

BTSC JE CIVIL

Q1. The combined correction for curvature and refraction for a distance of 3400 m will be nearly

- (a) 0.2 m
- (b) 0.4 m
- (c) 0.6 m
- (d) 0.8 m

Q2. A 100 m tape is suspended between the ends under a pull of 200 N. If the weight of the tape is 30 N, the correct distance between the tape ends will be nearly

- (a) 100.5 m
- (b) 100.3 m
- (c) 100.1 m
- (d) 99.9 m

Q3. A coarse-grained soil has a specific gravity as 2.67. The condition occurs

- (a) 0.62
- (b) 0.74
- (c) 0.82
- (d) 0.94

Q4. Which of the following is not a part of the theory of lateral earth pressure?

1. The soil mass is cohesionless.
 2. The ground surface is horizontal or inclined.
 3. The wall is rigid and does not deform.
- (a) 1 and 2 only
 - (b) 1 and 3 only
 - (c) 1, 2 and 3
 - (d) 2 and 3 only

Q5. The ratio of the active earth pressure to the passive earth pressure is called coefficient of earth pressure.

- (a) Active earth pressure
- (b) Passive earth pressure
- (c) Earth pressure
- (d) Plastic earth pressure

Q6. A bed consists of compressible clay of 4 m thickness with pervious sand on top and impervious rock at the bottom. In a consolidation test on an undisturbed specimen of clay from this deposit 90% settlement was reached in 4 hours. The specimen was 20 mm thick. The time for the building founded over this deposit to reach 90% of its final settlement will be

- (a) 91 years
- (b) 82 years
- (c) 73 years
- (d) 64 years

Q7. A 30 cm square bearing plate settles by 8 mm in the plate load test on cohesionless soil when the intensity of loading is 180 kN/m^2 . The settlement of a shallow foundation of 1.5 m square under the same intensity of loading will be nearly

- (a) 30 mm
- (b) 26 mm
- (c) 22 mm
- (d) 18 mm

Q8. When the observed value of $N_{exceeds}$ 15, the corrected penetration number N_C as per Terzaghi and Peck will be

$$15 - \frac{1}{2}(N_R - 15)$$

$$15 - \frac{1}{2}(N_R + 15)$$

$$15 + \frac{1}{2}(N_R - 15)$$

$$15 + \frac{1}{2}(N_R + 15)$$

Q9. The principal stresses at a point where the major principal stress is 100×10^{-6} and -200×10^{-6} are

- (a) 100×10^{-6}
- (b) 200×10^{-6}
- (c) 300×10^{-6}
- (d) 400×10^{-6}

Q10. A solid shaft transmits a torque T . The allowable shear stress is τ . The diameter of the shaft is

- (a) $\sqrt[3]{\frac{16T}{\pi\tau}}$
- (b) $\sqrt[3]{\frac{32T}{\pi\tau}}$
- (c) $\sqrt[3]{\frac{4T}{\pi\tau}}$
- (d) $\sqrt[3]{\frac{64T}{\pi\tau}}$

Q11. The ratio of Euler's buckling loads of columns with same parameter having

1. Both ends fixed
 2. One end fixed and the other end free, is
- (a) 1
 - (b) 4
 - (c) 8
 - (d) 16

Q12.

Two springs of stiffness K_1 & K_2 respectively are connected in series, what will be the stiffness of the composite spring-

- (a) $K = \frac{K_1 + K_2}{K_1 K_2}$
- (b) $K = K_1 K_2$
- (c) $K = K_1 + K_2$
- (d) $K = \frac{K_1 K_2}{K_1 + K_2}$

Q13. Calculate the quantity (cubic meter) of the cement required for 1 cubic meter of brick work with cement mortar (1:4).

- (a) 0.05
- (b) 0.06
- (c) 0.2
- (d) 0.24

Q14. What is percentage of

- (a) 0.1
- (b) 0.25
- (c) 0.4
- (d) 0.05

Q15. Central line

- (a) Building ha
- (b) Building ha
- (c) Wall having
- (d) Walls having

Q16. Find the

- the cost of construction of a locality is Rs. 1
- (a) 595003
 - (b) 595002
 - (c) 595001
 - (d) 595000

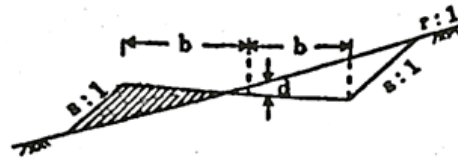
Q17. Estimate of?

- (a) Voltage
- (b) Number of points
- (c) Number of appliances
- (d) Power

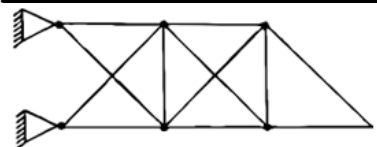
Q18. Calculate the quantity of the earth works in cubic meter for a canal embankment of 100 m long having cross section areas at the two sections are 20 square meters and 80 square meters. Use trapezoidal method.

- (a) 2000
- (b) 5000
- (c) 7000
- (d) 10000

Q19. The cross-section of a road partly in banking and partly in cutting is shown in the following figure, the area of the shaded portion is:



- (a) $\frac{1}{2} \times \frac{(b-rd)^2}{r-s}$
- (b) $\frac{1}{3} \times \frac{(b-rd)^2}{r-s}$
- (c) $\frac{1}{2} \times \frac{(b+rd)^2}{r-s}$
- (d) $\frac{1}{3} \times \frac{(b+rd)^2}{r-s}$



- (a) 2
- (b) 3
- (c) 4
- (d) 5

for the analysis

- (a) Equilibrium
- (b) Compatibility
- (c) Consistent deformation
- (d) Kani's method

- (a) Moment distribution method
- (b) Slope deflection method
- (c) Method of consistent deformation
- (d) Kani's method

Q23. Static indeterminacy of a beam fixed at both the ends is:

- (a) 6
- (b) 3
- (c) 2
- (d) 1

Q24. Moment distribution method of structural analysis is applicable to:

- (a) Stable but statically indeterminate structure
- (b) Stable but statically determinate structures
- (c) Unstable but statically indeterminate structure
- (d) Unstable but statically determinate structures

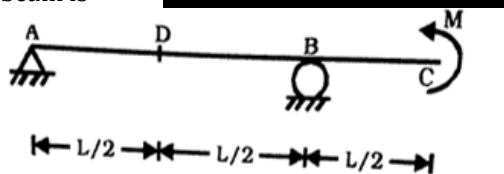
Q25. The unit of elastic modulus is the same as those of

- (a) Stress, shear modulus and pressure
- (b) Strain, shear modulus and force
- (c) Shear modulus, stress and force
- (d) Stress, strain and pressure

Q26. Which of the following statements is incorrect about Poisson's ratio

- (a) Can be negative
- (b) Can be zero
- (c) Can be positive
- (d) Can be Fraction

Q27. Shear force in a beam is



- (a) Zero
- (b) $2M/L$
- (c) M/L
- (d) $3M/L$

Q28. In an experiment, the bulk modulus of a material is equal to the modulus of elasticity. Poisson's ratio is.

- (a) 0.125
- (b) 0.250
- (c) 0.375
- (d) 0.500

Q29. The ratio of actual evapo-transpiration to potential evapo-transpiration is in the range

- (a) 0.0 to 0.4
- (b) 0.6 to 0.9
- (c) 0 to 1
- (d) 1.0 to 2.0

Q30. If area of the catchment is 62.5sq. km and axial length of the catchment is 10km, the form factor will be:

- (a) 0.625
- (b) 0.31
- (c) 6.25
- (d) 1

Q31. For calculating the maximum flood discharge in Northern India by Dicken's formula the value of coefficient 'C' is

- (a) 13.9
- (b) 19.5
- (c) 11.4
- (d) 22.4

Q32. Eutrophication of water bodies is caused by

- (a) Discharge of toxic substances
- (b) Excessive discharge of nutrients
- (c) Excessive discharge of suspended solids
- (d) Excessive discharge of chlorides

Q34.

- (a) Rice
- (b) Maize
- (c) Sugarcane

Q35. If the optimum depth of kor watering for a crop is 100 mm, the outlet factor for the crop for 4 weeks period is

- (a) 200
- (b) 1400

Q36. If the optimum depth of kor watering for a crop is 100 mm, the outlet factor for the crop for 120 days period is 1400 hect/cumec, then delta (Δ) for the crop is

- (a) 740 mm
- (b) 843 mm
- (c) 949 mm
- (d) 1056 mm

Q37. The maximum irrigation requirement of rice crop is exhibited its

- (a) Maximum delta value
- (b) Maximum duty value
- (c) Minimum duty value
- (d) None of the above

Q38. If the sediment size is 0.81 mm the silt factor will be -

- (a) 1.721
- (b) 1.010
- (c) 0.900
- (d) 1.584

Q39. One of the benefits of lining water canals for irrigation is that, it:

- (a) Helps increase the command area
- (b) Increases potential chances of beaching
- (c) Increases channel cross section
- (d) Increases seepage of water

Q40. A one dimensional flow is one which

- (a) Is uniform
- (b) Is steady
- (c) Takes place
- (d) Involves zero

Q41. A pitot tube is used to measure

- (a) Pressure
- (b) Difference in pressure
- (c) Velocity of flow
- (d) None of these.

Q42. The property of stream function ψ is:

- (a) ψ is constant everywhere on any stream line
- (b) The flow around any path in the fluid is zero for continuous flow
- (c) The velocity vector may be found by differentiating the stream function
- (d) All the above.

Q43.

The compressibility of the fluid is given as $5 \times 10^{-11} \text{ Pa}^{-1}$. What is the Bulk Modulus (GPa) of fluid?

- (a) 25
- (b) 20
- (c) 15
- (d) 10

Q44. If the volume of a liquid weighing 3000 kg is 4 cubic meters, 0.75 is its

- (a) Specific weight
- (b) Specific mass
- (c) Specific gravity
- (d) None of these

Q45. A liquid compressed in cylinder has a volume of 0.04 m^3 at 50 N/cm^2 and a volume of 0.039 m^3 at 150 N/cm^2 . The bulk modulus of elasticity of liquid is:

- (a) 400 N/cm^2
- (b) 4000 N/cm^2
- (c) 40000 N/cm^2
- (d) 40 N/cm^2

Q46.

- (a) Free surface
- (b) Free surface
- (c) Free surface
- (d) Free surface

Q48. Com

- (a) Piezometric head
- (b) Piezometric head
- (c) Piezometric head
- (d) Piezometric head

Q49.

- (a) Both 1 and 2
- (b) Both 1 and 2
- (c) Both 1 and 2
- (d) Both 1 and 2

Q50.

- (a) Pitot tube
- (b) Pitot tube
- (c) Single column manometer with mercury
- (d) Bourdon gauge

Q50. A water supply scheme has to be designed for a city having a population of 100,000 people. If the average consumption is 250 lpcd the estimated average daily draft is -

- (a) 35 MLD
- (b) 25 MLD
- (c) 45 MLD
- (d) 15 MLD

Q51. The rate of demand of water per capita per day for population between 50,000 to 2,00,000 is –

- (a) 110 to 150 litres
- (b) 180 to 210 litres
- (c) 150 to 180 litres
- (d) 210 to 240 litres

Q52. The population forecasting method which that is based on the assumption that the percentage increase in population from one decade to the other decade remains constant is called.....

- (a) Incremental increase
- (b) Geometrical increase
- (c) Arithmetical increase
- (d) Decrease rate of growth

Q53. The Bus for fire demand

- (a) $7500\sqrt{P}$
- (b) $3182\sqrt{P}$
- (c) $4637\sqrt{P}$
- (d) $5663\sqrt{P}$

Q54. Turbidity (water), and o

- (a) MPN
- (b) NTU
- (c) Moles
- (d) Grams

Q55. Workabi

- (i) Time of tra
- (ii) Water cem
- (iii) Grading of
- (iv) Strength of
- (v) Aggregate
- (a) (ii), (iii), (v)
- (b) (ii), (iii)
- (c) (iii), (iv), (v)
- (d) (i), (ii), (iv)

Q56. Presence

- (a) Gives smoo
- (b) Gives more
- (c) improves strength
- (d) reduces strength

Q57. If Q is the total quantity of water required by a town per year in litres, and P is the population of the town, then the per capita demand of water will be:

- (a) $\frac{2Q}{P \times 270}$
- (b) $\frac{2Q}{P \times 365}$
- (c) $\frac{Q}{P \times 365}$
- (d) $\frac{Q}{P \times 270}$

Q58. What is the peak factor of population above 2 lakh?

- (a) 1.0
- (b) 1.9
- (c) 3.9
- (d) 2.0

Q59. The most common constiuents of alkalinity in natural water are measured by titrating the water sample with 0.02 N H₂SO₄ using _____.

- (a) Phenolphthalein and methyl orange indicators
- (b) Ferroin and phenolphthalein indicators
- (c) Methyl orange and erichrome black-T indicators
- (d) Erichrome black-T and Ferrion indicators

Q60. From the engineering point of view, sandstone and

from the round

- (a)
- (b)
- (c) V
- (d) Fr

Q62. The stretched elastic to _____.

- (a) Viscosi
- (b) Capillar

Q63. The Central Pollution Control Board of India functions under the

- (a) Ministry of Environment, Forest and Climate Change
- (b) Ministry of Science and Technology

Q64. The environmental building block in estimating construction labour estimates?

- (a) Work hour unit rates per quantity
- (b) Project quantities
- (c) Project owner
- (d) Crew mix

Q65. The theory for the time rate of one-dimensional consolidation is NOT based on which of the following assumptions?

- (a) The clay layer is homogeneous
- (b) The compression of the soil layer is due to the change in volume only
- (c) Darcy's Law is valid
- (d) The clay layer is not saturated

Q66. For calculation of volume of earthwork, which of the following formulas assumes that short lengths in parabolic arcs are considered as parallel to each other?

- (a) Trapezoidal rule formula
- (b) Average area formula
- (c) Mid-section formula
- (d) Simpson's rule formula

Q67. For laminar flow through pipes, the Reynolds number should be:

- (a) Greater than 4000
- (b) 2000 to 3000
- (c) Less than 2000
- (d) 3000 to 4000

Q68. In which of the following is not required?

- (a) Compulsory
- (b) Buying and
- (c) Security of
- (d) A government

Q69. According to the equivalent shear stress theory, the equivalent shear stress is given by

WHERE

V_u = SHEAR
 V_E = EQUIVALENT SHEAR
 T_u = TORSIONAL MOMENT

b = breadth of

- (a) $V_e = V_u + T_u/b$
- (b) $V_e = V_u + 1.6 b/T_u$
- (c) $V_e = V_u - 1.6 T_u/b$
- (d) $V_e = V_u + 1.6 T_u/b$

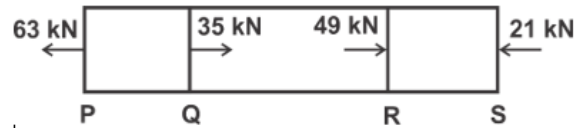
Q70. For which of the following materials is the Poisson's ratio unity?

- A. Steel
- B. Copper
- C. aluminium
- D. cast iron
- (a) only A
- (b) only B
- (c) only C
- (d) None of these

Q71. Percentage reduction of area in performing tensile test on cast iron may be of the order of

- (a) 50%
- (b) 25%
- (c) 0%
- (d) 15%

Q72. A cross-sectional bar of area 700 mm² is subjected to an axial load as shown in the figure below what is the value of stress (MPa) in the section QR



- (a) 30
- (b) 40
- (c) 50
- (d) 60

Q73. On the application of a given load, the length of a wire is stated to increase by 1 mm. if the same force is now applied to a wire of same material but of the length and diameter of the first wire, the increase in length would be

- (a) $4Wl/\pi d_1 d_2 E$
- (b) $4WEI/\pi d_1 d_2$
- (c) $\pi WEI/4d_1 d_2$
- (d) $\pi Wl/4d_1 d_2 E$

Q74. When a block of ice floating on water in a container melts, the level of water in the container will

Q75. In a 2-D flow field, the streamlines are defined as -

- (a) $U = \frac{\partial \phi}{\partial x}$ and $V = \frac{\partial \phi}{\partial y}$
- (b) $U = \frac{-\partial \phi}{\partial x}$ and $V = \frac{-\partial \phi}{\partial y}$
- (c) $U = \frac{-1 \partial \phi}{\partial x}$ and $V = \frac{\partial \phi}{\partial y}$
- (d) $U = \frac{\partial \phi}{\partial x}$ and $V = \frac{-\partial \phi}{\partial y}$

Q77. A pitot-static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 16 m and static pressure head 13.5 m. the velocity of flow is - (Velocity co-efficient = 0.98)

- (a) 5.34 m/s
- (b) 5.5 m/s
- (c) 6 m/s
- (d) 6.86 m/s

Q90. Which of the following statements related to Money Bills is **not** correct?

- (a) It cannot be introduced in the Council of States
- (b) If any question arises whether the Bill is Money Bill or not, the decision of the Speaker is final
- (c) In case of deadlock over a Money Bill, the president can summon a joint sitting of the Parliament
- (d) A Money Bill cannot be introduced except on the recommendation of the president

Q91. Where is the Headquarter of Amnesty International?

- (a) New York
- (b) London
- (c) Paris
- (d) Geneva

Q92. Who is the

- (a) Abul Kalam
- (b) Abdul Kalam
- (c) Arundhati
- (d) Chetan Bha

Q93. Prime M

first phase of t

recently. The a

- (a) Manohar P
- (b) Rajiv Gand
- (c) Sushma Sw
- (d) Arun Jaitle

Q94. Prime M

project under

supplies to a

disasters or h

project?

- (a) Aarogya N
- (b) Aarogya Vi
- (c) Aarogya M
- (d) Aarogya V

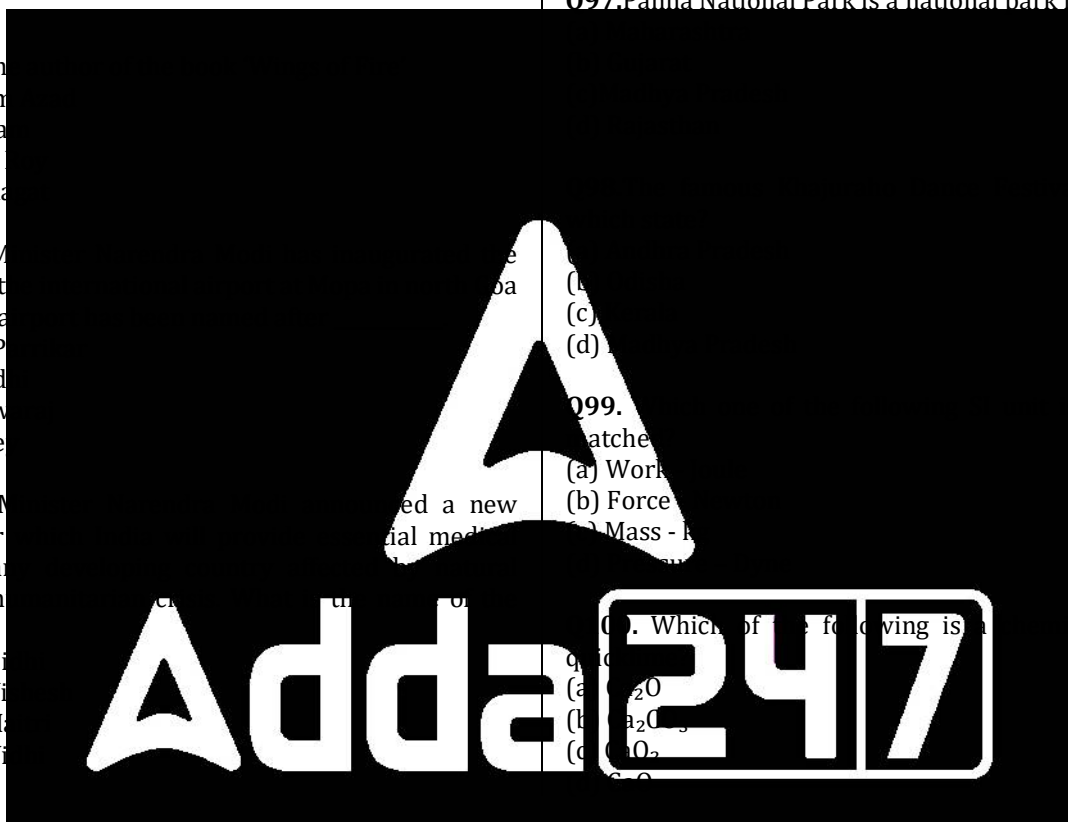
Q95. In which battle was Siraj-ud-Daulah defeated by Lord Clive?

- (a) Battle of Plassey
- (b) Battle of Buxer
- (c) Battle of Panipat
- (d) Battle of Haldighati

Q96. NASA's Dragonfly mission to explore Titan is scheduled for launch in 2027. What is Titan?

- (a) Jupiter's Moon
- (b) Constellation
- (c) Saturn's Moon
- (d) Sun's Aurora

Q97. Panna National Park is a national park located in-



Solutions

S1. Ans.(d)

Sol.

$$\begin{aligned}\text{Combined correction (C)} &= -0.06735 d^2 \\ &= -0.0673 \times 3.4^2 \\ &= 0.77798 \text{ m} \\ &\approx 0.8 \text{ m}\end{aligned}$$

S2. Ans.(d)

Sol.

$$\begin{aligned}\text{Sag correction (C}_s\text{)} &= \frac{w^2 l}{24 P_m^2} \\ C_s &= \frac{30^2 \times 100}{24 \times 200^2}\end{aligned}$$

$$\begin{aligned}&= \frac{30 \times 30 \times 100}{24 \times 200 \times 200} \\ &= \frac{9}{24 \times 2 \times 2} = \frac{9}{48 \times 2} = 0.09375 \approx 0.1 \text{ (negative)}\end{aligned}$$

Measured length of tape = 100 m

Correct length of tape = 100 - 0.1
= 99.9 m

S3. Ans.(d)

Sol.

Critical hydraulic gradient,

$$\begin{aligned}i_c &= \frac{G-1}{1+e} = \frac{2.67-1}{1+0.78} \\ &= 0.938\end{aligned}$$

S4. Ans.(c)

S5. Ans.(c)

Sol.

$$\frac{\text{Horizontal stress}}{\text{Vertical stress}} = \frac{\sigma_h}{\sigma_v} = K$$

K = Earth pressure coefficient.

S6. Ans.(c)

Sol.

By taking single drainage in field slab,

$$\text{In lab, } (T_v)_{90} = C_v \frac{t}{d^2}$$

$$\frac{(T_v)_{90}}{C_v} = \frac{4 \text{ hrs}}{(20 \times 10^{-3})^2}$$

$$\text{In field, } (T_v)_{90} = C_v \frac{t}{d^2}$$

$$t = \frac{(T_v)_{90}}{C_v} \times d^2 = \frac{4}{(10 \times 10^{-3})^2} \times 4^2$$

$$t = 18.26 \text{ years}$$

Note : Answer is not matching, hence try assuming double drainage in laboratory.

$$\text{In lab, } (T_v)_{90} = C_v \frac{t}{d^2} = C_v \times \frac{4 \text{ hrs}}{(10 \times 10^{-3})^2}$$

$$\text{In field, } (T_v)_{90} = C_v \frac{t}{(4m)^2}$$

$$t = \frac{(T_v)_{90}}{C_v} \times (4m)^2 = \frac{4}{(10 \times 10^{-3})^2} \times 4^2$$

$$= 73.059 \text{ years}$$

Alternatively,

$$t \propto H^2$$

$$\frac{t_{\text{field}}}{t_{\text{lab}}} = \left(\frac{H_{\text{field}}}{H_{\text{lab}}} \right)^2$$

$$H_{\text{lab}} = \frac{20}{2} = 10 \text{ mm}$$

$$\therefore t_{\text{field}} = \left(\frac{4 \times 10^3}{10} \right)^2 \times \frac{4}{24 \times 365} = 73 \text{ years}$$

S7. Ans.(c)

Sol.

$$B_f = 1.5 \text{ m. } B_p = 0.3 \text{ m, } S_p = 8 \text{ mm}$$

For cohesionless soil,

$$\frac{s_f}{s_p} = \left\{ \frac{B_f(B_p + 0.3)}{B_p(B_f + 0.3)} \right\}^2$$

$$S_f = 8 \left\{ \frac{1.5(0.3 + 0.3)}{0.3(1.5 + 0.3)} \right\}^2$$

$$= 22.22 \text{ mm}$$

S8. Ans.(c)

S9. Ans.(c)

Sol.

Maximum shear strain (γ_{xy})

$$\frac{\gamma_{xy}}{2} = \frac{\epsilon_1 - \epsilon_2}{2}$$

$$\gamma_{xy} = 100 \times 10^{-6} - (-200 \times 10^{-6})$$

$$= 300 \times 10^{-6}$$

S10. Ans.(a)

Sol.

we know that, the torsion equation

$$\frac{\tau}{r} = \frac{\tau}{r} = \frac{G\theta}{L}$$

$$\frac{T}{J} = \frac{\tau}{r} \quad \left[J = \frac{\pi}{32} d^4 \right]$$

$$\frac{T}{\frac{\pi}{32} d^4} = \frac{\tau}{d/2}$$

$$\tau = \frac{16T}{\pi d^3}$$

$$d^3 = \frac{16T}{\pi \tau}$$

$$d = \sqrt[3]{\frac{16T}{\pi \tau}}$$

S11. Ans.(d)

Sol.

$$\text{Euler's buckling load } P_{Cr} = \frac{\pi^2 EI}{l_e^2}$$

For having both End fixed [$l_e = l/2$]

$$P_{Cr} = \frac{\pi^2 EI}{(l/2)^2} = \frac{4\pi^2 EI}{l^2}$$

For having end fixed and the other end free,

$B(l_e = 2l)$

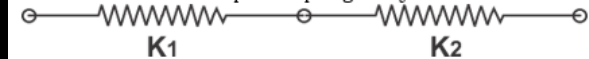
$$P_{Cr} (\text{one fixed or free}) = \frac{\pi^2 EI}{l_e^2} = \frac{\pi^2 EI}{(2l)^2} = \frac{\pi^2 EI}{4l^2}$$

$$\text{Ratio} = \frac{P_{Cr}(\text{both fixed})}{P_{Cr}(\text{one end free one fixed})} = \frac{4\pi^2 EI/l^2}{\pi^2 EI/4l^2} = 16$$

S12. Ans.

Sol.

Let stiffness of the composite spring be K_e



K_1 and K_2 are two springs connected in series for series combination,

$$\delta_c = \delta_1 + \delta_2$$

$$\frac{W}{K_e} = \frac{W_1}{K_1} + \frac{W_2}{K_2}$$

$$K_e = \frac{K_1 K_2}{K_1 + K_2}$$

But,

$$W_1 = W_2 = W$$

$$\frac{1}{K_e} = \frac{1}{K_1} + \frac{1}{K_2}$$

$$K_e = \frac{K_1 K_2}{K_1 + K_2}$$

S13. Ans.(b)

Sol.

1 m³ of dry volume of cement mortar is 0.3 m³ of wet volume of cement mortar.

Proportion of cement mortar = 1:4

$$\text{Quantity of cement in } 1\text{m}^3 = \frac{0.30 \times 1}{5} = 0.06 \text{ m}^3$$

S14. Ans.(b)

Sol.

$$\frac{\text{Cost of labour}}{\text{Cost of building}} = 25\% \text{ or } \frac{1}{4} \text{ or } 0.25$$

S15. Ans.(d)

Sol. Center line method → This method is suitable for symmetrical cross-sections like circular, hexagonal and other geometric shapes. This method is suitable for walls have the same thickness. In this method the center line for each type worked out and then multiplied by the breadth and depth of respective item to get the total quantity.

S16. Ans.(d)

Sol.

Given, Plinth area = 350 m^2

Rate per sq. meter = $1700/\text{m}^2$

Total cost = $350 \times 1700 = 595,000 \text{ Rs.}$

S17. Ans.(b)

Sol. Estimate of number of of total cost of

S18. Ans.(b)

Sol.

Given,

$$A_1 = 20 \text{ m}^2$$

$$A_n = 80 \text{ m}^2$$

Interval (d) = 100m.

Volume of earthwork (V) by trapezoidal method →

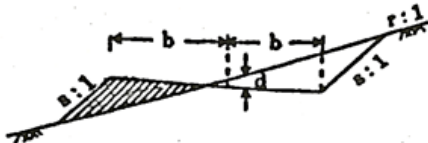
$$V = d \left[\left(\frac{A_1 + A_n}{2} \right) + A_2 + A_3 + \dots \right]$$

$$= 100 \left[\frac{20 + 80}{2} \right]$$

$$V = 5000 \text{ m}^3$$

S19. Ans.(a)

Sol.



$$\text{The area of shaded portion or area of filling} = \frac{1}{2} \times \frac{(b-rd)^2}{r-s}$$

$$\text{The area of unshaded portion or area of cutting} = \frac{1}{2} \times \frac{(b+rd)^2}{r-s}$$

S20. Ans.(a)

Sol.

$$\text{No. of members (m)} = 12$$

$$\text{No. of external reactions (r}_e\text{)} = 4$$

$$\text{No. of joints (j)} = 7$$

$$\text{Degree of static indeterminacy (D}_s\text{)} = m + r_e - 2j$$

$$= 12 + 4 - (2 \times 7)$$

$$D_s = 2$$

S21. Ans.(d)

Sol. The condition required to be satisfied for the analysis of indeterminate structure are equilibrium, compatibility and force-displacement relationship.

S22. Ans.(c)

Sol.

Method comes under displacement methods are-

→ slope deflection method

→ moment distribution method

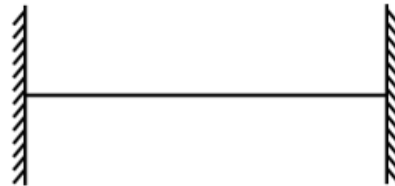
→ Kani's method

→ Minimum potential energy method.

S23. Ans.(b)

Sol.

Fixed beam →



$$\text{Static indeterminacy (D}_i\text{)} = r - 3$$

$$= 6 - 3$$

$$D_i = 3$$

S24. Ans.

Sol. Moment applicable for analysis is

S25. Ans.(a)

Sol. For modulus and procedure and unit is N/mm^2 . Elastic modulus is

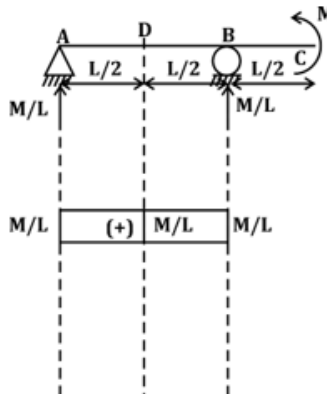
S26. Ans.(a)

Sol. The Poisson's ratio is a property of material which cannot be negative.

$$0 \leq \mu \leq 0.5$$

S27. Ans.(c)

Sol.



$$R_A + R_B = 0$$

$$\sum M_A = 0$$

$$M + R_B \times L = 0$$

$$R_B = -\frac{M}{L}$$

$$R_A = \frac{M}{L}$$

S28. Ans.(a)

Sol.

Given bulk modulus (K) = Shear modulus (G)

Now,

$$\text{Poisson's ratio } (\mu) = \frac{3K-2G}{6K+2G} = \frac{3-2}{6+2} = \frac{1}{8} = 0.125$$

S29. Ans.(c)

Sol.

Ratio of Actual evapotranspiration (AET) & Potential evapotranspiration (PET) equal to zero to one.

$$\text{Aridity Index} = \frac{\text{PET} - \text{AET}}{\text{PET}}$$

S30. Ans.(a)

Sol.

Area of Catchment = 62.5 mm²

Axial length = 10 mm

$$\text{Form factor} = \frac{\text{basin area}}{(\text{basin length})^2}$$

$$= \frac{62.5}{10 \times 10}$$

$$= 0.625$$

S31. Ans.(c)

Sol.

Dicken Formula

$$Q = CA^{3/4}$$

Q → discharge

C → Constant

A → Area

Area	C
(1) North India	11.5
(2) Madhya India	14-19.5
(3) Western ghat	22-25

S32. Ans.(b)

Sol.

Eutrophication - When a body of water becomes overly enriched of water with mineral & nutrients which induces excessive growth of algae.

S33. Ans.(b)

Sol.

$$\text{Irrigation efficiency} = \frac{\text{water actually utilized by growing crops}}{\text{water deliver from source}}$$

S34. Ans.(c)

Sol. Sugarcane has longest base period in regards to irrigation.

→ Depth of water is 120 cm in sugarcane.

190 mm.

$$\Delta = 15.12 \text{ cm} = 0.1512 \text{ metres}$$

$$B = 4 \text{ week}$$

$$= 28 \text{ day}$$

$$D = \frac{8.64B}{\Delta}$$

$$= \frac{8.64 \times 28}{0.1512}$$

$$D = 1600 \text{ hectare/cumec}$$

S36. Ans.

S37. Ans.(c)

Maximum irrigation requirement means how much irrigation required for given area also called duty of this crop. it's unit of measurement is hectare per cumec.

→ For rice maximum irrigation requirement of is exhibited by its minimum duty values...

S38. Ans.(d)

Sol.

$$\text{Silt factor } (f) = 1.75 \sqrt{dmm}$$

$$f = 1.75 \sqrt{0.81}$$

$$f = 1.575$$

Sol.

Advantage of canal lining

- (i) Seepage reduction
- (ii) Prevention of water logging
- (iii) Increase in commanded area
- (iv) Increase in channel capacity
- (v) less maintenance
- (vi) safety against flood.

S40. Ans.(d)

Sol. A one dimensional flow is one in which all the flow parameters expressed as function of time and one space coordinate only (say X - direction).

S41. Ans.(c)

Sol. A pitot tube is a device which is used to measure velocity of flow or velocity at a point while differential manometer measure pressure difference between two points.

S42. Ans.(d)

Sol. The properties of stream function are-

→ Ψ is constant everywhere on any stream line.

→ The rate of change of Ψ with distance in an arbitrary direction, is proportional to the component of velocity normal to that direction.

→ The flow around any path in the fluid is zero for continuous flow.

→ The velocity of flow is perpendicular to the stream function.

S43. Ans.(b)

Sol.

Given,

$$\text{Compressibility } (\beta) = 5 \times 10^{-11} \text{ Pa}^{-1}$$

We know,

$$\text{Compressibility } (\beta) = \frac{1}{\text{Bulk Modulus (K)}}$$

$$K = \frac{1}{5 \times 10^{-11}}$$

$$K = 2 \times 10^{10} \text{ Pa}$$

$$[K = 20 \text{ GPa}]$$

S44. Ans.(c)

Sol.

Given,

$$\text{Weight of liquid (W)} = 3000 \text{ kg}$$

$$\text{Volume of liquid (V)} = 4 \text{ m}^3$$

$$\text{Density of liquid } (\rho) = \frac{W}{V} = \frac{3000}{4} = 750 \text{ kg/m}^3$$

$$\text{Specific gravity (G)} = \frac{\text{Density of liquid } (\rho)}{\text{Density of water } (\rho_w)}$$

$$= \frac{750}{1000}$$

$$= 0.75$$

S45. Ans.(b)

Sol.

Bulk modulus

$$K = - \frac{\Delta P}{\Delta V/V}$$

$$K = - \left[\frac{0.04 \times [150 - 50]}{0.039 - 0.04} \right] = 4000 \text{ N/cm}^2$$

S46. Ans.(d)

Sol. All options are correct, we all are aware already with this fact that sea water contains dissolved salt, dissolved air and some suspended matters which increase its specific weight as compare to pure water.

S47. Ans.(a)

Sol.

There are two conditions

(i) If curvature is convex, r is positive $P > P_{sat}$

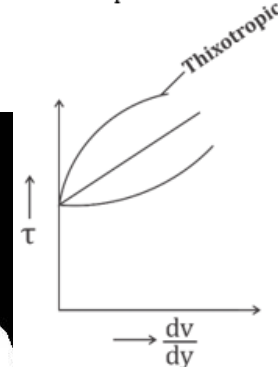
(ii) If curvature is concave, r is negative $P < P_{sat}$.

S48. Ans.(b)

Sol.

Piezometer is not able to measure pressure below ambient.

Thixotropic fluid- its viscosity decreases with time

**S49. Ans.(c)**

Sol.

For this case. It is used to measure the pressure which ranges 0.6 bar to 4 bar.

S50. Ans.(c)

Given, Population = 100,000

Average consumption = 250 lpcd

Average daily draft = 100,000 × 250

$$= 25 \times 10^6 \text{ l.}$$

$$= 25 \text{ MLD}$$

Sr.no.	Population	Per capita demand in l/day person
1.	Less than 20,000	110
2.	20,000 – 50,000	110-150
3.	50,000 – 2 lakh	150 – 240
4.	2 lakh – 5 lakh	240-275
5.	5 lakh – 10 lakh	275-335
6.	More than 10 lakh	335-360

S52. Ans.(b)

Sol.

Geometric increase method: - in this method the rate of growth of population is assumed to be constant.

$$P_n = P_0 \left(1 + \frac{r}{100} \right)^n$$

Where P_n = population after n no. of decades

r = rate of growth

P_0 = Initial population

N = no. of decades

S53. Ans.(d)

Sol.

Buston formula for estimating water required for fire demand $Q = 5663\sqrt{P}$

Where $Q = l/min.$

$P =$ population (in thousands)

S54. Ans.(b)

Sol. As per GOI, the turbidity of water is measured in NTU (Nephelometric turbid unit). The permissible limit of turbidity in drinking water is 1-10 NTU.

S55. Ans.(b)

Sol. Workability of concrete depends upon water cement ratio and grade of concrete. As the water cement ratio increases. Workability of concrete increases.

S56. Ans.(d)

Sol. The water strength of concrete is affected by the presence of impurities from oil, acid, alkali, etc. The strength of concrete is reduced.

S57. Ans.(c)

Sol.

Given, total quantity of water = Q

Population = P

Time = 1 year

$$\text{Per capita demand of water} = \frac{Q}{P \times 365}$$

S58. Ans.(d)

Sol.

Population	Peak factor
Up to 50,000	3
50,000 to 2 lakh	2.5
More than 2 lakh	2.0

S59. Ans.(a)

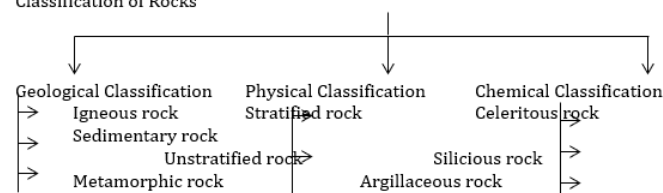
Sol.

Alkalinity is defined as the concentration of all ions in the water which are capable to neutralizing the acid. It is determined by titrating the water sample with $0.02N H_2SO_4$ using phenolphthalein and methyl orange indicators.

S60. Ans.(d)

Sol.

Classification of Rocks



Igneous rock : Formed by cooling and solidification of Magma and Lava.

Ex.: Granite, Trap, Pegmatite, Dolerite, Rhyolite, Basalt.

Sedimentary rock : Formed by weathering action of existing rocks.

Eg.: Sand Stone, Lime Stone, Shale, Gravel, Lignite etc.

Metamorphic rock : Igneous and sedimentary rocks are undergone considerable change with high pressure and temperature.

Eg.: Marble, Quartzite, Slate.

Stratified rock : Rocks which present in layer by layer

Eg.: All sedimentary rock, slate.

Unstratified rock : Does not show any layer.

They have the

are Calcium

lica.

argillaceous rock as their

main

Ex.: Slate

S61. Ans.

Veneer

the round logs Veneer.

like walnut, tell wood.

Veneers are also used for the construction of paneling board, Bottom boards

agricultural fiber from 6 mm to 12 mm.

Chip board :

These are made up of saw dust, wood chips and synthetic resin or other suitable binder.

These boards are used for partition doors, furniture making etc.

Block board :

Block boards are made up of strip of wood having 25 mm width.

These boards are used for the construction of bus bodies, railway carriage, river craft etc.

These boards are glued to form a slab which is glued between two or more Veneer.

S62. Ans.(c)

Sol.

Surface tension : Surface tension is a phenomenon due to which the exposed liquid behaves like a stretched membrane

- When a liquid is exposed to the air it behaves like a stretched membrane as the water molecule are attracted to each other.

$$\text{Surface tension } (\sigma) = \frac{\text{Force}}{\text{Length}}$$

Unit of surface tension = N/m

- Capillary action is an effect of surface tension that is only applicable to small tube that contain liquids.

S63. Ans.(a)

Sol.

Central Pollution Control Board

→ It is a statutory organisation under the Ministry of Environment, Forest and Climate Change of the Government of India.

→ The CPCB is responsible for monitoring and controlling air and water pollution in the country.

→ It was established in 1974 under the Water (Prevention and Control of Pollution) Act 1974, and later in 1981. It was given additional power under the Air (Prevention and Control of Pollution) Act 1981.

S64. Ans.(c)

Sol.

The fundamental of a building block in estimating construction labour estimate as follows :

- Project quantities
→ It is defined as the quantity used in the project.
- Work hour unit rate per quantity
→ It is a method to estimate the construction cost of quantities completed in one hour.
- Crew mix
→ It is the combination of 72% of skilled worker and 28% of unskilled worker.
→ The size depend upon the type of project, the schedule of the project and the amount of work required to completed.

Note :

Project Owner : Project owner is a person responsible for funding the design, construction operation, and maintenance of a trade project or simple project.

S65. Ans.(d)

Sol.

Assumption of consolidation
Soil is homogeneous
Coefficient of consolidation is constant
Secondary consolidation is negligible
Soil is completely elastic
Darcy's law is applicable
Loading is one dimensional, steady state and flow of water is vertical.

S66. Ans.(d)

Sol.

Simpson's rule :

An arc is assumed to be present between the boundaries of the ordinate. Therefore it is also called parabolic rule.

$$\text{Total area} = \frac{\text{Common distance}}{3} [(1\text{st ordinate} + \text{last ordinate}) + 4(\text{Sum of even ordinate}) + 2(\text{Sum of odd ordinate})]$$

- Limitations of Simpson's rule :
→ It is valid for only odd number of ordinate

Note : It gives more accurate result

Addition Information

- **Trapezoidal Rule**

$$A = \frac{\text{Common distance}}{2} [1\text{st ordinate} + \text{last ordinate} + 2(\text{Sum of other ordinate})]$$

S67. Ans.(c)

Sol.

Laminar flow : It is a type of flow in which fluid flow along stream line and fluid travels smoothly or in regular path.

Reynold's number for different type of flow are given as follows :

	Laminar	Transition	Turbulent
(i) Pipe flow	$R_e < 2000$	$2000 < R_e < 4000$	$R_e > 4000$
(ii) Flow between parallel plates	$R_e < 1000$	$1000 < R_e < 2000$	$R_e > 2000$
(iii) Flow in open channel	$R_e < 500$	$500 < R_e < 2000$	$R_e > 2000$
(iv) Flow through soil	$R_e < 1$	$1 < R_e < 2$	$R_e > 2$

S68. Ans.(d)

Sol. Valuation : It is the process of determining the worth value of an asset, investment, business or company.

It is typically used in finance and accounting to determine the fair market value of an asset and can be based on a variety of factors such as current market conditions, financial performance project earnings etc.

The main purpose of valuation are:

For buying and selling of property

Mortgage value or security of loans

It is also required for insurance

For getting loan of property

For rent fixation

To assess the tax of a property

constructed on
ed.

According to IS 456 : 2000, the expression for equivalent shear stress is given by

$$V_e = V_d + \frac{1.6 T_u}{b}$$

where,

V_e = equivalent shear stress

V_d = Nominal shear stress

T_u = Torsional moment

b = width of beam

Note:

The equivalent bending moment M_{ed} is given by

$$M_{ed} = M_d + \frac{T_u \left(1 + \frac{D}{b}\right)}{1.7}$$

where,

M_{ed} = Equivalent Bending moment

T_u = Torsional moment

D = Overall depth of beam

b = width of beam

M_u = Bending moment at cross-section.

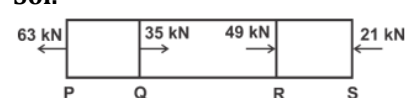
S69. Ans.(d)

Soil is homogeneous
Coefficient of consolidation is constant
Secondary consolidation is negligible
Soil is completely elastic
Darcy's law is applicable
Loading is one dimensional, steady state and flow of water is vertical.

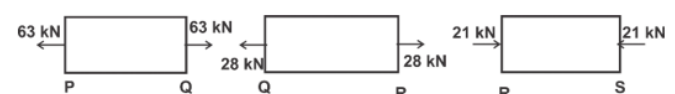
yielding takes place.

S72. Ans.(b)

Sol.



FBD of PQ, QR and RS



Stress in QR section

$$\sigma = \frac{P}{A} = \frac{28 \times 10^3}{700 \times 10^{-6}} = 40 \text{ MPa}$$

S73. Ans.(b)

Sol.

$$\text{extension in will } \delta l = \frac{PL}{AE}$$

$$\delta l = 1 \text{ mm}$$

$$\text{Now, } P' = P, L = 2L, A = \frac{\pi}{4} (2d)^2, E' = E$$

$$\delta l' = \frac{P' L'}{A' E'} = \frac{P \cdot 2L}{\frac{\pi}{4} [4d^2] \times E}$$

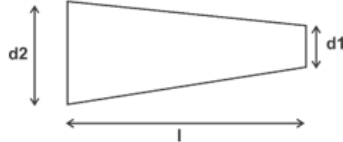
$$= \frac{2}{4} \times \frac{PL}{AE} = \frac{1}{2} \delta l$$

$$= \frac{1}{2} \times 1 = 0.5 \text{ mm}$$

S74. Ans.(a)

Sol.

Extension of a tapered bar



$$\delta l = \frac{4WL}{\pi d_1 d_2 E}$$

S75. Ans.(d)

Sol. When ice level of water volume of displaced submerged in volume is also

S76. Ans.(b)

Sol.

For velocity potential function
Velocity component in x-direction,

$$u = \frac{-\partial \phi}{\partial x}$$

velocity component in y-direction,

$$v = \frac{-\partial \phi}{\partial y}$$

S77. Ans.(d)

Sol.

Given:

Stagnation pressure head (h_{st}) = 16 m

Static pressure head (h_s) = 13.5 m

Effective head (h) = $h_{st} - h_s$

$$= 16 - 13.5$$

$$= 2.5 \text{ m}$$

We know that,

$$\text{Velocity of flow (V)} = C_v \sqrt{2gh}$$

$$= 0.98 \sqrt{2 \times 9.81 \times 2.5}$$

$$= 0.98 \times 7.0035 = 6.86 \text{ m/s}$$

S78. Ans.(b)

Sol.

Given:

Dia of orifice (d_o) = 75 mm

Dia of Vena-contracta (d_v) = 60 mm

Or

Dia of jet

We know that,

$$\text{Co-efficient of contraction, } C_c = \frac{\text{area of vena-contracta or Area of jet}}{\text{Area of orifice}}$$

$$= \frac{\frac{\pi}{4} (60)^2}{\frac{\pi}{4} (75)^2}$$

$$= 0.64$$

S79. Ans.(d)

Sol.

Momentum correction factor is the ratio of momentum rate based on the actual velocity to the momentum rate based on average velocity. It is denoted by ' β '.

$$\beta = \frac{\text{Momentum rate based on the actual velocity}}{\text{Momentum rate based on the average velocity}}$$

The value of momentum correction factor for laminar flow is 1.33.

The value of momentum correction factor for turbulent flow is 1.02-1.05.

a) **Weir** : It is a low head dam which act as a barrier across the width of a river that alters the flow characteristics of water and usually results in a change in height of river level.

b) **Notch** : It is a device used for measuring the rate of flow of a liquid through a small channel.

• It is an opening provided in the side of tank such that the liquid surface in tank is below the top edge of opening.

c) **Regulator** :

• Discharge can be regulated through regulator.

• The structures constructed at the head of the canal is termed as canal head regulator and its purpose is to control the supplies of water and entry of silt into the off-taking canal.

d) **Orifice** : It is a device which is used for measuring the discharge.

Harappan sites Kalibangan used bricks in ample
the construction of houses.

S82. Ans.(a)

Sol. In 1717, French subsidiary was introduced by the British East India Company the right to regulate trade in the
freely, except

Sol. INC did not take part in the first Round table Conference. In the First Round Table Conference, Dr. B.R. Ambedkar demanded separate electorates for the depressed classes.

S84. Ans.(b)

Sol. The subsidiary Alliance System was first introduced by the French East India Company Governor Joseph Francois Dupleix. It was later used by British Lord Wellesley who was the Governor-General of India from 1798 to 1805. Early in his governorship, Lord Wellesley adopted a policy of non-intervention in the princely states.

S85. Ans.(b)**Sol.**

- ② La-Nina is a coupled ocean-atmosphere phenomena which is a counterpart of El-Nino. When it occurs, the sea surface temperature across the Pacific Ocean decreases by 3 to 5-degree Celsius than normal.
- ② It affects the Pacific Ocean by cooling down the temperature of water.

S86. Ans.(d)**Sol.**

- ② The Earth's atmosphere has a series of layers, each with its own unique characteristics.
- ② Going away from the ground level, these levels are called troposphere, stratosphere, mesosphere and thermosphere.

S87. Ans.(a)

Sol. 82°30'E is the longitude of the Meridian of Indian Standard Time (Pradesh). Indian Standard Time is based on the longitude of Pradesh, Madhya Pradesh.

S88. Ans.(b)

Sol. The idea of a Fundamental Rights was borrowed from the American Constitution. Interestingly, the American Constitution has 10 Fundamental Rights, while the Indian Constitution has 6.

S89. Ans.(a)

Sol. The 86th Amendment to the Indian Constitution gave a constitutional right to free and compulsory education. The Act inserts a new Article 51A, which states that it is the duty of every citizen to provide for the education of his children or ward between the age of 6 to 14 years to the right to free and compulsory education.

S90. Ans.(c)**Sol.**

- If any question arises as to whether a Bill has been introduced in the Lok Sabha or not, the decision shall be taken by the Speaker.
- A money Bill can only be introduced in the Lok Sabha and that too on the recommendation of the president.
- There is no chance of any disagreement between the two Houses and hence, there is no provision of a joint sitting of both the Houses in this regard.

S91. Ans.(b)**Sol.**

- Headquarter - London, United Kingdom
- Amnesty International is a non-governmental organization with its headquarters in London, the United Kingdom focused on human rights.
- It was founded by Peter Benenson.
- It was founded in July 1961.

S92. Ans.(a)**Sol.**

- 'Agni Ki Udan' or 'Wings of Fire' book was written by APJ Abdul Kalam.
- APJ Abdul Kalam was born on 15th October 1931 at Rameswaram, Tamil Nadu
- His nickname was 'Missile Man'.
- He was sworn in as India's 11th President in 2002

S93. Ans.(a)

Sol. Prime Minister Narendra Modi inaugurated Mopa International Airport in Goa, which has been named after former Chief Minister Manohar Parrikar.

S95. Ans.(a)

Sol. The Battle of Plassey was fought on June 23, 1757, between the British and the French.

S96. Ans.(c)

Sol. Titan is the largest moon of Saturn. It is the second-largest moon in the Solar System.

- It is larger than Mercury.

S97. Ans.(c)

Sol. Panna National Park is a national park located in Panna and Chhatarpur districts of Madhya Pradesh.

S98. Ans.(d)

Sol. Khajuraho dance festival, organized by the Madhya Pradesh Kala Parishad, is a one-week-long festival of classical dances held annually against the spectacular backdrop of the magnificently lit Khajuraho temples in Chhatarpur district of Madhya Pradesh state in central India.

S99. Ans.(d)

Sol. The SI unit that is not correctly matched in the given options is:

(d) Pressure - Dyne

The correct SI unit for pressure is the Pascal (Pa), not the Dyne. The Dyne is a unit of force in the centimeter-gram-second (CGS) system, whereas the Pascal is the unit of pressure in the International System of Units (SI).

S100. Ans.(d)

Sol. The chemical formula for quicklime is CaO . Quicklime, also known as calcium oxide, is a white, caustic, alkaline crystalline solid that is commonly used in various industrial applications, such as in the production of steel, and as a flux in the steel-making process.

- Ca_2O_3 Calcium oxide with oxygen which is not as an oxygen

- Ca_2CO_3 : Calcium carbonate is a common compound found in minerals such as limestone, marble, and chalk. It is often used in construction materials, as a dietary supplement, and in the production of cement and lime.

