



UPPSC AE

Civil Engineering

Mega Mock Test Paper - 2

(May 23th - May 24th 2022)

Questions &
Solutions

1. The SI unit of kinematic viscosity is:
- A. m/s^2
 - B. m^2/s
 - C. m^3/s^2
 - D. $kg/m-s$

Ans. B

Sol. SI unit Kinematic viscosity = m^2/sec
SI unit Dynamic viscosity = $kg/m-sec$

2. Calculate the hydraulic mean radius using Manning's equation for a trapezoidal channel to carry 200 cumec discharge laid at a slope of 30cm/km with side slope 1.5 : 1 at flow velocity of 2m/sec. Take rugosity factor of 0.017.
- A. 2.07 m
 - B. 3.75 m
 - C. 2.75 m
 - D. 1.57 m

Ans. C

Sol. $v = \frac{1}{n}(R)^{2/3}(s)^{1/2}$

$$S \Rightarrow 30\text{cm} / \text{km} \Rightarrow \frac{30}{100000} = \frac{3}{10000}$$

$$n = 0.017$$

$$v = 2\text{m/sec}$$

$$\text{So, } 2 = \frac{1}{0.017}(R)^{2/3}\left(\frac{3}{10000}\right)^{1/2}$$

$$R = 2.75\text{m}$$

3. The force exerted by a static fluid on a vertical, horizontal or an inclined plane surface that is immersed depends on the
- A. Density of the liquid, area of the immersed surface and depth of the centre of gravity of the immersed surface
 - B. Density of the liquid only
 - C. Area of the immersed surface
 - D. Density of the liquid and area of the immersed surface.

Ans. A

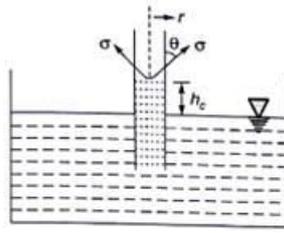
Sol. Using the Archimedes principle

4. Which of the below is the desired property of the manometric fluid?
- A. High surface tension
 - B. High density
 - C. Low density
 - D. Low surface tension

Ans. B

Sol. Manometric fluid shall have high density so that small height difference can predict a large difference in pressure across the manometer.

5. An incompressible fluid (kinematic viscosity, $7.4 \times 10^{-7} m^2/s$, specific gravity = 0.88) is held between two parallel plates. If the top plate is moved with a velocity of 0.5 m/s while the bottom one is held stationary, the fluid attains a linear velocity profile in the gap of 0.5 mm between these plates; the shear stress in Pascals on the surfaces of top plate is



13. In connection with a gradually varied flow with notations Y_o = normal depth, Y_c = critical depth and Y = depth in the gradually varied flow, match list-I with list-II and select the correct answer using the codes given below the lists :

List-I

- a. $Y_c > Y_o > Y$
- b. $Y_o > Y > Y_c$
- c. $Y > Y_c > Y_o$
- d. $Y > Y_o > Y$

List-II

- 1. M1
- 2. S3
- 3. M2
- 4. S1

Code:

- | | |
|--------------------|--------------------|
| A. a-4 b-1 c-2 d-3 | B. a-2 b-3 c-4 d-1 |
| C. a-4 b-3 c-2 d-1 | D. a-2 b-1 c-4 d-3 |

Ans. B

- Sol. a - 2
 b - 3
 c - 4
 d - 1

14. When the depth of flow changes abruptly over a short distance, then the flow will be termed as:

- | | |
|------------------------|--------------------------|
| A. Rapidly varied flow | B. Unsteady flow |
| C. Turbulent flow | D. Gradually varied flow |

Ans. A

Sol. When the depth of flow changes abruptly over a short distance, then the flow will be termed as Rapidly varied flow.

15. A rectangular channel will be most economical when the flow depth and bottom width are in the ratio:

- | | |
|----------|----------|
| A. 2 : 1 | B. 1 : 1 |
| C. 1 : 2 | D. 1 : 4 |

Ans. C

Sol.

Ans. D

Sol. Classification of hydraulic jump

Froude number	Type of jump
1.8 – 1.7	undular
1.7 – 2.5	weak
2.5 – 4.5	oscillating
4.5 – 9.0	steady
> 9.0	strong

21. In a tank or channel, notch is provided to measure:

- A. Velocity
- B. Discharge
- C. Pressure
- D. Static energy

Ans. B

Sol. Notches are used to measure discharges in tanks or channels.

22. The specific speed (N_s) of a pump is given by the expression

- A. $N_s = \frac{N\sqrt{Q}}{H_m^{5/4}}$
- B. $N_s = \frac{N\sqrt{P}}{H_m^{3/4}}$
- C. $N_s = \frac{N\sqrt{Q}}{H_m^{3/4}}$
- D. $N_s = \frac{N\sqrt{P}}{H_m^{5/4}}$

Ans. C

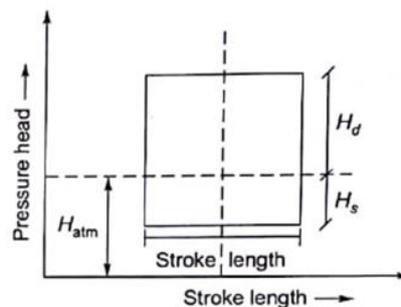
Sol. Specific speed for pumps is defined as the speed which produces 1 cumec of discharge under a head of 1 m for geometrically similar turbine.

23. A graph between the pressure head in the cylinder and the distance travelled by the piston from inner dead centre for one complete revolution of crank is known as

- A. Slip diagram
- B. Crank diagram
- C. Polar diagram
- D. Indicator diagram

Ans. D

Sol. Indicator diagram shows variation of pressure head with stroke length.



24. A 6 hour storm with intensities of 5, 7, 12, 20, 16 and 2 mm/hr produced a runoff of 30 mm. Then f-index is

- A. 6.25 mm/hr
- B. 5.33 mm/hr
- C. 6.00 mm/hr
- D. 5.00 mm/hr

Ans. A

Sol. Given, runoff = 30 mm

Assume f-index is < 2 mm/hr

$$\therefore \sum(i - \phi)t = R$$

$$(5 - \phi) \times 1 + (7 - \phi) \times 1 + (12 - \phi) \times 1 + (20 - \phi)$$

$$\times 1 + (16 - \phi) \times 1 + (2 - \phi) \times 1 = 30$$

$$60 - 6\phi = 30$$

$$6\phi = 30$$

$$\phi = \frac{30}{6} = 5.33 \text{ mm/hr} > 2 \text{ mm/h}$$

\therefore Our assumption is wrong

Assuming ϕ -index

$$5.33 < \phi < 7 \text{ mm/hr}$$

$$\therefore \sum(i - \phi)t = R$$

$$(7 - \phi) \times 1 + (12 - \phi) \times 1 + (20 - \phi) \times 1 + (16 - \phi)$$

$$\times 1 = 30$$

$$55 - 4\phi = 30$$

$$4\phi = 25$$

$$\phi = 6.25 \text{ mm/hr (o.k.)}$$

Our assumption is right.

25. The most suitable chemical which can be applied to the water surface for reducing evaporation is

A. methyl alcohol

B. ethyl alcohol

C. cetyl alcohol

D. butyl alcohol

Ans. C

Sol. properties of suitable chemical:

i. It should easily spread over water body.

ii. It should be stable and very less reactive.

iii. Non toxic and insoluble in water.

26. The slope area method is extensively used in:

A. Development of rating curve

B. Estimation of flood discharge based on high water marks

C. Cases where shifting control exists

D. Cases where backwater effect is present

Ans. B

Sol. In this method, we find the discharge with the help of Manning's equation

This equation is used to relate the depth at either ends of river reach to the flowing discharge in that reach and in this way by knowing the depth, we find out the discharge.

27. Which one of the following is a linear reservoir?

A. In which storage volume varies linearly with time since initiation of rainfall excess

B. In which outflow rate varies linearly with storage

C. In which release varies linearly with inflow rate

D. In which storage volume varies linearly with water surface elevation

Ans. B

Change in ground storage, $\Delta_s = AxdxS_y$

$$90 \times 10^6 = 100 \times 10^6 \times 5 \times S_y$$

$$S_y = 0.18$$

31. The following rainfall data refers to station P and R which are equidistant from station:

	Station P	Station Q	Station R
Long term normal annual rainfall in mm	150	240	200
Annual rainfall for the year 1980 in mm	105	X	180

The value of X will be

- A. 180 mm
- B. 192 mm
- C. 216 mm
- D. 204 mm

Ans. B

Sol. As the normal precipitation of other stations P and R are not within 10% of normal precipitation Q.

Annual precipitation at station P in year 1980, $P_p = 105$ mm

Normal precipitation at station P, $N_p = 150$ mm

Annual precipitation at station R in year 1980, $P_R = 180$ mm

Normal precipitation at station R, $N_R = 200$ mm

Annual precipitation at station Q in year 1980, $P_Q = X$

Normal precipitation at station Q, $N_Q = 240$ mm

Number of additional station chosen, $m = 2$

Then by Normal ratio method

$$X = P_Q = \frac{N_Q}{m} \left(\frac{P_p}{N_p} + \frac{P_R}{N_R} \right)$$

$$X = \frac{240}{2} \left(\frac{105}{150} + \frac{180}{200} \right)$$

$$X = 192 \text{ mm}$$

32. The flow-mass curve is an integral curve of

- A. The hydrograph
- B. The S-curve
- C. The flow-duration curve
- D. The unit-hydrograph

Ans. A

Sol. The flow mass curve is the integration of the hydrograph and therefore represents the area under the hydrograph from one time to another.

33. A unit hydrograph has

- A. One unit of time base of direct runoff.
- B. One unit of rainfall duration.
- C. One unit of direct runoff.
- D. One unit of peak discharge.

Ans. C

Sol. The unit hydrograph of a drainage basin is defined as a hydrograph of direct runoff resulting from 1cm of effective rainfall applied uniformly over the basin area at a uniform rate during a specified period of time.

34. The peak of flood hydrograph due to a 3 h duration isolated storm in a catchment is 270 m³/s. The total depth of rainfall is 5.9 cm. Assuming an average infiltration loss of 0.3 cm/h and a constant base flow of 20 m³/s, estimate the peak of the 3 h unit hydrograph of this catchment?

- A. 70 m³/s
- B. 50 m³/s
- C. 30 m³/s
- D. 10 m³/s

Ans. B

Sol. Duration of rainfall excess = 3 hr

Loss at the rate of 0.3 cm/hr for 3 hr = 0.9 cm

Total depth of rainfall = 5.9 cm

Rainfall excess = 5.9 – 0.9 = 5.0 cm

Peak of flood hydrograph = 270 m³/s

Peak of DRH = 250 m³/s

Base flow = 20 m³/s

$$\text{Peak of 3 h unit hydrograph} = \frac{\text{Peak of DRH}}{\text{Rainfall excess}} = \frac{250}{5} = 50 \text{ m}^3/\text{s}$$

35. A canal is 80 km long and has an average width of 15 m. A USWB class A pan installed near the canal indicated an evaporation of 5 mm/day. The volume of water evaporated from this canal in a month of 30 days would be _____ hectare?

- A. 10.6 ha-m
- B. 12.6 ha-m
- C. 14.9 ha-m
- D. 19.4 ha-m

Ans. B

Sol. Volume $V_E = A \times C_p \times E_p$

$$V_E = 80 \times 1000 \times 15 \times 0.7 \times \frac{5}{1000} \times 30$$

$$V_E = 126000 \text{ m}^3$$

$$V_E = 12.6 \text{ ha-m}$$

36. The water which can be utilized by the crops from the soil is called

- A. Field capacity water
- B. Hygroscopic water
- C. Capillary water
- D. None of the above

Ans. C

Sol. Hygroscopic water is in general not available for plant use.

Field capacity is defined as the maximum amount of moisture which can be held by a soil against gravity.

Capillary water induce greater water holding capacity which can be utilized by crops from the soil.

37. Critical velocity ratio for use in Kennedy’s theory is:

- A. Less than 1
- B. More than 1
- C. Equal to 1
- D. All of the above

Ans. D

Sol. Kennedy introduced a factor to account for the type of soil through which the canal has to pass. This factor is known as Critical velocity Ratio (CVR)

$$\text{Equation for modified critical velocity} = V_0 = 0.55 m d^{0.64}$$

d = depth of water in channel

m = critical velocity ratio

Sand coarser than standard were assigned value of m between 1.1 and 1.2

Sand finer than standard were assigned value of m between 0.9 and 0.8.

38. The normal annual rainfall of the stations A, B, C and D in a catchment is 82 mm, 91 mm, 85 mm, and 90 mm respectively. In the year 2007, the station D was inoperative when stations A, B and C recorded annual rainfall of 91 mm, 72 mm and 80 mm. Estimate the missing rainfall at station D in the year 2007.

- A. 90 mm
- B. 85 mm
- C. 81 mm
- D. 78 mm

Ans. C

Sol. Normal precipitation of all the station A, B and C are within 10% of that at station D.

$$10\% \text{ of } 90 \text{ mm} = 9 \text{ mm}$$

$$\text{Range} = 90 \pm 9 = 99 \text{ or } 81$$

Hence simple arithmetic average will be used for missing data of station D in year 2007.

$$P_D = \frac{91 + 72 + 80}{3} = 81 \text{ mm}$$

39. Find SAR value of the given sample:

$$[Na^+] = 345 \text{ mg/l}, [Ca^{2+}] = 60 \text{ mg/l}, [Mg^{2+}] = 18 \text{ mg/l}$$

- A. 20
- B. 10
- C. 5
- D. 0

Ans. B

$$\text{Sol. Sodium absorption ratio (SAR)} = \frac{Na^{2+}}{\sqrt{\frac{Ca^{2+} + Mg^{2+}}{2}}}$$

Where $[Na^+]$, $[Ca^{2+}]$ and $[Mg^{2+}]$ is represented in meq/l

$$\text{Concentration in meq/l} = \frac{\text{given weight in mg/l}}{\text{equivalent weight in g}}$$

$$[Na^+] \text{ in meq/l} = \frac{345 \text{ mg/l}}{23 \text{ g}} = 15 \text{ meq/l}$$

$$[Ca^{2+}] \text{ in meq/l} = \frac{60 \text{ mg/l}}{20 \text{ g}} = 3 \text{ meq/l}$$

$$[Mg^{2+}] \text{ in meq/l} = \frac{18 \text{ mg/l}}{12 \text{ g}} = 1.5 \text{ meq/l}$$

$$\text{Sodium absorption ratio (SAR)} = \frac{15}{\sqrt{\frac{3+1.5}{2}}} = 10$$

40. Which one of the following is NOT a cause of water logging?
- A. Excess tapping of the ground water.
 - B. Frequent irrigation.
 - C. High water table.
 - D. Seepage from unlined canals.

Ans. A

Sol. Water logging refers to the saturation of soil with water. Soil may be regarded as waterlogged when it is nearly saturated with water much of the time such that its air phase is restricted and anaerobic conditions prevail. Causes of water logging are frequent irrigation, high water table, seepage from unlined canals, etc.

41. The DBL of a canal and the HFL of a drain at their crossing point are 120m and 110m respectively. The adopted cross drainage work here, will be a
- A. Siphon
 - B. Aqueduct
 - C. Super passage
 - D. Siphon aqueduct

Ans. B

Sol. In case of aqueduct, HFL of the drainage should remain lower than the level of the underside of canal trough.

42. The hydraulic structure, which allows the drainage water to join the canal water to augment canal supplies, is called
- A. Module
 - B. Canal outlet
 - C. Canal inlet
 - D. Level crossing

Ans. C

Sol. An inlet is an open cut or a pipe which is provided in a canal bank to pass the drain water into the canal.

43. Calculate the permanent wetting point if the depth of water in the root zone at the permanent wilting point per meter depth of soil is 0.4 m. the dry density of the soil is 16 kN/m³
- A. 0.025
 - B. 0.245
 - C. 0.4
 - D. 0.64

Ans. B

Sol.

$$d_w = \frac{\gamma_d}{\gamma_w} \times d \times PWP$$

Given,

$$d_w = 0.4 \text{ m}, d = 1 \text{ m}, \gamma_d = 16 \text{ kN/m}^2, \gamma_w = 9.81 \text{ kN/m}^2$$

So,

$$0.4 = \frac{16}{9.81} \times 1 \times PWP$$

$$\text{So, } PWP = 0.245$$

The various equations developed by Lacey are applicable to channels which has attained final regime.

Silt charge and silt grade have not been defined properly by Lacey.

48. The reception signal is
- A. outer signal only
 - B. starter only
 - C. neither (outer signal) nor (starter)
 - D. both (outer signal) and (starter)

Ans. A

Sol. Reception signals are outer signals and departure signals are starter and advance starter.

49. As per ICAO, for A and B type of airports, maximum effective grade is
- A. 1.75%
 - B. 1.5%
 - C. 1.25%
 - D. 1%

Ans. D

Sol. As per ICAO, Maximum effective gradient for A, B and C type is 1% and for D and E type is 2%.

50. The capacity of parallel runway system depends primarily on
- A. lateral spacing between two runways
 - B. distance from terminal
 - C. Slopes of adjacent areas
 - D. Length of runways

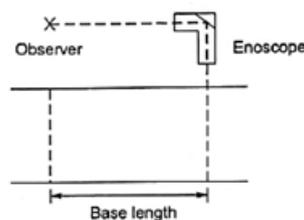
Ans. A

Sol. Capacity of parallel runway system depends primarily on lateral spacing between two runways.

51. Enoscope is used to find
- A. space-mean speed only
 - B. spot speed only
 - C. spot speed and space-mean speed
 - D. flow of vehicles only

Ans. B

Sol.



It measures spot speed.

52. The length of transition curve is dependent on
- A. rate of change of superelevation
 - B. rate of change of centrifugal acceleration

- C. both rate of change of superelevation and rate of change of centrifugal acceleration
- D. neither rate of change of superelevation nor rate of change of centrifugal acceleration

Ans. C

Sol. length of transition curve depends both on rate of change of superelevation and rate of change of centrifugal acceleration.

53. Which of the following is used in a regular pavement maintenance activity?

- A. Tack coat
- B. Prime coat
- C. Fog seal
- D. None of these are correct

Ans. C

Sol. A fog seal is a light application of a diluted slow setting asphalt emulsion to the surface of an aged (oxidized) pavement surface. Fog seals are low cost and are used to restore flexibility to an existing pavement surface.

54. The road length of National Highway by Third Road Plan Formulae, in a certain district in India having its area as 13,400 sq.m will be

- A. 1340 km
- B. 2680 km
- C. 4020 km
- D. 10988 km

Ans. D

Sol. As per 3rd 20 yr plan

Total length of road (km) = maximum {4.74 × (Number of towns + villages) Road density × Area

We know that,

For 3rd 20 yr plan

Road density = 82 km/100 km²

Given, Area = 13,400 sq.km

$$\text{Total length of road} = \left(\frac{82 \times 13400}{100} \right)$$

= 10988 km

55. The maximum utility system is based on the concept of

- A. Maximum utility per unit cost of road
- B. Maximum utility per unit length of road
- C. Maximum utility per unit population
- D. None of the above

Ans. B

Sol. Maximum utility system is based on the concept of maximum utility per length of road.

To choose from different alternatives of road projects, utility units are given to different alternatives based on (1) population and (2) productivity. The combined utility units are then divided by the road length.

The alternative with highest value is taken up.

Sol. IRC specification for carriage way width

Single lane - 3.75 m

Two lane, no kerbs - 7.0m

Two lane raised kerbs - 7.5 m

Intermediate carriage - 5.5 m

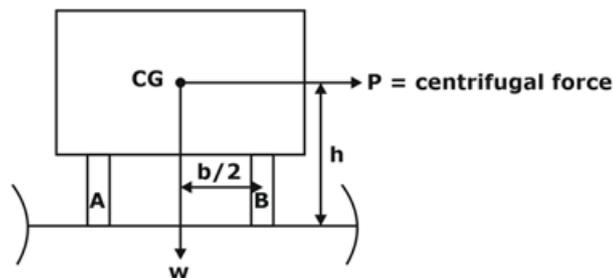
Multilane - 3.5 m per lane

60. The centrifugal force is assumed to act at a height of _____ above the level of the carriageway of the bridge

- A. 1 m
- B. 1.2 m
- C. 1.5 m
- D. 1.75 m

Ans. B

Sol.



Centrifugal force passes through the CG of the vehicle.

The height h is take as 1.2 m according to IS code

61. _____ loading is adopted on all roads on which permanent bridges and culverts are constructed.

- A. IRC Class A
- B. IRC Class AA
- C. IRC Class B
- D. IRC Class AB

Ans. A

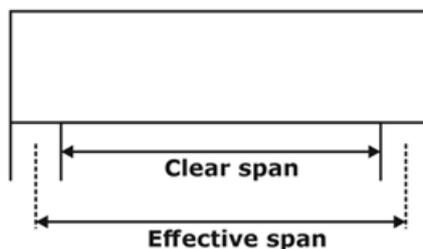
Sol. IRC class A loading is adopted on all roads on which permanent bridge and culverts are constructed.

62. The centre - to centre distance between any two adjacent supports is called the _____ of a bridge.

- A. Span
- B. Clear span
- C. Nominal span
- D. Effective span

Ans. D

Sol.



63. The method used to control the amount of dust where use of water while drilling may be impracticable or undesirable is
- A. Dry system
 - B. Vacuum hood system
 - C. Control system
 - D. Absorption system

Ans. B

Sol. To remove dust, if water can not be used, then we use vacuum to suck out the dust.

64. In compressed air tunneling, the amount of air required per minute per m² of face area is
- A. 1 m³/min/m²
 - B. 6 m³/ min/ m²
 - C. 10 m³/ min/ m²
 - D. 20 m³/ min/ m²

Ans. B

Sol. Compressed air tunneling:

- The recent method of tunneling using compressed air is very useful in many soft and water bearing soils.
- In this method compressed air is forced into the enclosed space which is made air light through locks.
- The air pressure required to force back the percolating water or water mixed soil and keep the tunnel dry varies with the nature of ground and the depth of the cover.

65. Which of the following is true in case of railway track maintenance?
- A. Shovel is used to lift rail while Rail tongs is used to handle ballast
 - B. Rail tongs is used to lift rail while Shovel is used to handle ballast
 - C. Shovel can be used to correct track alignment as well as to lift rail
 - D. Rail tongs can be used to handle ballast as well as to remove dog spikes

Ans. B

Sol. Rail tongs are used to lift rails. They are designed to handle all standard size rails. Tongs are provided with no slip machined diamond face gripping pads. Shovel is a tool used for lifting and moving small material. In railways it is used to handle ballast.

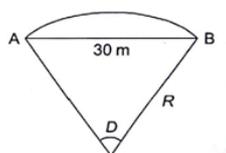
66. One degree of curve is equivalent to
- A. $\frac{1600}{R}$
 - B. $\frac{1700}{R}$
 - C. $\frac{1720}{R}$
 - D. $\frac{1820}{R}$

Ans. C

Sol. Degree of curve is defined as the central angle to the ends of an arc or chord of agreed length standard chord length used in railways and highways is 30m

Since $R \gg 30m$

$$\overline{AB} \approx \widehat{AB}$$



- A. Industrial water > river water > tap water > bottled water
- B. Tap water > bottled water > river water > industrial water
- C. Bottled water > tap water > river water > industrial water
- D. River water > industrial water > tap water > bottled water

Ans. A

Sol. Bottled water is the most treated water, hence BOD value for it is the least. Same goes for tap water but it may contain some impurities and hence its BOD is slightly higher than bottled water. Between industrial water and river water industrial water has high BOD value because of heavy chemical concentration.

76. Sedimentation is the process related to

- A. Floating material in rivers
- B. Bed material carried by flowing water
- C. Cutting land for channeling
- D. Seepage into Embankments

Ans. B

Sol. Sedimentation refers to settling down of particles in still water but if the water is in motion, the sediments may flow with it.

77. Slow sand filters require

- A. Finer sand
- B. Coarser sand media
- C. Medium sand media
- D. Any type of sand media

Ans. A

Sol. Slow and filter has less D_{10} value so it requires Finer sand. Also Finer sand will help in better cleaning of water.

78. The gaseous pollutants such as hydro carbons and carbon monoxides can be effectively controlled by

- A. Combustion or incineration
- B. Electrostatic precipitators
- C. Gravity settling chambers
- D. Fabric filters

Ans. A

Sol. Combustion (or incineration) units:

- Combustion as a process is used to purify polluted gases, only when the admixed pollutants are oxidisable to inert gases. Hydrocarbons and carbon monoxide (CO) can be easily burnt, oxidised and removed.
- For efficient combustion to occur, it is necessary to have the proper combination of four basic elements-oxygen, temperature turbulence and time.

79. According to ambient air quality standard in respect of noise (MOEF) mention noise limits for silence zone in day time

- A. 40 dB (A) Leq
- B. 45 dB (A) Leq
- C. 50 dB (A) Leq
- D. 75 dB (A) Leq

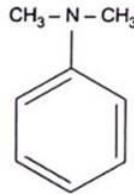
Ans. C

Sol. Acceptable noise level is 50 dB for silence zone in day time.

80. The common chemical used in solution form to remove SO₂ gaseous pollutant is
- A. Dolomite
 - B. Dimethylaniline
 - C. Aluminium Oxide
 - D. Sodium Oxide

Ans. B

Sol. Dimethylaniline (DMA) is an organic chemical compound, a substituted derivative of aniline.



81. Minimum size of the solid particulates that can be removed in a settling chamber can be calculated using
- A. Stoke's law
 - B. Darcy's law
 - C. Henry's law
 - D. Newton's law

Ans. A

Sol. Stoke's law gives settling velocity of a spherical particle in a viscous medium.

$$V_s = \frac{(\gamma_s - \gamma_w) d^2}{18\mu}$$

From this we can determine minimum size of solid particulates that can be removed in a settling chamber.

82. 'Methemoglobinemia' disease to children is caused due to excess presence of
- A. Nitrates
 - B. Nitrites
 - C. Free ammonia
 - D. Albuminoid nitrogen

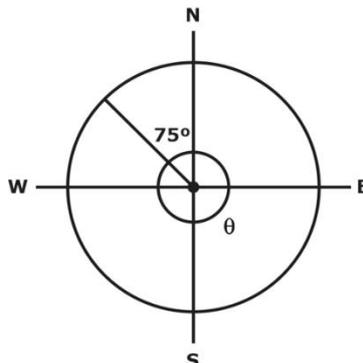
Ans. A

Sol. Nitrates are fully oxidized nitrogen compounds. They don't possess any threat in adults but if present in concentration more than 45 mg/l cause a disease called methemoglobinemia in small children. Due to this disease, the color of baby changes to blue and hence it is also known as blue baby diseases.

83. The reduced bearing of a line is N 75° W. Its whole circle bearing is
- A. 75°
 - B. 95°
 - C. 15°
 - D. 285°

Ans. D

Sol. Given, reduced bearing of a line is N 75°W.



Whole circle bearing = $\theta = 360 - 75^\circ = 285^\circ$

84. In surveying total station can be used to measure
- A. Horizontal angle
 - B. Vertical angle
 - C. Sloping distance
 - D. All of the above

Ans. D

Sol. A total station is an optical instrument commonly used in construction, surveying and civil engineering. It is useful for measuring. Horizontal angles, vertical angles and distance.

* It does this by analyzing the slope between itself and a specific point.

85. Systematic Errors are those
- A. Whose effects are cumulative and can be eliminated
 - B. Which cannot be recognized
 - C. Whose character is not understood
 - D. Whose effect in recognized but character is not understood

Ans. A

Sol. Systematic errors are repetitive type of errors caused by instrumental defects. These errors are cumulative because of repetition and can be eliminated.

86. Consider the following assumptions of Bowditch method:
- 1) Angular measurements are more precise than linear measurements
 - 2) Linear measurements are more precise than angular measurements
 - 3) Error in linear measurements are proportional to square root of its length.
 - 4) Correction to latitude or departure of any side = Total error in L (or) D \times length of the line/perimeter of the traverse

Which of these statements are correct?

- A. 3 and 4
- B. 1, 2 and 3
- C. 2, 3 and 4
- D. 1 and 3

Ans. A

Sol. Assumptions of Bowditch method.

→ Angular & linear measurements taken as some precision.

→ Errors in linear measurement is directly proportional to \sqrt{l} .

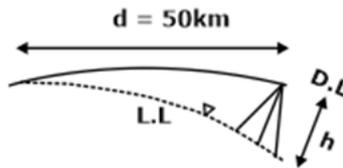
→ Errors in angular measurement are inversely proportional to \sqrt{l} .

→ Correction to attitude or departure of any side

= Total error in L or D \times $\left(\frac{\text{length of that side}}{\text{perimeter of traverse}} \right)$

So, option (A) is correct

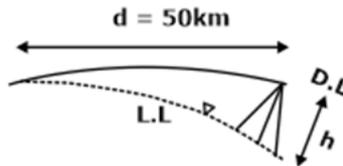
87. A lighthouse is visible just above the horizon at a certain station at the sea level. The distance between the station and the lighthouse is shown in figure. Value of h is ____.



- A. 168.25 m
- B. 33 .65 m
- C. 179.35 m
- D. 287.50 m

Ans. A

Sol. (A) 168.25



Consider lower is at horizon and it will be just visible after considering curvature correction & refraction correction, i.e. combined correction.

$$C = h = 0.0673 \text{ k}$$

Where, dis distance in km

h is height of object.

Given distance is 50 km.

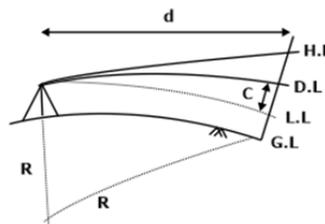
So, height, $h = 0.0673 (50)^2$

$$h = 168.25\text{m}$$

88. The combined correction due to curvature and refraction (in m) for distance of 1 km on the surface of the earth is _____.
- A. 0.763
 - B. 0.673
 - C. 7.63
 - D. 0.0673

Ans. D

Sol. Correct option is (d) 0.0673



⇒ Correction due to Earth curvature

$$C_c = \frac{d^2}{2R}$$

$$= \left(\frac{d^2}{2 \times 6370} \right) \times 1000 = 0.0785d^2$$

Which is always negative

⇒ Refraction correction is considered as $\frac{1}{7} C_C$

$$C_R = \frac{1}{7} C_C$$

Always positive.

Total correction $C = -C_C + C_R$

$$= -0.0785d^2 + \frac{1}{7} \times 0.0785d^2$$

$$= 0.0673d^2$$

For $d = 1\text{Km}$

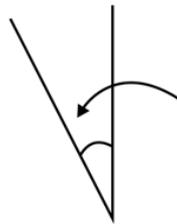
$$C = 0.0673$$

89. The angle between true meridian and magnetic meridian is termed as:

- A. True bearing
- B. Dip
- C. Declination
- D. Local attraction

Ans. C

Sol. Magnetic meridian



True meridian

It can be in east or west side.

90. Head is

- A. Inclination of the fault plane with the vertical.
- B. Inclination of the fault plane with the horizontal.
- C. Inclination of the fault plane in any direction.
- D. None of these

Ans. A

Sol. The head angle is defined as the complement of the dip angle it is the angle between the fault plane and a vertical plane that strikes parallel to the fault.

91. The interior angles of four triangles are given below:

Triangle Interior Angles

P $90^\circ, 40^\circ, 40^\circ$

Q $90^\circ, 55^\circ, 20^\circ$

R $110^\circ, 45^\circ, 35^\circ$

S $140^\circ, 40^\circ, 25^\circ$

Which of the triangles are ill-conditioned and should be avoided in Triangulation surveys?

- A. Both Q and S
- B. Both P and S
- C. Both Q and R
- D. Both P and Q

Ans. A

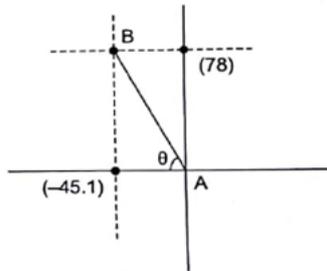
Sol. A well condition triangle has angles not less than and more than 30 and 120 degree.

92. The latitude and departure of a line AB are + 78 m and -45.1 m respectively. The whole circle bearing of the line AB is

- A. 30°
- B. 150°
- C. 210°
- D. 330°

Ans. D

Sol.



$$\begin{aligned} \tan \theta &= \frac{78}{45.1} \\ \Rightarrow \tan \theta &= 1.729 \\ \theta &= 60^\circ \\ \text{WCB} &= 270 + \theta \\ &= 270 + 60^\circ = 330^\circ \end{aligned}$$

93. The poles of the celestial horizon are called

- A. Zenith and Nadir
- B. North and South poles
- C. Perihelion and aphelion
- D. Perigee and apogee

Ans. A

Sol. Poles of celestial horizon are called Zenith and Nadir.

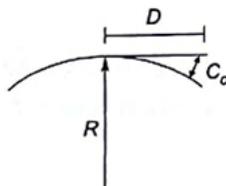
94. In levelling, curvature correction is given by

- A. $C_c = \frac{D^2}{(R)}$
- B. $C_c = \frac{D}{(2R)}$
- C. $C_c = \frac{D^2}{(2R)}$
- D. $C_c = \frac{D}{R}$

Ans. C

Sol.

$$C_c = \frac{D^2}{2R}$$



95. Face right and left observation in theodolite survey, controls error due to

- A. Non-Parallelism of line of sight
- B. Improper graduations
- C. Instrument not being centred
- D. Improper permanent adjustment

Ans. A

Sol. A higher degree precision is achieved during method of repetition because the following errors are eliminated:

- (i) By reading both the verniers errors due to eccentricity of verniers and centres are eliminated.
- (ii) By taking both the faces reading, errors due to the line of sight and the trunnion axis being out of adjustment are eliminated.
- (iii) By taking the reading on the different part of circle, errors due to inaccurate graduations on the main scale are eliminated.

96. When the magnetic declination is $5^{\circ} 20'$ east, the magnetic bearing of the sun at noon will be :
- A. $95^{\circ}20'$
 - B. $174^{\circ}40'$
 - C. $185^{\circ}20'$
 - D. $354^{\circ}40'$

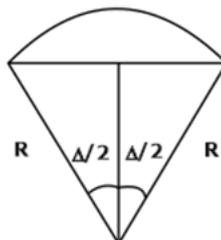
Ans. B

Sol. True bearing of sun at noon = 180°
Since, magnetic declination is towards east
True bearing = $180^{\circ} - 5^{\circ} 20'$
= $174^{\circ}40'$

97. If a radius of a circular curve is 100 m, deflection angle is 90° , the length of long chord is _____.
- A. Zero
 - B. 100 m
 - C. infinity
 - D. 141.42 m

Ans. D

Sol. Correct option (d) 141.42
Given:-



Radius of circular curve = 100m
Deflection angle = $\Delta = 90^{\circ}$
Length of lang chord = ?

$$L = 2R \sin \frac{\Delta}{2}$$

Sol. In a closed traverse sum of included angles should be $(2N-4)$ times right angle, where N represents the number of sides.

101. What is the maximum membership of a state Legislative Assembly?

- A. 400
B. 500
C. 450
D. 550

Ans. B

Sol. Members of a Vidhan Sabha are direct representatives of the people of the particular state as they are directly elected by an electorate consisting of all citizens above the age of 18 of that state. Its maximum size as outlined in the Constitution of India is not more than 500 members and not less than 60 members.

102. River carrying maximum sediment in the world is?

- A. Amazon
B. Nile
C. Brahmaputra
D. Ganga

Ans. C

Sol. Brahmaputra River is carrying maximum sediment in the world. The river suspended sediment load of about 1.84 billion tons per year is the world's highest.

103. Saffron is obtained from

- A. bud
B. leaf
C. flower stigma
D. calyx

Ans. C

Sol. Saffron is obtained from flower's stigma. Saffron is a spice derived from the flower of *Crocus sativus*, commonly known as the "saffroncrocus". The vivid crimson stigmas and styles, called threads, are collected and dried to be used mainly as a seasoning and colouring agent in food.

104. *Shakuntalam* was written by

- A. Kalidas
B. Bhasa
C. Kamban
D. Asvaghosha

Ans. A

Sol. *Shakuntalam* is a well-known Sanskrit play by Kalidasa, dramatizing the story of Shakuntala told in the epic Mahabharata. It is considered to be the best of Kalidasa's works. Its date is uncertain, but Kalidasa is often placed in the period between the 1st century BCE and 4th century CE.

105. Who among the following rulers was also known as 'Lakh Baksh'?

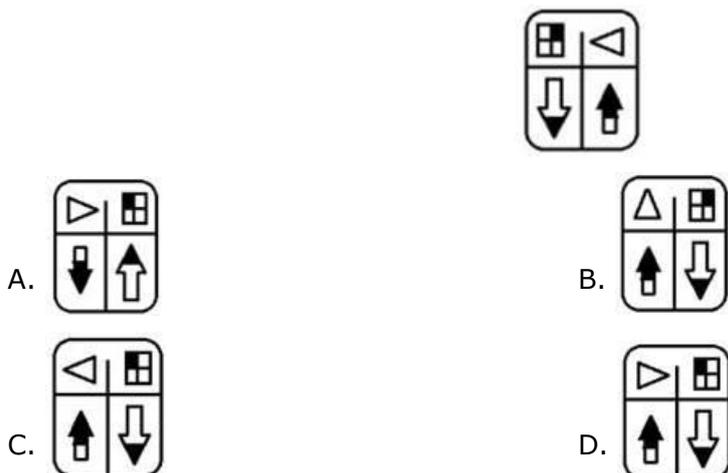
- A. Aram Shah
B. Qutub-ud-din Aibak
C. Ilthumish
D. Sulthana Raziya

Ans. B

Sol. • Qutub-ud-din Aibak was also known as 'Lakh Baksh'. He used to donate large sums of money in charity, thus people used to call him by a new name 'LAKH BAKSH or giver of lakhs.

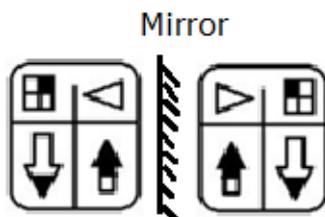
- He founded the Slave Dynasty in 1206 AD.

106. **Select the correct mirror image of the given figure when a mirror is placed on its right side.**



Ans. D

Sol. On close observation we find that the correct mirror image will be:



Hence, option D is the correct answer.

107. Dilwara temples are examples of

- A. Jain architecture
- B. Buddhist architecture
- C. Mughal architecture
- D. Sultanate architecture.

Ans. A

Sol. Dilwara Temples of Rajasthan are popular for their beautiful artistic work. Located near Mount Abu in Rajasthan. Dilwara Temples are considered to be an example of perfect architecture, in terms of Jain Temples. The intricately carved ceilings, entryways, pillars and panels highlight the aesthetic appeal of this temple. Dilwara Temple forms a famous pilgrimage of the followers of Jainism. It was built during the 11th and 13th century.

108. Which fertilizer is highly hygroscopic?

- A. Calcium ammonium nitrate
- B. Sodium nitrate
- C. Ammonium sulphate
- D. Urea

Ans. D

Sol. Urea is a white, granular, solid and slightly hygroscopic fertilizer. It can also be applied in solution form as a spray.

Urea becomes a remarkably hygroscopic substance if the humidity of the air is at relatively high-level.

109. Freedom of speech and expression is not unlimited. It can be restricted on the basis of
- A. threat to national unity and integrity
 - B. disobeying of Parliament and Judiciary or their contempt
 - C. public order, decency and morality
 - D. All of the above

Ans. D

Sol. Freedom of speech and expression is not unlimited. It can be restricted on the basis of threat to national unity and integrity, disobeying of Parliament and Judiciary or their contempt and public order, decency and morality.

110. In a certain code, "COMPREHENSION" is written as "GLQMVBLBRPMLR". How is "ADVENTURES" written in that code?
- A. EAZBRQZOIP
 - B. EAZBRQYOPQ
 - C. AEBZQROYPI
 - D. EAZBRQYOIP
 - E. AEBZRQOYPI

Ans. D

Sol. "COMPREHENSION" is written as "GLQMVBLBRPMLR"
Odd places are increased by +4 while the Even places are decreased by -3
C is preceded by +4 i.e G , O is succeed by -3 i.e L
Similarly "ADVENTURES" is coded as **"EAZBRQYOIP"**

111. Unemployment and poverty estimates in India are based on
- A. NSSO household consumption expenditure survey
 - B. CSO household consumption expenditure survey
 - C. Planning Commission's household consumption expenditure survey
 - D. NSSO family income survey
 - E. None of the above/More than one of the above

Ans. A

Sol. The estimates of poverty and unemployment in India are based on the survey of consumption expenditure of families by NSSO.
National Sample Survey Office was established in the form of a permanent survey organization in the year 1950, so that, a national survey can be conducted to help in socio-economic planning and policy-making.

112. Which one of the following reservoirs is associated with Rihand Project?
- A. Gandhi Sagar
 - B. Govind Ballabh Pant Sagar
 - C. Jawahar Sagar
 - D. Govind Sagar

Ans. B

Sol. Govind Ballabh Pant Sagar is a reservoirs associated with Rihand Project. Rihand project is the most important multi-purpose project in Uttar Pradesh. It is located in the borders of Uttar Pradesh and Madhya Pradesh. It consists of 934 m long and 92 m high straight gravity concrete dam across the Rihand River. It has the capacity to hold 11.4 lakh hectare metres of water. Another dam about 25 km north of the Rihand Dam has been constructed at Obra.

113. Which soil is found in the maximum area in Uttar Pradesh?

- A. Sandy Clay
- B. Red Clay
- C. Alluvial Clay
- D. Red and black mixed clay

Ans. C

Sol. Alluvial soil is found in the maximum area in Uttar Pradesh. This soil is deposited by rivers and best for agriculture. This soil is rich in Potash and humus. Alluvial soils are suitable for rice, wheat, sugarcane etc.

114. Firozabad is famous for which industry?

- A. Silk Industry
- B. Glass making Industry
- C. Leather Industry
- D. Steel Industry

Ans. B

Sol. The city of Firozabad is famous for Glass making industry. It is the center of India's glass blowing industry. Firozabad is known for the quality of the bangle. In Firozabad, Every other family is engaged in making bangles.

115. Which one among the following is called 'Roof of the World'?

- A. Satpura
- B. Pamir
- C. Aravali
- D. Myanmar

Ans. B

Sol. The Pamir Mountains are a mountain goes in Central Asia, at the intersection of the Himalayas with the TianShan, Karakoram, Kunlun, Hindu Kush, Suleman and Hindu Raj ranges. They are among the world's most astounding mountains. Since Victorian occasions, they have been known as the "Top of the World".

116. The sum of the interior angles of a regular polygon is 1260° . What is the difference between an exterior angle and an interior angle of the polygon?

- A. 120°
- B. 105°
- C. 100°
- D. 108°

Ans. C

Sol. The sum of the interior angles of a polygon = $(n - 2) \times 180^\circ$

$$= (n - 2) \times 180^\circ = 1260^\circ$$

$$= n - 2 = 7$$

$$n = 9$$

$$\text{Measure of each interior angle} = 1260^\circ / 9 = 140^\circ$$

$$\text{Measure of each exterior angle} = 360^\circ / n = 360/9 = 40^\circ$$

$$\text{Required difference} = 140^\circ - 40^\circ = 100^\circ$$

117. **Arrange the following words in a logical and meaningful order.**

- 1) Irrigation
- 2) Harvesting
- 3) Seed sowing
- 4) Crop growth
- 5) Fertilizing

- A. Germany
C. Japan
E. Saudi Arabia
- B. Australia
D. Denmark

Ans. B

Sol. * India and Australia on Tuesday signed a letter of intent (LoI) for working towards bringing down the cost of renewable energy (RE) technologies.

* Both the countries will also focus on scaling up the manufacturing of low cost solar and clean hydrogen.

* This was signed during the fourth India–Australia energy dialogue.

* The dialogue was co-chaired by Power and New & Renewable Energy Minister RK Singh and Hon'ble Minister for Energy and Emissions Reduction, Mr. Angus Taylor from the Australian side.

121. With what financial outlay the central government has approved the continuation of a mega police modernisation scheme for five years up to 2025-26?

- A. Rs 16,275 crore
C. Rs 20,275 crore
E. Rs 28,275 crore
- B. Rs 18,275 crore
D. Rs 26,275 crore

Ans. D

Sol. • The central government has approved the continuation of a mega police modernisation scheme for five years up to 2025-26.

- The total financial outlay of the scheme will be Rs 26,275 crore.
- The scheme is being implemented by the Ministry of Home Affairs (MHA) since 1969-70.
- This scheme comprises all relevant sub-schemes that contribute to the modernisation and improvement.

122. Which has become the world's first government to turn 100 per cent paperless?

- A. Dubai
C. Tokyo
E. London
- B. Singapore
D. Riyadh

Ans. A

Sol. * Dubai became the world's first government to turn 100 percent paperless, the announcement was made by the United Arab Emirate (UAE) Crown Prince, Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum.

* It will save around 3 billion Dirham (USD 350 million) and 14-million-man hours.

* A comprehensive digital government services platform is managing all internal, external transactions and procedures of the Government of Dubai.

* The Dubai Paperless Strategy was implemented in five consecutive phases, each entity consisting of a different group of the Dubai Government's entities.

123. Navrang Saini has been assigned the additional charge of the chairperson of which regulatory body?

- A. Insolvency and Bankruptcy Board of India
B. Insurance Regulatory and Development Authority of India

- C. Telecom Regulatory Authority of India
- D. Pension Fund Regulatory and Development Authority
- E. Securities and Exchange Board of India

Ans. A

Sol. * The center has further assigned the additional charge of the chairperson of Insolvency and Bankruptcy Board of India (IBBI) to Navrang Saini.

* The Centre had in Oct last year assigned additional charge of chairperson of IBBI Saini for a period of three months.

* The IBBI Chairperson is appointed by the center on the recommendations of the selection committee headed by the Cabinet Secretary.

* M S Sahoo, who was the first Chairperson of IBBI since October 1, 2016.

124. 83rd National Table Tennis Championships 2022 will be hosted by which state on April 18, 2022?

- A. Sikkim
- B. Manipur
- C. Meghalaya
- D. Arunachal Pradesh
- E. Mizoram

Ans. C

Sol. The 83rd National Table Tennis Championship 2022, which will begin on April 18, 2022, will be held at SAI Indoor Training Centre, NEHU in Shillong Meghalaya.

The Northeast has hosted the world's largest table tennis tournament for the second time. The event also marks the 50th statehood celebration of Meghalaya.

125. Recently, the Uttar Pradesh government has launched a campaign, 'School Chalo Abhiyan' to ensure 100% enrolment in primary and upper primary schools across the state. What is the female literacy rate in Uttar Pradesh according to the Census 2011?

- A. 69.72%
- B. 79.24 %
- C. 59.26 %
- D. 84.56%
- E. 74.53%

Ans. C

Sol. • Uttar Pradesh CM Yogi Adityanath has launched School Chalo Abhiyan to ensure 100% enrolment in primary schools across all districts in the state.

• The campaign has been launched from one of the state's lowest literacy districts, Shravasti.

• Governor of Uttar Pradesh: Anandiben Patel

• Uttar Pradesh literacy rate: 69.72%

• Male - 79.24 %

• Female - 59.26 %
