EAC/DWR/II/25/8

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

Test Booklet No. : 02350

Series B

TEST BOOKLET
Paper—II
(CIVIL ENGINEERING)

Time Allowed : 2 Hours | **Full Marks : 100**

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

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
3. All questions carry equal marks.
   The Answer-Sheet should be submitted to the Invigilator.
   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.
   Example :
   Suppose the following question is asked :
   The capital of Bangladesh is
   (A) Chennai
   (B) London
   (C) Dhaka
   (D) Dhubri
   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
5. Please ensure that the Test Booklet has the required number of pages (16) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.
10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

[No. of Questions : 100]

SEAL

1. Which of the following is a characteristic of an artesian well?

(A) Requires a pump for extraction

(B) Water level above ground surface

(C) Low hydraulic gradient

(D) Occurs in unconfined aquifers

2. How can we improve the duty of water?

(A) Lining of canals

(B) Construction of weirs

(C) Construction of dam

(D) Check dams

3. Which one of the following practices causes reduction in the per capita water consumption?

(A) Good quality water

(B) Hotter climate

(C) Modern living

(D) Metering system

4. The suitable method for forecasting population for a young and a rapidly developing city is

(A) arithmetic mean method

(B) geometric mean method

(C) comparative mean method

(D) None of the above

5. Which source of water, among the following, is ***not*** a surface source?

(A) River (B) Well

(C) Lake (D) Ocean

6. The measure of the amount to which light is adsorbed or scattered by the suspended matter in water is called

(A) opacity (B) turbidity

(C) celerity (D) diffraction

7. The maximum permissible limit of fluoride in drinking water should ***not*** exceed

(A) 0·5 ppm (B) 1·5 ppm

(C) 5 ppm (D) 10 ppm

8. Which of the following factors primarily influences the quantity of sanitary sewage generated?

(A) Precipitation

(B) Rate of water supply

(C) Area

(D) Population

9. In silence zone, permissible noise level standard during day time (6 AM to 9 AM) is

(A) 40 dBA (B) 60 dBA

(C) 50 dBA (D) 70 dBA

10. The method which is used for managing solid waste is

(A) composting

(B) incineration

(C) landfilling

(D) All of the above

11. A pitot tube is used to measure

(A) static pressure

(B) dynamic pressure

(C) total pressure

(D) All of the above

12. Specific volume of a fluid is the reciprocal of its

(A) surface tension

(B) viscosity

(C) mass density

(D) dynamic viscosity

13. A body weighs 20 N and 10 N when submerged in the liquids of specific gravity 0·8 and 1·2 respectively. The volume of the body will be given by

(A) $2 \cdot 548 \times 10^{-3}$ m^3

(B) $2 \cdot 935 \times 10^{-3}$ m^3

(C) $3 \cdot 215 \times 10^{-3}$ m^3

(D) $2 \cdot 875 \times 10^{-3}$ m^3

14. The key characteristic of a uniform flow in an open channel is

(A) the flow depth varies along the channel length

(B) the velocity varies along the channel length

(C) the flow depth and velocity are constant along the channel length

(D) the flow is turbulent

15. Which type of open well is suitable when the subsoil is formed of gravel or coarse sand deposits?

(A) Unlined wells

(B) Temporary wells

(C) Wells with impervious lining

(D) Wells with pervious lining

16. Which of the following is ***not*** an application of reservoir routing?

(A) Design of spillway capacity

(B) Fixing location of reservoir

(C) Selecting the size of reservoir

(D) Cost-benefit analysis of reservoir

17. The fall of moisture from the atmosphere to the earth surface in any form is called

(A) evaporation

(B) transpiration

(C) precipitation

(D) None of the above

18. The groundwater stored between the layers of hard rocks below the water table is known as

(A) underground water

(B) aquifer

(C) perched water

(D) secret water

19. Which of the following is ***not*** a primary standard for assessing drinking water quality?

(A) Turbidity

(B) Blue baby syndrome (from nitrates)

(C) Total dissolved solids (TDS)

(D) pH

20. The sewerage system in which the society's waste is carried in buckets or carts is called

(A) hygienic system

(B) water carriage system

(C) bucket system

(D) conservancy system

21. Which of the following is a type of fluid based on viscosity?

(A) Real fluid

(B) Ideal fluid

(C) Newtonian fluid

(D) All of the above

22. In a prestressed concrete member

(A) high strength concrete should be used

(B) low strength concrete should be used

(C) high strength concrete and low tensile steel should be used

(D) high strength concrete and high tensile steel should be used

23. A combined footing is provided when the

(A) bearing capacity of soil is less

(B) end column is near a property line

(C) columns are very near to each other so that their footings overlap

(D) All of the above

24. For a longitudinal reinforcing bar in a column, the cover should ***not*** be less than

(A) 10 mm (B) 20 mm

(C) 30 mm (D) 40 mm

25. The initial setting of cement is caused due to

(A) dicalcium silicate

(B) tricalcium silicate

(C) tricalcium aluminate

(D) tricalcium aluminoferrite

26. The aggregate crushing value of coarse aggregate which is used for making concrete, which in turn is used for purposes other than wearing surfaces, should **not** exceed

(A) 30% (B) 40%

(C) 45% (D) 50%

27. The loss of stress in concrete with time at constant strain is called

(A) relaxation

(B) creep

(C) shrinkage

(D) ductility

28. Closed contours, with higher value inwards, represent a

(A) depression

(B) hillock

(C) plain surface

(D) All of the above

29. The lines passing through points at which the magnetic declination is equal at a given time are called

(A) isogonic lines

(B) agonic lines

(C) concurrent lines

(D) centre lines

30. Leaching is a process

(A) by which alkali salts present in the soil are dissolved and drained away

(B) by which alkali salts in soil come up with water

(C) of draining excess water of irrigation

(D) which controls water-logging

31. The pipe mains carrying water from the source to the reservoir are designed for the

(A) maximum daily draft

(B) average daily draft

(C) maximum hourly draft of the maximum day

(D) maximum weekly draft

32. The molecular formula of bleaching powder is

(A) ClO_2 (B) $CaCl_2$

(C) $Ca(OH)_2$ (D) $Ca(OCl)_2$

33. Mohr's circle is used to determine the stresses on an oblique section of a body subjected to

(A) direct tensile stress in one plane accompanied by a shear stress

(B) direct tensile stress in two mutually perpendicular directions

(C) direct tensile stress in two mutually perpendicular directions accompanied by a simple shear stress

(D) All of the above

34. The continuous strain, which the concrete undergoes due to the application of external loads is called

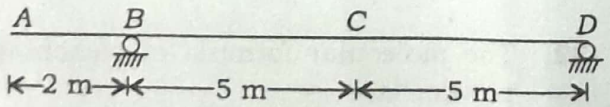
(A) workability

(B) bleeding

(C) segregation

(D) creep

35. A rolling load 10 kN is moving over the beam *ABCD* in the figure below. The maximum bending moment (in kN-m) at *C* subjected to this rolling load is given by



(A) 125 (B) 50

(C) 25 (D) 10

36. When a load on the free end of a cantilever beam is increased, failure will occur

(A) at the free end

(B) at the fixed end

(C) in the middle of the beam

(D) at a distance $\frac{2}{3}$ of length from free end

37. According to Euler's column theory, the crippling load for a column length (l) hinged at one end and fixed at the other end is

(A) $\frac{\pi^2 EI}{l^2}$ (B) $\frac{\pi^2 EI}{4l^2}$

(C) $\frac{4\pi^2 EI}{l^2}$ (D) $\frac{2\pi^2 EI}{l^2}$

38. Plain cement concrete is strong in taking

(A) tensile stress

(B) compressive stress

(C) shear stress

(D) All of the above

39. The trunk of a tree left after cutting all the branches is known as

(A) log (B) batten

(C) plank (D) baulk

40. How many layers of concrete are needed to fill a slump cone?

(A) 5 layers

(B) 4 layers

(C) 3 layers

(D) 2 layers

41. A parabolic cable carries a uniformly distributed load over the entire span. The supports are at the same level. Horizontal thrust and vertical reactions at supports are 300 kN and 400 kN respectively. Ratio of the least tension and greatest tension in the cable will be

(A) 1·0

(B) 0·75

(C) 0·6

(D) 0·5

42. In a simple bending theory, one of the assumptions is that the plane section before bending remains plane after bending. This assumption means that

(A) stress is uniform throughout the beam

(B) strain is uniform throughout the beam

(C) stress is proportional to the distance from the neutral axis

(D) strain is proportional to the distance from the neutral axis

43. Two shafts, *A* and *B*, are of the same material. If the diameter of *A* is thrice the diameter of *B*, then the torque that can be transmitted by *A* will be

(A) 9 times that of *B*

(B) 27 times that of *B*

(C) 16 times that of *B*

(D) 64 times that of *B*

44. A two-span continuous beam *ABC* is simply supported at *A* and *C* and is continuous over support *B*. Span *AB* = 6 m; *BC* = 6 m. The beam carries a u.d.l. of 2 t/m over both the spans. *EI* is constant for the entire beam. The fixed end moment at *B* in span *BA* or *BC* would be

(A) 12 t-m (B) 9 t-m

(C) 8 t-m (D) 6 t-m

45. The percentage of alumina in a good brick clay should vary from

(A) 20% to 30%

(B) 30% to 40%

(C) 40% to 50%

(D) 50% to 60%

46. The type of footing which is used to transmit heavy loads through steel columns is

(A) raft foundation

(B) grillage foundation

(C) well foundation

(D) isolated footing

47. Two concrete cubes are made from same batch of concrete. Their sizes are 30 cm × 30 cm × 30 cm and 15 cm × 15 cm × 15 cm. After 28 days of curing, which one will show more compressive strength?

(A) 30 cm cube

(B) 15 cm cube

(C) Both will show same strength

(D) 30 cm cube but it will fracture early

48. In singly reinforced beams, steel reinforcement is provided in

(A) tensile zone

(B) compressive zone

(C) both tensile and compressive zones

(D) neutral zone

49. When a slab is supported on all the four edges and the ratio of long span to short span is small, bending takes place along both the spans. Such a slab is known as a

(A) slab spanning in one direction

(B) one-way slab

(C) slab spanning in two directions

(D) two-way slab

50. The probability distribution taken to represent completion time of a PERT network analysis is

(A) beta distribution

(B) gamma distribution

(C) Gaussian distribution

(D) normal distribution

51. Which of the following is an advantage of using PERT/CPM?

(A) It simplifies project planning and scheduling

(B) It eliminates all project risks

(C) It helps to identify critical activities that need close monitoring

(D) It guarantees project completion on time and within budget

52. The height between two floors is 3 m and riser is 150 mm. Assuming two flights between the floors, the number of treads will be

(A) 18 (B) 19

(C) 20 (D) 21

53. When 1 cm on the map represents 10 m on the ground, the representative fraction of the scale is

(A) $\frac{1}{10}$ (B) $\frac{1}{100}$

(C) $\frac{1}{1000}$ (D) $\frac{1}{10000}$

54. If the chain length used in measuring distance is longer than the standard length, the error in the measured distance will be

(A) negative error

(B) positive error

(C) compensating error

(D) All of the above

55. The magnetic bearing of the sun at noon is 189°. What is the magnetic declination?

(A) 9° W (B) 9° E

(C) 9° N (D) 9° S

56. For determining relative position of a large number of points, the most preferred method is

(A) theodolite

(B) chain traverse

(C) compass survey

(D) triangulation

57. A total station is a combination of which two surveying instruments?

(A) Compass and theodolite

(B) EDM and theodolite

(C) Compass and EDM

(D) GPS and theodolite

58. The minimum value of camber provided for thin bituminous surface hill roads is

(A) 2·2% (B) 2·5%

(C) 3·0% (D) 3·5%

59. As per the recommendation of IRC, traffic volume study is carried out for rural roads for 7 days continuously during

(A) harvesting

(B) lean season

(C) harvesting and lean season both

(D) None of the above

60. Reflection cracking is observed in

(A) flexible pavement

(B) rigid pavement

(C) bituminous overlay over rigid pavement

(D) rigid overlay over rigid pavement

61. For rigid pavement, critical load location on the slab is

(A) interior

(B) edge

(C) corner

(D) All of the above

62. Safe stopping sight distance as per Indian practice for design speed of 80 kmph is

(A) 100 m (B) 120 m

(C) 130 m (D) 140 m

63. Which of the following is ***not*** a stage of highway alignment survey?

(A) Map study

(B) Soil survey

(C) Reconnaissance survey

(D) Preliminary survey

64. The design of horizontal and vertical alignments, superelevation and gradient is worst affected by

(A) length of vehicle

(B) width of vehicle

(C) speed of vehicle

(D) height of vehicle

65. The type of transition curves generally provided on hill roads is

(A) circular

(B) cubic parabola

(C) lemniscate

(D) spiral

66. In water bound macadam (WBM) roads, the binding material is

(A) sand (B) stone dust

(C) cement (D) brick dust

67. A yellow traffic signal means

(A) stop and proceed when safe

(B) stop, then proceed when clear

(C) slow down and proceed with caution

(D) stop and wait for the green light

68. As per IRC-37, the maximum volume of traffic (in vehicles per hour) entering from all legs of the rotary intersection can be handled efficiently is

(A) 1000 (B) 5000

(C) 3000 (D) 2000

69. The device used to measure the speed of moving vehicle is

(A) weigh bridge

(B) LIDAR gun

(C) noise meter

(D) loop detector

70. The minimum thickness of the base of a flexible pavement is kept as

(A) 5 cm (B) 10 cm

(C) 15 cm (D) 20 cm

71. The transverse joint may be a/an

(A) expansion joint

(B) contraction joint

(C) warping joint

(D) All of the above

72. The soil that got transported by wind is termed as

(A) colluvial (B) aeolian

(C) lacustrine (D) alluvial

73. If G is specific gravity and e is void ratio, the critical gradient of seepage of water in a soil mass is given by

(A) $\frac{1-G}{1+e}$ (B) $\frac{G-1}{1+e}$

(C) $\frac{1+e}{1-G}$ (D) $\frac{1+e}{G-1}$

74. How many layers of prepared soils to be compacted in a modified proctor test?

(A) 2 layers (B) 3 layers

(C) 4 layers (D) 5 layers

75. If ϕ is angle of internal friction, the active earth pressure of a soil is proportional to

(A) $\tan(45° - \phi)$

(B) $\tan^2\left(45° + \frac{\phi}{2}\right)$

(C) $\tan^2\left(45° - \frac{\phi}{2}\right)$

(D) $\tan(45° + \phi)$

76. The water content at which the soil just begins to crumble when rolled into 3 mm threads in diameter, is known as

(A) liquid limit

(B) plastic limit

(C) shrinkage limit

(D) None of the above

77. The plate load test was conducted on a clayey strata by using a plate of 0·3 m × 0·3 m dimensions, and the ultimate load per unit area for the plate was found to be 180 kPa. The ultimate bearing capacity (in kPa) of a 2 m wide square footing would be

(A) 27 (B) 180

(C) 1200 (D) 2000

78. The minimum size of grains of silts is about

(A) 0·02 mm

(B) 0·002 mm

(C) 0·0002 mm

(D) 0·00002 mm

79. A soil sample is having a specific gravity of 2·60 and a void ratio of 0·78. The water content in percentage required to fully saturate the soil at that void ratio will be

(A) 10 (B) 30

(C) 50 (D) 70

80. The property of the soil mass which allows the seepage of water through its interconnecting voids is called

(A) capillarity

(B) porosity

(C) permeability

(D) None of the above

81. For a sandy soil, the angle of internal friction is 30°. If the major principal stress is 50 kN/m^2 at failure, the corresponding minor principal stress will be

(A) 12·2 kN/m^2

(B) 16·66 kN/m^2

(C) 20·8 kN/m^2

(D) 27·2 kN/m^2

82. Negative skin friction on a pile

(A) acts downwards and increases the load carrying capacity of the pile

(B) acts upwards and increases the load carrying capacity of the pile

(C) acts downwards and reduces the load carrying capacity of the pile

(D) acts upwards and reduces the load carrying capacity of the pile

83. Terzaghi's bearing capacity factors N_c, N_q and N_γ are the functions of

(A) cohesion only

(B) angle of internal friction only

(C) cohesion and angle of internal friction both

(D) None of the above

84. The process of improving the performance of a soil as a construction material, usually by the use of some admixtures or additives, is known as

(A) soil exploration

(B) soil stabilisation

(C) soil compaction

(D) soil consolidation

85. According to Rankine's analysis, the minimum depth of foundation is equal to

(A) $\frac{q}{\gamma}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)$

(B) $\frac{q}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)$

(C) $\frac{q}{\gamma}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$

(D) $\frac{q}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$

86. Increase in compaction energy in compaction test leads to

(A) increase in both MDD and OMC

(B) decrease in both MDD and OMC

(C) increase in MDD and decrease in OMC

(D) decrease in MDD and increase in OMC

(MDD = Maximum dry density and OMC = Optimum moisture content)

87. A constant head permeability test was conducted on a sandy soil with a cross-sectional area of 50 cm^2 and a length of 10 cm. Under a constant head of 40 cm, 200 cm^3 of water was collected in 100 seconds. What is the permeability of the soil in cm/sec?

(A) $2 \cdot 0 \times 10^{-2}$ (B) $4 \cdot 0 \times 10^{-2}$

(C) $3 \cdot 0 \times 10^{-2}$ (D) $5 \cdot 0 \times 10^{-2}$

88. Among the following methods of flood control, identify a non-standard measure of flood control.

(A) Flood plain zoning

(B) Retention reservoir

(C) Channel improvement

(D) Levees

89. A flood of certain magnitude has a return period of 25 years. The probability of exceedance is

(A) 4% (B) 12%

(C) 16% (D) 32%

90. The gross commanded area for a distributary is 10000 hectares, 50% of which is culturable irrigable. The intensity of irrigation is 60% and corresponding average duty at the head of the distributary is 2000 ha/cumec. Discharge required at the head of the distributary from average demand consideration is

(A) 3·5 cumec

(B) 2·45 cumec

(C) 1·11 cumec

(D) 1·5 cumec

91. The amount of water content remaining in a unit volume of soil after downward gravity has ceased is called

(A) field capacity

(B) permanent wilting point

(C) seepage water

(D) readily available moisture

92. Cross-drainage work where bed levels of the stream and canal are more or less at the same level is called

(A) aqueduct

(B) syphon-aqueduct

(C) level crossing

(D) superpassage

93. The most suitable location of canal headwork is

(A) rock stage of the river

(B) boulder stage of the river

(C) trough stage of the river

(D) delta stage of the river

94. Khosla's safe exit gradient for design of weir will be the lowest for which soil type?

(A) Fine sand

(B) Gravel

(C) Coarse sand

(D) Clayey soil

95. According to Lacey's regime theory, what will be the regime scour depth for channel in soil having silt factor 1 and discharge 96 m^3/s? Base width of the channel = 12 m.

(A) 2·7 m (B) 10·8 m

(C) 8·0 m (D) 5·4 m

96. For a given discharge, in case of a rectangular channel, the critical flow depth depends upon

(A) channel geometry only

(B) channel geometry and bed slope only

(C) channel geometry and bed roughness only

(D) channel geometry, bed slope and bed roughness

97. Calculate the wetted perimeter for a rectangular channel having top width of 4·5 m and depth of 3 m.

(A) 12 m (B) 10·5 m

(C) 7·5 m (D) 15 m

98. For a channel to be economic, which of the following parameters should be minimum?

(A) Wetted perimeter

(B) Wetted area

(C) Section factor

(D) Hydraulic depth

99. A hydraulic jump occurs in an open channel when the slope of the channel changes from

(A) mild slope to steep slope

(B) steep slope to mild slope

(C) mild slope to zero slope

(D) steep slope to a steeper slope

100. The quantity of water retained by the sub-soil against gravity, is known as

(A) yield

(B) specific yield

(C) specific retention

(D) porosity