

(Contd.)

29 Match List-I with List-II and select the correct answer using the code given below the lists

List-I	*List-II*
A. Shallow open well	1. Submersible pump
B. Deep open well	2. Wind power (mill)
C. Shallow tube well	3. Persian wheel
D. Deep tube well	4. Centrifugal pump

Code :

	A	B	C	D
(a)	3	2	4	1
(b)	1	2	4	3
(c)	3	4	2	1
(d)	1	4	2	3

30. An identified source of irrigation water has ion concentrations of Na^+, Ca^{++} and Mg^{++} as 20, 10 and 8 milliequivalents per litre, respectively. The SAR of this water is approximately
(a) 2.06
(b) 6.67
(c) 2.67
(d) Zero

31. Two different channels, M and N, in two different sites are designed based on Lacey's theory, to carry same quantum of discharge. But the bed material of M is found to be finer than that of N.
(a) Channel M will have steeper longitudinal slope
(b) Channel N will have steeper longitudinal slope
(c) Channels M and N can have same longitudinal slopes
(d) Silting is more in M than in N

32. In alluvial channels carrying clear water, the ratio of maximum tractive shear stress on the sides and that on the channel bed is approximately :
(a) 0.5
(b) 1.76
(c) 0.76
(d) 1.5

33. The relation between suspended sediment transport Q_s and stream flow Q is often represented by an equation of the form

$$Q_s = K \cdot Q^n$$

where n commonly varies between :
(a) 1/3 and 1/2
(b) 0.2 and 0.3
(c) 1 and 3
(d) 0.6 and 0.8

34. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Deflector	1. Low-height wall across canal down-stream of the fall
B. Biff wall	2. Vertical end wall with horizontal pro-jection
C. Cistern	3. Short wall at down-stream end of the fall
D. Baffle wall	4. Pond level below the fall

Code :

	A	B	C	D
(a)	1	2	4	3
(b)	3	2	4	1
(c)	1	4	2	3
(d)	3	4	2	1

(Contd.)

35. Consider the following statements :

Mitra's hyperbolic transition design is based on the principle that :

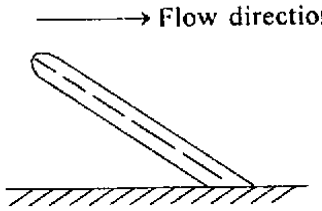
1. Flow depth in the canal, as well as the discharge, is constant
2. Width of the canal varies along with the discharge
3. Rate of change of velocity per unit length of transition is constant throughout the length of the transition.

Which of these statements are correct ?

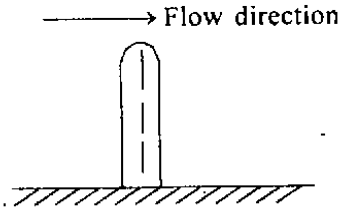
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1 and 3 only

36. Which one of the groyne arrangements represents an 'attracting groyne' ?

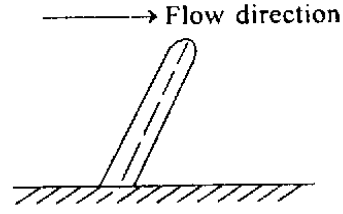
(a)



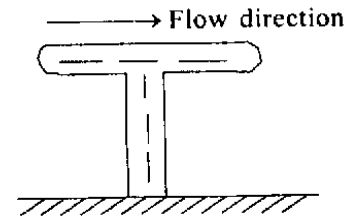
(b)



(c)



(d)



37. Consider the following statements :

1. In a super-passage, the drain runs over the canal
2. In a siphon, the drain runs below the canal
3. In a siphon aqueduct, type-II, the canal banks are made of RCC walls

Which of these statements are correct ?

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

38. A depth-discharge relationship of the canal section is maintained at a notch fall because the sill of the notches is :

(a) Level with downstream canal bed
(b) Below the upstream canal bed
(c) Level with upstream canal bed
(d) Above the upstream canal bed

39. Flexibility of an outlet may be defined as the ratio of the rate of change of :

(a) Outlet discharge to the rate of change of water level of the parent channel
(b) Outlet discharge to the rate of change of the discharge of the parent channel
(c) Parent channel discharge to the rate of change of the outlet discharge
(d) Parent channel water level to the rate of change of the outlet discharge

40. Consider the following statements.

The general depth of scour calculated by Lacey's formula in a river represents the depth below the :

1. Maximum flood level in the river
2. Minimum flow water level in the river
3. Normal flow water level in the river
4. Existing river bed level

Which of these statements is/are correct ?

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

(Contd.)

41. If organic sources of carcinogenic compounds in water persist even after chlorination, then what is the correct sequence among treatment processes listed below if all these are considered compulsory ?
1. Coagulation
2. Sedimentation
3. Filtration in general
4. Activated carbon bed filtration
5. Flocculation
6. Chlorination
(a) 4-5-3-2-6 and 1
(b) 1-2-3-4-5 and 6
(c) 4-2-3-1-5 and 6
(d) 1-5-2-3-4 and 6

42. Match List-I with List-II and select the correct answer using the code given below the lists :

List I (Parameters)		*List II (Units)*
A	Turbidity	1. TON
B	Pathogen	2. TCU
C.	Odour	3. JTU
D.	Colour	4. MPN

Code :

	A	B	C	D
(a)	2	1	4	3
(b)	3	1	4	2
(c)	2	4	1	3
(d)	3	4	1	2

43. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I		*List II*
A.	Viruses in water	1. Parasite-based diseases
B.	Depletion of oxygen	2. Fish extinction
C.	Excess nitrates in water	3. Methemeglobinemia
D.	Excess fluorides in water	4. Mottling of teeth

Code :

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	3	1
(c)	1	3	2	4
(d)	4	3	2	1

44. Consider the following statements.
The role of the gravel bed in a rapid sand filter is :
1. To filter out large suspended matter
2. To support the sand bed above it
3. To prevent the escape of sand particles
4. To uniformly distribute the backwash water
5. To prevent algae growth
Which of these statements are correct ?
(a) 1, 2, 3, 4 and 5
(b) 2, 3 and 4 only
(c) 3, 4 and 5 only
(d) 1, 2 and 3 only

45. Consider the following statements.
The following factors relate to the process of coagulation :
1. Percentage removal is higher when turbidity is more
2. Addition of activated silica aids in the process of coagulation
3. pH of water is an important consideration for selecting a coagulant
Which of these statements are correct ?
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1 and 3 only

46. Which of the following methods are employed for determination of free and combined chlorine residuals in water ?
1. Starch-iodide method
2. Orthotolidine method
3. Amperometric titration method
4. SNORT method
5. DPD method
(a) 1, 2, 4 and 5
(b) 1, 2 and 3 only
(c) 3, 4 and 5 only
(d) 2, 3 and 4 only

(Contd.)

47. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Primary sedimentation	1. Differential settling
B. Coagulation	2. Hindered settling
C. Flocculation	3. Charge neutralization
D. Secondary sedimentation	4. Growth of flocs
	5. Flow-through velocity

Code :

	A	B	C	D
(a)	2	5	4	1
(b)	1	3	4	2
(c)	2	4	3	1
(d)	5	4	3	2

48. Which of the following operational problems relate to the functioning of rapid gravity filter ?

1. Inadequate media comprising filter bed
2. Sludge bulking
3. Mud balls
4. Negative head
5. Incrustation of media

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

49. Conversion of dynamic velocity head into static pressure head in a centrifugal pump is the result of :

(a) Increasing area of flow between adjacent vanes from inlet to outlet
(b) Difference in pressure between suction and delivery ends
(c) Radial thrust in pumps
(d) Stuffing Box

50. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Steel pipe	1. Highly resistant to corrosion but can break easily
B. Concrete pipe	2. Virtually corrosion-resistant
C. AC pipe	3. Sulfide corrosion
D. Vitrified clay pipe	4. Electrolyte corrosion

Code :

	A	B	C	D
(a)	2	3	1	4
(b)	4	3	1	2
(c)	2	1	3	4
(d)	4	1	3	2

51. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Pelton turbine	1. Mixed flow reaction turbine
B. Francis turbine	2. Operating under low head and large discharge
C. Kaplan turbine	3. Operating under high head and large discharge
D. Banki turbine	4. No draft tube

Code :

	A	B	C	D
(a)	4	2	1	3
(b)	3	1	2	4
(c)	4	1	2	3
(d)	3	2	1	4

(Contd.)

52. Consider the following statements :

Activated sludge process can be said to comprise

1. Conversion of dissolved organic matter into biological flocs
2. Removal of dissolved BOD of the waste water
3. Digestion of the sludge

Which of these statements are correct ?

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

53. Which one of the following tests employs ferroin indicator ?

(a) Chemical oxygen demand
(b) Ammonia nitrogen
(c) Nitrate nitrogen
(d) Fluoride

54. During sewage treatment, effluent from which one of the following treatment units has minimum wt vol amount of suspended solids ?

(a) Detritus channel
(b) Primary sedimentation tank
(c) Secondary sedimentation tank
(d) Activated sludge process aeration tank

55. In a pressure penstock 4500 m long, water is flowing at a velocity of 4 m/s. If the velocity of the pressure wave travelling in the pipe, due sudden complete closure of a valve at the downstream end, is given as 1500 m/s, what would be the period of oscillation in seconds under frictionless conditions ?

(a) 6
(b) 8
(c) 9
(d) 11

56. The group of micro-organisms involved in production of methane from acetic acid (or acetate) in anaerobic wastewater treatment processes is :

(a) Methanothrix and Methanobacterium
(b) Methanobacterium and Methanosarcina
(c) Methanosarcina and Methanospirillum
(d) Methanothrix and Methanosarcina

57. When sufficient energy through mechanical mixing is supplied to keep the entire contents, including the sewage solids, mixed and aerated, the reactor is termed :

(a) An aerobic lagoon
(b) An aerobic pond
(c) A facultative lagoon
(d) A facultative pond

58. Deep ponds, in which oxygen is absent except, perhaps, across a relatively thin surface layer, are called :

(a) Aerobic ponds
(b) Anaerobic ponds
(c) Facultative ponds
(d) Polishing ponds

59. The manufacturer of aeration devices reports the oxygen transfer rate of the device obtained through laboratory tests carried under standard conditions. Such standard conditions are :

(a) Wastewater at zero DO, 25°C and 760 mm Hg
(b) Tapwater at zero DO, 0°C and 700 mm Hg
(c) Tapwater at zero DO, 20°C and 760 mm Hg
(d) Wastewater at zero DO, 0°C and 700 mm Hg

(Contd.)

60. Which of the following are responsible for the formation of photochemical smog ?

1. Light intensity
2. Ratio of hydrocarbons to nitric oxide
3. CO_2
4. Hydrocarbon reactivity
5. SO_2

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

61. A flownet for seepage under a sheetpile wall has $n_f = 4$, $n_d = 8$ and the permeabilities of the soil in the horizontal and vertical directions are : $K_H = 8 \times 10^{-5}$ m/sec and $K_V = 2 \times 10^{-5}$ m/sec. If the head loss through the soil is 2 m, the quantity of seepage per meter length of the wall will be :

(a) 2×10^{-5} m^3/sec
(b) 4×10^{-5} m^3/sec
(c) 8×10^{-5} m^3/sec
(d) 16×10^{-5} m^3/sec

62. On analysis of particle size distribution of a soil, it is found that $D_{10} = 0.1$ mm, $D_{30} = 0.3$ mm and $D_{60} = 0.8$ mm. The uniformity coefficient and coefficient of curvature, as given by the particle size distribution curve, are, respectively :

(a) 3 and 3
(b) 2.67 and 1.125
(c) 2.67 and 3
(d) 8 and 1.125

63. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Plate load	1. Specific gravity
B. Pycnometer	2. Bearing capacity
C. Core cutter	3. Grain size analysis
D. Mechanical sieve	4. Field density

Code :

	A	B	C	D
(a)	3	1	4	2
(b)	2	1	4	3
(c)	3	4	1	2
(d)	2	4	1	3

64. When the compaction energy increases the compaction of soils :

(a) Both of OMC and maximum dry density decrease
(b) Both of OMC and maximum dry density increase
(c) OMC decreases but maximum dry density increases
(d) OMC increases but maximum dry density decreases

65. Unconfined compression test is most suitable for determining the :

1. Sensitivity of clays
2. Settlement of embankments
3. 'Strength' of partially saturated clay sample
4. 'Strength' of fully saturated clay sample

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

(Contd.)

66. During consolidation process of clayey soils, indicate the sequence of occurrence of the following events in the order from first to last :

1. Load being taken up by the pore water
2. Load being taken up by the soil grains
3. Drainage of water from the pores of the soil

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

67. If, instead of single drainage, the number of drainage faces is increased to two in responding soils, the rate of compression will be :

(a) 4 times slower
(b) 2 times slower
(c) 4 times faster
(d) 2 times faster

68 Settlement due to creep in soils is contingent on :

(a) Primary consolidation
(b) Secondary consolidation
(c) Initial settlement
(d) Compaction settlement

69. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Geophysical methods	1. Primarily for cohesive soils
B. SPT	2. Clays and silts
C. DCPT	3. Reconnaissance covering large area and large depth
D. Piston-type sampler	4. Suitable for sandy soils

Code :

	A	B	C	D
(a)	2	1	4	3
(b)	3	1	4	2
(c)	2	4	1	3
(d)	3	4	1	2

70. The observed N-value from a standard penetration test conducted in saturated sandy strata is 30; the N-value corrected for dilatancy may be taken as :

(a) 15
(b) 20
(c) 23
(d) 39

71. Which one of the following statements is correct ?

(a) Dynamic viscosity is the property of a fluid which is not in motion
(b) Surface energy is a fluid property giving rise to the phenomenon of capillarity in water
(c) Cavitation results from the action of very high pressure
(d) Real fluids have lower viscosity than ideal fluids

72. The lateral earth pressure coefficients of a soil, K_a for active state, K_p for passive state and K_o for at-rest condition, compare as :

(a) $K_a < K_o < K_p$
(b) $K_a < K_o < K_p$
(c) $K_o < K_p < K_a$
(d) $K_p < K_a < K_o$

73. In a closed traverse ABC, following readings were taken :

Line	Fore Bearing	Back Bearing
AB	20°	201°
BC	101°	278°
CA	278°	50°

Station A is free from local attraction. Correct bearing of CB is :

(a) 275°
(b) 276°
(c) 281°
(d) 280°

(Contd.)

74. Best side slope for most economical trapezoidal section in open channel flow, wherein side slopes are defined by : X horizontal to 1 vertical, is when X equals :
(a) 0.404
(b) 0.500
(c) 0.577
(d) 0.673

75. Two footings, one circular and the other square, are founded on the surface of a purely cohesionless soil. The diameter of the circular footing is the same as that of the side of the square footing. The ratio between their ultimate bearing capacities will be :
(a) 1.0
(b) 1.3
(c) 1.33
(d) 0.75

76. Match List-I with List-II and select the correct answer using the code given below the lists :

	List-I	*List-II*
A.	Large diameter piles	1. Heavy loads in water structures, but foundation strata at shallow depth
B.	Drilled pier	2. Heavy loads in water structures with horizontal loads
C.	Open caisson	3. Heavy but isolated loads
D.	Box caisson	4. Very heavy loads

Code :

	A	B	C	D
(a)	3	2	4	1
(b)	1	2	4	3
(c)	3	4	2	1
(d)	1	4	2	3

77. Working from the whole to the part is followed as the fundamental principle of surveying so as to :
1. Distribute errors
2. Improve ease of working
3. Prevent accumulation of errors
4. Compensate errors in a way
5. Refer to a common datum, say MSL
(a) 1, 2 and 4
(b) 1, 3 and 5
(c) 3 and 4
(d) 2 and 5

78. A rectangular plot of 16 km^2 in area is shown on a map by a similar rectangular area of 1 cm^2. R.F. of the scale to measure a distance of 40 km will be :
(a) $\frac{1}{1600}$
(b) $\frac{1}{400000}$
(c) $\frac{1}{400}$
(d) $\frac{1}{16000}$

79. An object on the top of a hill 100 m high is just visible above the horizon from a station at sea level. The distance between the station and the object is :
(a) 38.53 km
(b) 3.853 km
(c) 3853 km
(d) 385.3 km

80. The magnitude of 'sag correction' during measurement of lengths by taping is proportional to the :
(a) Cube of the weight of the tape, in kg per m run
(b) Cube root of the weight of the tape, in kg per m run
(c) Square of the weight of the tape, in kg per m run
(d) Square root of the weight of the tape, in kg per m run

(Contd.)

81. The angle between the index glass and the horizon glass of a box sextant is 40°; the horizontal angle between the two points sighted by the instrument is
(a) 20°
(b) 60°
(c) 40°
(d) 80°

82. Which one of the following statements is ***not*** correct ?
(a) A surveyor's compass has two sight vanes
(b) A prismatic compass has an object vane and an eye vane
(c) A trough compass is an accessory to a plane table
(d) In a prismatic compass the graduations on the aluminimum disc rotate and the index remains stationary

83. Match List-I with List-II and select the correct answer using the code given below the lists

List-I	*List-II*
A. Traverse surveying	1. Weddel's sounding machine
B. Geodetic surveying	2. Alidade
C. Plane table surveying	3. Chain and compass
D. Hydrographic surveying	4. Theodolite

Code :

	A	B	C	D
(a)	3	4	2	1
(b)	1	4	2	3
(c)	3	2	4	1
(d)	1	2	4	3

84. Which one of the following statements is ***not*** correct ?
(a) Parallax error is eliminated when there is no change in the staff reading when eye is moved up and down
(b) The objective lens is to be focused towards a white or bright background for clear visibility of cross-hairs
(c) Temporary adjustments of the dumpy level are to be performed at every set up
(d) The eyepiece need not be adjusted after the first set up when the same surveyor is taking readings

85. The purpose of a 'satellite station' in triangulation can be served by :
(a) A 'Church spire' in order to secure a well-shaped triangle
(b) A 'Flag pole' in order to secure a well-shaped triangle
(c) A 'Steeple' in order to secure a well-shaped triangle
(d) An 'Eccentric station' near the true station whereon the instrument cannot be setup

86. The sum of the three interior angles of a triangle, the vertices of which lie on the surface of the earth, covering a vast area of several hundreds of sq kms, is
(a) Less than 180°
(b) Equal to 180°
(c) More than 180° but not less than 270°
(d) More than 180° but not more than 225°

87. With all other relevant conditions remaining the same, the speed of a vehicle negotiating a curve is proportional to
(a) $\sqrt{\text{Weight of the vehicle}}$
(b) Weight of the vehicle
(c) $\frac{1}{\text{Weight of the vehicle}}$
(d) $\frac{1}{\sqrt{\text{Weight of the vehicle}}}$

88. If a 'vertical aerial photograph', (20 cm × 20 cm) in size, on a R.F. 1:10,000, has 60% longitudinal overlap and 40% side overlap, the actual ground length covered by each photograph in the longitudinal direction of the flight will be :
(a) 4 km
(b) 6 km
(c) 0.8 km
(d) 0.4 km

89. If the original scale of a negative is 1 : 10,000, the ground resolution, considering that we get nearly 20 lines pair per mm, will be :
(a) 50 mm
(b) 20 cm
(c) 2 m
(d) 25 cm

(Contd.)

90. In a solution of the three-point problem in plane table surveying, the converging of error is attained through :
(a) Concyclic concept
(b) Bessel's method
(c) Triangle of error
(d) Tracing paper method

91. A 3% downgrade curve is followed by a 1% upgrade curve and rate of change of grade adopted is 0.1% per 20 m length. The length of the respective vertical curve is :
(a) 800 m
(b) 200 m
(c) 100 m
(d) 400 m

92. In a concrete pavement, during summer, at and soon after mid-day, the combined stress at the interior of the slab is equal to :
(a) Wheel load stress + Temperature warping stress + Sub grade resistant stress
(b) Wheel load stress + Temperature warping stress – Sub grade resistant stress
(c) Wheel load stress – Temperature warping stress + Sub grade resistant stress
(d) Wheel load stress – Temperature warping stress – Sub grade resistant stress

93. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Lateral friction	1. Disparity between relevant travel distances
B. Cut-off lagoons	2. Vehicle movement on a curve
C. Skid	3. Summit curves
D. Sight distance	4. Prevention of flooding

Code :

	A	B	C	D
(a)	2	1	4	3
(b)	3	1	4	2
(c)	2	4	1	3
(d)	3	4	1	2

94. Which of the following correspond to the recommendations of IRC for pavement thickness determination by CBR Method ?
1. CBR tests are to be conducted in-situ
2. Static compression is best adopted
3. The top 50 cm of subgrade should be compacted to as near the proctor density as possible
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1 and 3 only

95. If the ruling gradient is 1 in 150 on a particular section of a broad gauge track, the allowable ruling gradient on a 4° curve in the track will be :
(a) 0.51%
(b) 0.53%
(c) 0.61%
(d) 0.67%

96. Wind-rose diagram is useful in deciding on the orientation of :
(a) Taxiway
(b) Hanger
(c) Apron
(d) Runway

97. Which of the following complete sets do not recommend the siting of a harbor layout in that vicinity ?
1. Submarine canyon
2. Lee of an island
3. Closely located promontories
4. Indentation coves on the coastline
5. Hooked bays with not-so-rugged rocky bottom
(a) 2, 3, 4 and 5
(b) 1, 4 and 5 only
(c) 2, 3 and 4 only
(d) 3, 4 and 5 only

(Contd.)

98. Match List-I with List-II and select the correct answer using the code given below the lists :

List-I	*List-II*
A. Rails	1. Connect one section of rail to next
B. Sleepers	2. Convert line load into uniformly distributed load
C. Ballast	3. Convert point load into uniformly distributed load
D. Fish Plates	4. Convert rolling loads into point load(s)

Code :

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	4	2	3	1
(d)	1	3	2	4

99. For safe landing and takeoff, the following factors need to be carefully considered :
1. Cross-wind
2. Runway grade
3. Runway width and side clearance
4. Obstructions

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

100. Overland flow drainage on and from the tarmac of an airport invokes, in its design, principles involving :
(a) Spatially varied flow without hydraulic jumps
(b) Backwater flow
(c) Subcritical flow throughout
(d) Attention to rolling flows within spatially varied flows and possibly to moving hydraulic jumps

Directions : –

Each of the next **Twenty (20)** items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is ***not*** the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

101. Assertion (A) : At the point of boundary layer separation, the shear stress is zero.
Reason (R) : The point of separation demarcates between zones of forward and reverse flow close to the wall.

102. Assertion (A) : Loss of head at a sudden contraction in a pipe is smaller than the loss at a sudden expansion in the pipe.
Reason (R) : Increase in turbulence level is higher at a sudden expansion than at a sudden contraction.

103. Assertion (A) : The efficiency of a reciprocating pump is 10-20 percent higher than that of a centrifugal pump for comparable discharge-head conditions.
Reason (R) : The discharge from a reciprocating pump is dependent upon speed.

(Contd.)

104. Assertion (A) : In centrifugal pumps, flow takes place from low pressure zone to high pressure zone.

Reason (R) : Possibility of separation occurring in pumps can be more; and characterizing efficiency of pumps is less than that of turbines.

105. Assertion (A) : In the case of water power plants, it is advisable to provide the surge tank as close to the turbine unit as possible.

Reason (R) : Purpose of surge tank is to provide the intended protection for the portion of the penstock which lies on the upstream of it.

106. Assertion (A) : Fluorides should always be present in drinking water upto a value 1.5 mg/l.

Reason (R) : Such a water helps clean the teeth well.

107. Assertion (A) : The duty of water decreases as the point of its measurement moves away from the field of application.

Reason (R) : Duty depends on soil characteristics.

108. Assertion (A) : The BOD gets removed at a very fast rate immediately after sewage is discharged into a river.

Reason (R) : A part of the BOD in the sewage is due to settleable organic matter therein.

109. Assertion (A) : The bottom layers of water in a deep reservoir are usually not acceptable as raw water in a water supply system.

Reason (R) : The bottom water layers may contain products of anaerobic degradation.

110. Assertion (A) : Disinfection is the last treatment given to water before it is supplied to consumers.

Reason (R) : Any other treatment after disinfection may incidentally also contaminate the water.

111. Assertion (A) : Laterals of minimum specified diameter in sewerage systems have to be laid at slopes designed for self-cleaning velocity.

Reason (R) : For the specified minimum lateral diameter at specified slopes, a minimum flow rate is not essential to maintain self-cleansing velocity.

112. Assertion (A) : In non-cohesive soils, settlement occurs immediately after application of load.

Reason (R) : The settlement is attributed to volume changes caused by lateral yielding or shear strains occurring in the soil.

113. Assertion (A) : In the secondary sedimentation tank of a sewage treatment plant, the settling particles form a blanket which descends and captures more particles.

Reason (R) : The particles are flocculant and in very high concentration whenever there is an efficient working activated sludge, or trickling filter, process.

114. Assertion (A) : Batter piles are provided to resist lateral loads coming onto structures.

Reason (R) : The batter of batter piles is helpful in converting a part of the applied lateral load into axial compressive load on the batter piles.

(Contd.)

115. Assertion (A) : The angle made by the lines of the magnetic force with the earth's surface is called dip.

Reason (R) : In the northern hemisphere, the south end of the needle dips downwards; and in the southern hemisphere, the north end of the needle dips downwards.

116. Assertion (A) : The diurnal variation is the variation of the declination in a year from the mean position during the year.

Reason (R) : The diurnal variation is greater in summer than in winter.

117. Assertion (A) : Reciprocal levelling is adopted to decide the precise difference of level between two points at a considerable distance apart.

Reason (R) : Reciprocal levelling eliminates errors due to :

(i) Curvature

(ii) Refraction, and

(iii) Line of collimation not being exactly parallel to bubble line.

118. Assertion (A) : IRC has recommended a minimum coefficient of friction in the longitudinal direction on wet pavements after allowing a suitable factor of safety in the range 0.15-0.30

Reason (R) : When the longitudinal coefficient of friction of 0.40 is allowed for stopping the vehicle, the resultant retardation is 3.93 m/sec^2 which is not too uncomfortable to the passengers.

119. Assertion (A) : The efficiency of the sheepsfoot roller depends on the weight of the roller and the number of 'feet' in contact with the ground at a time

Reason (R) : Sheepsfoot rollers are considered most suitable for compacting clayey soils.

120. Assertion (A) : In a compaction test, at γ_{max} and OMC, the degree of saturation is never 100%.

Reason (R) : It is not possible to expel all the air entrapped in soil by compaction.

SPACE FOR ROUGH WORK

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