

1. Plaster of Paris is obtained by calcining \_\_\_\_\_.

- A. bauxite
- B. gypsum
- C. kankar
- D. lime stone

Ans. B.

Plaster is made by heating gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) powder, thus converting it to calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ). The hemihydrate is also known as stucco or Plaster of Paris

2. For the manufacture of Portland cement the proportions of raw material used are \_\_\_\_\_.

- A. lime 63%; silica 22%; other ingredients 15%
- B. silica 22%; lime 63%; other ingredients 15%
- C. silica 40%; lime 40%; other ingredients 40%
- D. silica 70%; lime 20%; other ingredients 20%

Ans. A.

Lime (CaO)	60 to 67%
Silica (SiO <sub>2</sub> )	17 to 25%
Alumina (Al <sub>2</sub> O <sub>3</sub> )	3 to 8%
Iron oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.5 to 6%
Magnesia (MgO)	0.1 to 4%
Sulphur trioxide (SO <sub>3</sub> )	1 to 3%
Soda and/or Potash (Na <sub>2</sub> O+K <sub>2</sub> O)	0.5 to 1.3%

3. To retard the initial setting time of cement, the compound responsible is \_\_\_\_\_.

- A. Tri-calcium silicate
- B. Gypsum
- C. Di-calcium silicate
- D. Tri calcium aluminate

Ans. B.

When needed, clinkers are mixed with 2-5% gypsum to retard the setting time of cement when it is mixed with water.

4. Quick setting cement is produced by adding \_\_\_\_\_.

- A. less amount of gypsum in very fine powdered form

B. more amount of gypsum in very fine powdered form

C. aluminium sulphate in very fine powdered form

D. pozzolana in very fine powdered form

Ans. C.

Quick Setting Cement as the name indicates, these types of cements are used where quick setting is needed. The quick setting cement is manufactured by adding a small percentage of aluminum sulphate and then it is finely grinded with cement. And also for quick setting action a small percentage of gypsum or retarder is added. The aluminum sulphate is mainly added to accelerate the setting time fast.

Initial setting time = 5 minutes

Final setting time = 30 minutes

5. If P is the percentage of water required for normal consistency, water to be added for determination of initial setting time is \_\_\_\_\_.

- A. 0.75 P
- B. 0.75 P
- C. 0.80 P
- D. 0.85 P

Ans. D.

The standard IS 4031 :1988 (Part V) requires the water content to be gauged for determining the setting time of cement by Vicat's Apparatus to be 0.85 P (wherein P is the Percentage of water required to attain Normal Consistency of the said Cement

Normal consistency for initial setting time = 0.85P

Normal consistency for soundness test = 0.78P

6. Pick up the correct statement from the following.

- A. Adding 5% to 6% moisture content by weight, increases the volume of dry sand from 18% to 38%
- B. The bulking of fine sand is more than that of coarse sand
- C. If the percentage content of moisture exceeds 10%, increase in bulk of sand starts increasing
- D. all options are correct

Ans. D.

The increase in moisture of sand increases the volume of sand. The reason is that moisture causes film of water around sand particles which results in the increase of volume of sand. For moisture content

percentage of 5 to 8 there will be an increase in volume up to 20 to 40 percent depending upon sand.

If the sand is finer there will be more increase in volume. This is known as bulking of sand.

7. Strength of cement concrete primarily depends upon \_\_\_\_\_.

- A. quality of water
- B. quantity of aggregate
- C. quantity of cement
- D. water-cement ratio

Ans. D.

The most important factor of determining the strength of concrete is water cement ratio.

It is the ratio of mixing water to that of cement in the mixture. Cement needs water of about 38% by weight for complete hydration.

8. The most valuable timber may be obtained from \_\_\_\_\_.

- A. chair
- B. shisham
- C. sal
- D. teak

Ans. D.

Teak is also resistant to termites, though it is only moderately resistant to marine borers and powder post beetles.

Teak is very expensive.

The reason is that teak is valuable both for its elegance and its durability

9. The timber having maximum resistance against white ants is obtained from \_\_\_\_\_.

- A. chair
- B. shisham
- C. Sal
- D. teak

Ans. D.

Because its smell of this tree is not favorable to white ants or termites

10. Due to attack of dry rot, the timber \_\_\_\_\_.

- A. cracks
- B. shrinks
- C. reduces to powder
- D. none of these

Ans. C.

Dry rot is the term given to brown rot decay caused by certain fungi that deteriorate timber in buildings and other wooden construction without an apparent source of moisture.

Dry rot is caused by the attack of certain fungi which break down the wood.

11. The detention period in a septic is assumed to be \_\_\_\_\_.

- A. 20 minutes
- B. 25 minutes
- C. 30 minutes
- D. 40 minutes

Ans. C.

The maximum detention time in the wet well will not exceed 30 minutes of average flow.

Ans. D.

12. The inspection pit or chamber is a manhole provided in a base drainage system \_\_\_\_\_.

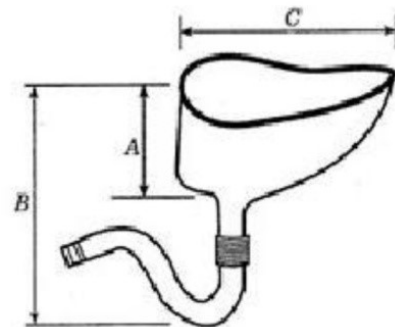
- A. at every change of direction
- B. at every change of gradient
- C. at every 30 m intervals
- D. all options are correct

Ans. D.

These are provided at every bend, junction, change of gradient or change of diameter of the sewer.

The maximum spacing between the manholes recommended is 30 m, and 300 m spacing for pipe greater than 2.0 m diameter

13. The value of "C" of Indian type W.C. shown in the figure given below is



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

Ans. C.

These types of water closets can then vary greatly by shape (square, angular, round, D-shaped) and by size, with differences in dimensions (both length and width) between anywhere in the region of 350mm - 500mm.

14. The diameter of a domestic sewer pipe laid at gradient 1 in 100 is recommended \_\_\_\_\_.

- A. 100 mm
- B. 150 mm
- C. 200 mm
- D. 175 mm

Ans. B.

Peak flow (liters/sec)	Pipe size (mm)	Minimum gradient
less than 1	75	1:40
	100	1:40
greater than 1	75	1:60
	100	1:80
	150	1:150

15. Pick up the incorrect statement from the following.

- A. Lead is the average horizontal straight distance between the borrow pit and the place of spreading soil
- B. The lead is calculated for each block of the excavated area
- C. The unit of lead is 50 m for a distance up to 500 m
- D. The unit of lead is 1 km where the lead exceeds 2 km

Ans. D.

It is the average horizontal distance between the center of excavation to the centre of deposition. The unit of lead is 50m.

16. If B is the width of formation d is the height of the embankment, side slope s:1, for a highway with no transverse slope, the area of cross-section is \_\_\_\_\_.

- A.  $B \div d + Sd$
- B.  $Bd + Sd^2$
- C.  $B \times d - Sd^{1/2}$
- D.  $1/2(Bd + Sd^2)$

Ans. B.

Area of sides =  $Sd^2$

Total Sectional Area =  $(Bd + Sd^2)$

17. In the mid-section formula \_\_\_\_\_.

- A. The mean depth is the average of depths of two consecutive sections
- B. The area of mid-sections is calculated by using mean depth
- C. The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two sections
- D. All of the above

Ans. D.

By averaging the depths of two consecutive sections, mean depth is calculated first and from the mean depth the area of mean section is calculated and finally volume of earthwork is computed by multiplying the area of mid-section by the distance between the two original sections.

Volume of earthwork = area of mid-section \* distance between two consecutive sections =  $A_m * L$

$A_m$  = area of mid-section + area of two sides

$A_m = Bd_m + Sd_m^2$

$d_m = (d_1 + d_2) / 2$

Therefore; volume of earthwork =  $(Bd_m + Sd_m^2) * L$

18. The ground surface slopes 1 in 50 along a proposed railway embankment 150 m in length. The height of the embankment at zero chainage is 0.5 m, the width is 11 m and side slopes 2:1. If the falling gradient of the embankment is 1 in 150, the quantity of the earthwork calculated by prismoidal formula is \_\_\_\_\_.

- A.  $3250 \text{ m}^3$
- B.  $3225 \text{ m}^3$
- C.  $3275 \text{ m}^3$
- D.  $3300 \text{ m}^3$

Ans. B.

Prismoidal formula =  $h/6(A_1 + A_n + 4(A_2 + A_4) + 2(A_3 + A_5))$

19. A cement concrete road is 1000 m long, 8 m wide and 15 cm thick over the sub-base of 10 cm thick gravel. The box cutting in road crust is \_\_\_\_\_.

- A.  $500 \text{ m}^3$
- B.  $1000 \text{ m}^3$
- C.  $1500 \text{ m}^3$
- D.  $2000 \text{ m}^3$

Ans. C.

The road is 1000m long = 1000m.

The width is 8m = 8m.

The thickness of slab = 0.15m.

Excavation for sub base (10cm thick - 6.25cm compaction) = 3.75cm for gravel.

So,

$1000\text{m} \times 8\text{m} \times (0.15\text{m} + .0375\text{m}).$

$1000\text{m} \times 8\text{m} \times 0.1875\text{m} = 1500 \text{ cubic m.}$

20. Berms are provided in canals if these are \_\_\_\_\_.

- A. fully in excavation
- B. partly in excavation and partly in embankment
- C. fully in embankment
- D. all options are correct

Ans. B.

Berm is the horizontal distance left at ground level between the toe of the bank and the top edge of cutting.

The berm is provided in such a way that the bed line and the bank line remain parallel. If  $s_1:1$  is the slope in cutting and  $s_2:1$  in filling, then the

Initial berm width =  $(s_1 - s_2) d_1$ .

21. The main principle of surveying is to work \_\_\_\_\_.

- A. from part to the whole
- B. from whole to the part
- C. from higher level to the lower level
- D. from lower level to higher level

Ans. B.

Working from whole to part is done in surveying in order to ensure that errors and mistakes of one portion do not affect the remaining portion.

22. In case of a direct Vernier scale \_\_\_\_\_.

- A. graduations increase in opposite direction in which graduations of the main scale increase
- B. smallest division is longer than smallest division of the main scale
- C. graduations increase in the same direction in which graduations of the main scale increase
- D. None of these

Ans. C.

In case of direct vernier both scales, namely Vernier and main, move in the same direction and vernier divisions are marked in the same direction as that of the main scale.

23. The slope correction for a length of 30 m along a gradient of 1 in 20 is \_\_\_\_\_.

- A. 3.75 cm
- B. 0.375 cm
- C. 37.5 cm
- D. 2.75 cm

Ans. A.

Length=30m, gradient=1/20; h=1.5.

Correction for a slope:  $\frac{h^2}{2l}$ .

$\frac{(1.5)^2}{2 \times 30} = 3.75 \text{ cm.}$

24. Correction per chain length of 100 links along a slope having a rise of 1 unit in n horizontal units is \_\_\_\_\_.

- A.  $\frac{100}{n^2}$
- B.  $100 n^2$
- C.  $\frac{100}{n^3}$
- D.  $\frac{100}{n}$

Ans. A.

Hypotenuse allowance=  $\frac{50}{n^2}$

25. In chain surveying field work is limited to \_\_\_\_\_.

- A. linear measurements only
- B. angular measurements only
- C. both linear and angular measurements
- D. all options are correct

Ans. A.

In chain surveying only linear measurements i.e. lengths are only measured by chain or with tape.

Chain surveying is the simplest and the most accurate kind of surveying. In this the area is divided into network of triangles since the triangle is the only figure which can be plotted without any angular measurements.

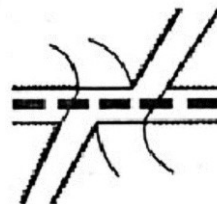
26. If the chain line which runs along N-S direction is horizontal and the ground in E-W direction is slopping \_\_\_\_\_.

- A. it is possible to set offsets correctly on east side
- B. it is possible to set offsets correctly on west side
- C. it is not possible to set offsets correctly on west side
- D. it is possible to set offsets correctly on both sides

Ans. D.

Chain survey is the simplest method of surveying. In this survey only measurements are taken in the field, and the rest work, such as plotting calculation etc. are done in the office. If the chain line which runs along N-S direction is horizontal and the ground in E-W direction is slopping is possible to set offsets correctly on both sides

27. The conventional sign shown in the figure below represents a :-

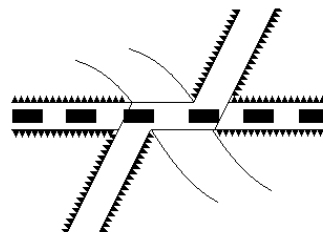


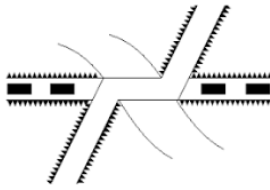
- A. Bridge carrying railway below road.
- B. Bridge carrying road below railway
- C. Bridge carrying road and railway at the same level.
- D. A level crossing

Ans. B.

The ABOVE diagram represents the bridge carrying road below railway

The below diagram shows Bridge carrying railway below road.





The above represents Bridge carrying road and railway at the same level.

28. The real image of an object formed by the objective must lie \_\_\_\_\_.

- A. in the plane of cross hairs
- B. at the center of the telescope
- C. at the optical center of the eye piece
- D. anywhere inside the telescope

Ans. A.

The real image is the plane of cross hairs because upper middle and lower number we have to get in this by cross hairs.

29. A relatively fixed point of known elevation above datum is called \_\_\_\_\_.

- A. bench mark
- B. datum point
- C. reduced level
- D. reference point

Ans. A.

A benchmark is a point of reference by which something can be measured. In surveying, a "bench mark" (two words) is a post or other permanent mark established at a known elevation that is used as the basis for measuring the elevation of other topographical points.

30. For true difference in elevations between two points A and B the level must be set up \_\_\_\_\_.

- A. at any point between A and B
- B. at the exact mid-point of A and B
- C. near the point A
- D. near the point B

Ans. B.

True difference in elevations between two points A and B is the level must be set up at the exact midpoint of BS and FS.

31. The property of a soil which permits water to percolate through it, is called \_\_\_\_\_.

- A. moisture content
- B. permeability
- C. capillarity
- D. none of these

Ans. B.

Soil permeability is the property of the soil to transmit water and air. The coefficient of permeability (or permeability) in soil mechanics is a measure of how easily water can flow through a porous soil medium

32. If the specific gravity and voids in soil sample are G and e respectively, the hydraulic gradient  $i$ , is \_\_\_\_\_.

- A.  $(G-1)/(1+e)$
- B.  $(G+1)/(1-e)$
- C.  $(1-G)/(1+e)$
- D.  $(1+G)/(1+e)$

Ans. A.

Critical Hydraulic gradient =  $(G-1) / (1+e)$ .

Where,

e - Void ratio.

G - Specific gravity of soil.

33. The shear strength in plastic undrained clay, is due to \_\_\_\_\_.

- A. inter-granular friction
- B. internal friction
- C. cohesion
- D. none of these

Ans. C.

This makes the shear vane most reliable in clays which when nearly 100% saturated have no angle of internal friction and in which all of the shearing strength is due to cohesion.

34. The Mohr's straight theory is based on the following fact.

- A. Material fails essentially by shear
- B. Ultimate strength of the material is determined by the stress in the plane of slip
- C. Failure criterion is independent of the intermediate principal stress
- D. all options are correct

Ans. D.

The Mohr-Coulomb failure criterion is a set of linear equations in principal stress space describing the conditions for which an isotropic material will fail, with any effect from the intermediate principal stress being neglected. MC can be written as a function of major and minor principal stresses, or normal stress  $r$  and shear stress  $s$  on the failure plane

35. To avoid an interruption in the flow of a siphon, an air vessel is provided \_\_\_\_\_.

- A. at the inlet
- B. at the outlet
- C. at the summit
- D. at any point between the inlet and outlet

Ans. C.

A syphon is a long bent pipe used to connect two reservoirs at different levels intervened by a high ridge. The highest point of the syphon is called the summit. An air vessel is provided at the summit in order to avoid interruption in the flow.

36. The line of action of the buoyant force acts through the centroid of the \_\_\_\_\_.

- A. submerged body
- B. volume of the floating body
- C. volume of the fluid vertically above the body
- D. displaced volume of the fluid

Ans. D.

The line of action of the buoyant force passes through the centroid of the displaced liquid volume only if it has uniform density. This point through which FB acts is called the center of buoyancy

37. The time oscillation of a floating body with increase in metacentric height will be \_\_\_\_\_.

- A. same
- B. higher
- C. lower
- D. lower/higher depending weight of body

Ans. C.

$$\therefore \text{The Periodic Time } T = 2\pi \sqrt{\frac{k^2}{mg}}$$

so metacentric height is lowered so that time period of oscillation of ship increases and you don't feel that ship is rolling

38. Euler's equation for motion of liquids is based on the assumption that the \_\_\_\_\_.

- A. flow is streamline
- B. flow takes place continuously
- C. flow is homogeneous and incompressible
- D. flow is turbulent

Ans. C.

Euler's equation is based on the following assumptions:

- ❖ The fluid is non-viscous (i.e., the frictional losses are zero).
- ❖ The fluid is homogeneous and incompressible (i.e., mass density of the fluid is constant).
- ❖ The flow is continuous, steady and along the streamline.

❖ The velocity of the flow is uniform over the section.

❖ No energy or force (except gravity and pressure forces) is involved in the flow.

39. In order to replace a compound pipe by a new pipe, the pipes will be equivalent when following are same for both the pipes.

- A. length and flow
- B. diameter and flow
- C. loss of head and flow
- D. length and loss of head

Ans. D.

Equivalent pipes refer to imaginary pipes which are used to determine the head loss and flow of discharge considering that the flow of discharge and head loss in the actual piping system is same as that of the equivalent pipe.

40. Steady flow occurs when \_\_\_\_\_.

- A. conditions change steadily with time
- B. conditions do not change with time at any point
- C. conditions are same at adjacent points with time
- D. velocity vector at any point remains constant

Ans. B.

a flow in which the velocity of the fluid at a particular fixed point does not change with time — called also stationary flow; compare uniform flow.

41. A body is said to be provided optimum amount of streamlining when \_\_\_\_\_.

- A. friction drag is minimum
- B. pressure drag is minimum
- C. profile drag (i.e. sum of friction drag and pressure drag) is minimum
- D. production of friction and pressure drag is minimum

Ans. C.

A streamlined body is a shape that lowers the friction drag between a fluid, like air and water, and an object moving through that fluid.

42. The losses in open channel vary as proportional to \_\_\_\_\_.

- A. velocity (V)
- B.  $V^2$
- C.  $\sqrt{V}$
- D.  $V^3$

Ans. B.

Minor loss of open channel flow =  $V^2/2g$

43. If  $\rho$  is density of fluid, then pressure of fluid due to water hammer is direct proportional to \_\_\_\_\_.

- A.  $\rho$                                       B.  $1/\sqrt{\rho}$   
 C.  $\sqrt{\rho}$                                       D.  $\rho^2$

Ans. B.

$C = \sqrt{\text{(bulk modulus/density)}} = A = \sqrt{\frac{B}{\rho}}$

44. The hydraulic radius is given by \_\_\_\_\_.

- A. wetted perimeter divided by area  
 B. area divide by square of wetted perimeter  
 C. area divided by wetted perimeter  
 D. square root of area

Ans. C.

Based on the 'constant shear stress at the boundary' assumption, hydraulic radius is defined as the ratio of the channel's cross-sectional area of the flow to its wetted perimeter

45. Pick up the correct sequence of the part of a canal system from the following.

- A. Head work-distributary canal-minor  
 B. Head work-main canal-branch canal-distributary-minor  
 C. Head work-main canal-branch canal-minor- distributary  
 D. Head work-branch canal-main canal-distributary-minor

Ans. B.

TYPES OF CANAL

(BASED ON DISCHARGE)

- MAIN CANAL
- BRANCH CANAL
- MAJOR DISTRIBUTARY
- WATER COURSE OR FIELD CHANNEL

46. Which one of the following statements is correct?

- A. The canal system and the drainage system are complementary  
 B. The canal system runs on ridges, gets divided into smaller channels and spreads its water on the land  
 C. The drainage system runs along the lowest line, collects drainage water from the slopes and joins the main stream  
 D. all options are correct

Ans. D.

The drainage system minimizes the impact of flooding by safely carrying storm water away from built-up areas into rivers and creeks.

The dividing ridge line between the catchment areas of two streams (drains) is called the watershed or ridge canal.

Since the drainage flows away from the ridge, no drainage can cross a canal aligned on the ridge. Thus, a canal aligned on the watershed saves the cost of construction of cross-drainage works.

47. If  $L$  is the length of vehicles in meters,  $C$  is the clear distance between two consecutive vehicles (stopping sight distance),  $V$  is the speed of vehicles in km per hour, the maximum number  $N$  of vehicles/hour is \_\_\_\_\_.

- A.  $N = \frac{1000V}{L+C}$                                       B.  $N = \frac{L+C}{1000V}$   
 C.  $N = \frac{1000L}{C+V}$                                       D.  $N = \frac{1000C}{L+V}$

Ans. A.

$C = 1000 V/S$ .

Where  $V$  = Velocity of moving vehicle.

$S$  = Stopping distance + Average length of vehicle.

48. If  $n$  is the length of a rail in meters, the number of sleepers per rail length generally varies from \_\_\_\_\_.

- A.  $n$  to  $(n+2)$   
 B.  $(n+2)$  to  $(n+4)$   
 C.  $(n+3)$  to  $(n+6)$   
 D.  $(n+4)$  to  $(n+5)$

Ans. C.

Number of sleepers provided for one rail length of track is called sleeper density. If " $N$ " is the length of one rail in meters, Sleeper Density =  $N+X$ , ( $X \rightarrow 3$  to  $6$ )  
 For a Broad Gauge track, total number of sleepers required for 1km length of railway track if sleeper density =  $N+5$   
 Length of one rail =  $12.8\text{m} \approx 13\text{m}$

49. The density of population over 40 hectares is 250/hectare. If water supply demand per day is 200 liters and sewage discharge is 80% of water supply, the sewage flow in sewers of separate system is \_\_\_\_\_.

- A. 0.05552 cumec                                      B. 0.05554 cumec  
 C. 0.05556 cumec                                      D. 0.05558 cumec

Ans. C.

$[(40 * 250) * 200 * 80\% / (1000 * 24 * 60 * 60)] \text{ cumec.} = 0.0185 \text{ cumec.}$

Dry weather flow is equal to 3 times of average flow. So the answer is  $0.185 * 3$  i.e. 0.05556.

Ans. D.

50. Before discharging the foul sewage into rivers, it is generally treated by \_\_\_\_\_.

- A. screening
- B. sedimentation
- C. oxidation
- D. all options are correct

Ans. D.

The sewage will then flow into various chambers for equalisation, desilting, grease separation, mixing, aeration, chlorination, flocculation, sedimentation, etc. Wastewater level monitoring in sewage treatment plants is required in most of these stages for accurate liquid level control

51. The ratio of lateral strain to axial strain of a homogeneous material is known \_\_\_\_\_.

- A. Yield ratio
- B. Hooke's ratio
- C. Poisson's ratio
- D. Plastic ratio

Ans. C.

Poisson's ratio is the ratio of transverse contraction strain to longitudinal extension strain in the direction of stretching force. Tensile deformation is considered positive and compressive deformation is considered negative.

$$\mu = - \frac{e_{\text{trans}}}{e_{\text{longitudinal}}}$$

52. The normal and tangential components of stress on an inclined plane

through  $\theta^\circ$  to the direction of the force will be equal if  $\theta$  is \_\_\_\_\_.

- A.  $45^\circ$
- B.  $30^\circ$
- C.  $60^\circ$
- D.  $90^\circ$

Ans. A.

The stresses vary as the inclined plane is cut at various angles. As expected,  $\sigma_x'$  is a maximum ( $\sigma_{\text{max}}$ ) when  $\theta$  is  $0^\circ$  or  $180^\circ$ , and  $\zeta_{x'y'}$  is maximum ( $\zeta_{\text{max}}$ ) when  $\theta$  is  $45^\circ$  or  $135^\circ$ . Also,  $\tau_{\text{max}} = \pm \frac{1}{2} \sigma_{\text{max}}$ .

53. The locus of the end point of the resultant of the normal and tangential components of the stress on an inclined plane is \_\_\_\_\_.

- A. circle
- B. parabola
- C. ellipse
- D. straight line

Ans. C.

The normal and shear stresses acting across the characteristics are defined by the points of contact of the envelope E with Mohr's circle for the considered state of stress. The locus of the highest and lowest points of the circle is an ellipse representing the yield criterion

54. Principal planes are subjected to \_\_\_\_\_.

- A. normal stresses only
- B. tangential stresses only
- C. normal stresses as well as tangential stresses
- D. None of these

Ans. A.

The maximum and minimum values of normal stresses occur on planes of zero shearing stress. The maximum and minimum normal stresses are called the principal stresses, and the planes on which they act are called principal plane the solution of equation.

55. The strain energy due to volumetric strain \_\_\_\_\_.

- A. is directly proportional to the volume
- B. is directly proportional to the square of exerted pressure
- C. is inversely proportional to Bulk modulus
- D. all options are correct

Ans. D.

$$U = \frac{\sigma^2}{2E} \times V.$$

Where,

$\sigma$  = stress,

$E$  = young's modulus,

$V$  = volume of body.

56. A simply supported beam carries a varying load from zero at one end and  $w$  at the other end. If the length of the beam is  $a$ , the shear force will be zero at a distance  $X$  from least loaded point where  $X$  is \_\_\_\_\_.

- A.  $a/2$
- B.  $a/3$
- C.  $a/\sqrt{3}$
- D.  $(a\sqrt{3})/2$

Ans. C.



**To summarize:**

Supports equations:  $A_y = \frac{wL}{6}$   $B_y = \frac{wL}{3}$

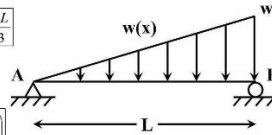
Shear force equation:  $V_x = \frac{wL}{2} \left( \frac{1}{3} - \frac{x^2}{L^2} \right)$

Bending moment equation:  $M_x = \frac{wLx}{6} \left( 1 - \frac{x^2}{L^2} \right)$

Maximum shear force at right support  $V_{max} = \frac{wL}{3}$

Minimum shear force at  $x = \frac{L}{\sqrt{3}}$

Maximum bending moment at zero shear location  $x = \frac{L}{\sqrt{3}}$  and equal to  $M_{max} = \frac{wL^2}{9\sqrt{3}}$



57. For a strongest rectangular beam cut from a circular log, the ratio of the width and depth is \_\_\_\_\_.

- A. 0.303                      B. 0.404  
C. 0.505                      D. 0.707

Ans. D.

Ratio of width to depth =  $1/\sqrt{2} = 0.707$ .

58. The maximum magnitude of shear stress due to shear force F on a rectangular section of area A at the neutral axis is \_\_\_\_\_.

- A. F/A                          B. F/2A  
C. 3F/2A                      D. 2F/3A

Ans. C.

$$s = \left( \frac{\delta M}{\delta x} \right) \frac{A \bar{y}}{z I} = F \cdot \frac{A \bar{y}}{z I}$$

If  $\frac{F}{bd}$  is called the Mean Stress then:

$$\hat{s} = 1.5 \times s_{mean}$$

$$\hat{s} = \frac{3 F}{2 b d}$$

59. The ratio of maximum and average shear stresses on a rectangular section is \_\_\_\_\_.

- A. 1                              B. 1.25  
C. 1.5                          D. 2

Ans. C.

- The ratio of maximum shear stress to average shear stress is 4/3 in circular cross-section.
- The ratio of maximum shear stress to average shear stress is 3/2 in rectangular cross-section.
- The ratio of maximum shear stress to average shear stress is 3/2 in triangular cross-section.

60. A cantilever of length 2 cm and depth 10 cm tapers in plan from a width 24 cm to zero at its free end. If the modulus of elasticity of the material is

$0.20 \times 10^6 N/mm^2$ , the deflection of the free end is \_\_\_\_\_.

- A. 2 mm                      B. 3 mm  
C. 4 mm                      D. 5 mm

Ans. D.

Use Deflection formulae.

61. A truss containing j joints and m members will be a simple truss if \_\_\_\_\_.

- A.  $m = 2j - 3$                       B.  $j = 2m - 3$   
C.  $m = 3j - 2$                       D.  $j = 3m - 2$

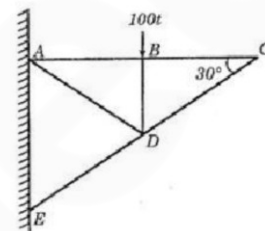
Ans. A.

The member of joints j and the number of members (rods) m are related as follows:

$$m = 2j - 3$$

This makes a truss statically determinate.

62. In the truss shown in the figure below, the force in member BC is :-



- A. 100 t compressive                      B. 100 t tensile  
C. zero                                      D. indeterminate

Ans. C.

Take moment at C

$$\Sigma H = 0$$

No horizontal force at C.

So force in BC is zero.

63. A concrete having a slump of 6.5 cm is said to be \_\_\_\_\_.

- A. dry                              B. earth moist  
C. semi-plastic                      D. plastic

Ans. D.

Slump value	Consistency
0	Moist dry
0 - 25	Very dry
25 - 50	Dry
50 - 100	Plastic
100 - 175	Sem - Plastic

64. Concrete is unsuitable for compaction by a vibrator if it is \_\_\_\_\_.

- A. dry                              B. earth moist  
C. semi-plastic                      D. plastic

Ans. D.

Plastic concrete when spun at a very high speed, gets well compacted by centrifugal force.

65. The increased cohesiveness of concrete, makes it \_\_\_\_\_.  
 A. less liable to segregation  
 B. more liable to segregation  
 C. more liable to bleeding  
 D. more liable for surface scaling in frosty weather

Ans. A.

When the cohesive property of concrete increases, then there will be chance of generation of bonding between each particle in concrete, so there will be no chance of segregation (Separation of particles).

66. After casting, an ordinary cement concrete on drying \_\_\_\_\_.

- A. expands
- B. either expands or shrinks
- C. shrinks
- D. none of these

Ans. C.

Concrete shrinks after drying due to the voids are filled by air after drying. It is considerably filled by water. Water will evaporate from that place by drying. Thus it shrinks.

67. To obtain cement dry powder lime stones and shales or their slurry is burnt in a rotary kiln at a temperature between \_\_\_\_\_.

- A. 1100° and 1200° C
- B. 1200° and 1300° C
- C. 1300° and 1400° C
- D. 1400° and 1500° C

Ans. D.

The mixture of different ingredients of cement, is burn at 1400 – 1500°C

68. The minimum percentage of chemical ingredient of cement is that of \_\_\_\_\_.

- A. magnesium oxide
- B. iron oxide
- C. alumina
- D. lime

Ans. A.

Ingredient	Nomenclature	Percentage
1. Lime	Ca	60-67
2. Silica	SiO	17-25
3. Alumina	Al <sub>2</sub> O <sub>3</sub>	3-8
4. Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.5-6
5. Magnesia	MgO	0.1-4
6. Sulphur Trioxide	SO <sub>3</sub>	1-2.75
7. Alkalies	K <sub>2</sub> O & Na <sub>2</sub> O	0.4-1.3
8. Gypsum	CaSO <sub>4</sub>	3-5

69. Pick up the correct proportions of chemical ingredients of cement.

A. Lime : Silica : Alumina : Iron oxide = 63 : 22 : 6 : 3

B. Silica : Lime : Alumina : Iron oxide = 63 : 22 : 6 : 3

C. Alumina : Silica : Lime : Iron oxide = 63 : 22 : 6 : 3

D. Iron oxide : Alumina : Silica : Lime = 63 : 22 : 6 : 3

Ans. A.

Lime (CaO)	60 to 67%
Silica (SiO <sub>2</sub> )	17 to 25%
Alumina (Al <sub>2</sub> O <sub>3</sub> )	3 to 8%
Iron oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.5 to 6%
Magnesia (MgO)	0.1 to 4%
Sulphur trioxide (SO <sub>3</sub> )	1 to 3%
Soda and/or Potash (Na <sub>2</sub> O+K <sub>2</sub> O)	0.5 to 1.3%

70. Pick up the correct statement from the following

A. Lime in excess, causes the cement to expand and disintegrate

B. Silica in excess, causes the cement to set slowly

C. Alumina in excess, reduces the strength of the cement

D. all options are correct

Ans. D.

**Lime (CaO):** This is the important ingredient of cement and its proportion is to be carefully maintained. The lime in excess makes the cement unsound and causes the cement to expand and disintegrate. On the other hand, if lime is in deficiency, the strength of cement decreases and it causes cement to set quickly.

**Silica (SiO<sub>2</sub>):** This is also an important ingredient of cement and it gives or imparts strength to the cement due to the formation of dicalcium and tricalcium silicates. If silica is present in excess quantity, the strength of cement increases but at the same time, its setting time is prolonged.

**Alumina (AI2O3):** This ingredient imparts quick setting property to the cement. It acts as a flux and it lowers the clinkering temperature. However the high temperature is essential for the formation of a suitable type of cement and hence the alumina should not be present in excess amount as it weakens the cement.

71. For an ordinary Portland cement \_\_\_\_\_.

- A. Residual does not exceed 10% when sieved through IS Sieve No. 9
- B. soundness varies from 5 to 10 mm
- C. initial setting time is not less than 30 minutes
- D. compressive stress after 7 days, is not less than 175 kg/cm<sup>2</sup>

Ans. C.

Initial Setting time of Cement:-

The time to which cement can be moulded in any desired shape without losing its strength is called Initial setting time of cement. As per IS specification, the minimum initial setting time is 30 minutes for ordinary Portland cement

Final setting time of Cement:-

The time at which cement completely loses its plasticity and became hard is a final setting time of cement. As per IS specification, the maximum final setting time for all type of cement is 10 hours.

72. The commercial name of white and colored cement in India is \_\_\_\_\_.

- A. colocrete
- B. rainbow cement
- C. silvicrete
- D. all options are correct

Ans. D.

Colocrete, rainbow cement, silvicrete and snowcem are the name of white & colored cement

73. Inert material of a cement concrete mix is \_\_\_\_\_.

- A. water
- B. cement
- C. aggregate
- D. none of these

Ans. C.

Cements may be used alone (i.e., "neat," as grouting materials), but the normal use is in mortar and concrete in which the cement is mixed with inert material known as aggregate.

74. According to IS : 382-1963, a good aggregate should be \_\_\_\_\_.

- A. chemically inert
- B. sufficiently strong
- C. hard and durable
- D. All options are correct

Ans. D.

A good aggregates should satisfy the following requirement :

- It should be chemically inert.
- It should be sufficiently strong.
- It should be sufficiently hard.
- It should be sufficiently durable.
- It should be of limited porosity.
- It should be cubicle and spherical in shape.
- It should have rough surface.
- It should be free from coatings of clay and other materials.

75. An aggregate is known as cyclopean aggregate if its size is more than \_\_\_\_\_.

- A. 4.75 mm
- B. 30 mm
- C. 60 mm
- D. 75 mm

Ans. D.

Coarse aggregate is that aggregate whose particles completely pass through 7.5 cm mesh sieve and which are entirely retained on 4.75 mm sieve.

Crushed Stone known as a cyclopean aggregate.

76. The bulk density of aggregates does not depend upon \_\_\_\_\_.

- A. size and shape of aggregates
- B. specific gravity of aggregates
- C. grading of aggregates
- D. size and shape of the container

Ans. C.

There are several measures of density among which bulk density and relative density are the most important ones. Bulk density is the density of the material in bulk granular form. Relative density is the ratio of the density of substance to the density of a given reference material (usually water). Logically, The aggregates density affects the proportioning of concrete ingredients.

77. The aggregate containing moisture in pores and having its surface dry is known as \_\_\_\_\_.

- A. moist aggregates
- B. very dry aggregates
- C. dry aggregates
- D. saturated surface dry aggregate

Ans. D.

Depending upon the amount of moisture content in aggregates, it can exist in any of the 4 conditions.

- Very dry aggregate (having no moisture)
- Dry aggregate (contain some moisture in its pores)
- Saturated surface dry aggregate (pores completely filled with moisture but no moisture on surface)
- Moist or wet aggregates (pores are filled with moisture and also having moisture on surface)

78. If 20 kg of coarse aggregate is sieved through 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron, and 150 micron standard sieves and the weights retained are 0 kg, 2 kg, 8kg, 6 kg, 4 kg, respectively, the fineness modulus of the aggregate lies in the range of \_\_\_\_\_.

- A. 6.85 – 7.10                      B. 7.20 – 7.45  
C. 7.50 – 7.75                      D. None of these

Ans. B.

Sieve Size	Weight of sand Retained (g)	Cumulative weight of sand retained (g)	Cumulative percentage of sand retained (%)
80	0	0	0
40	2	10	10
20	8	40	50
10	6	30	80
4.75	4	20	100
2.36	0	0	100
1.18	0	0	100
600	0	0	100
300	0	0	100
150	0	0	100

ADD CUM % RET AND DIVIDE BY 100 = 740/100 = 7.4.

79. Pick up the correct statement from the following.

- A. Gypsum in cement decreases the setting time  
B. The first compound of cement which reacts with water is C<sub>2</sub>S  
C. Bulking of sand is less when its particles are fine  
D. all options are correct

Ans. A.

Gypsum is used for decrease the setting time and calcium chloride used for increase the setting time.

80. The datum temperature for maturity by Plowman, is \_\_\_\_\_.

- A. 23°C                                      B. 0°  
C. -5.6°C                                    D. -11.7°

Ans. D.

Plowman (1958) proposed a single strength-maturity equation based on past studies performed by various authors, with various mixtures, water-to-cement ratios, and curing temperatures between 11°F and 105°F (-12°C to 41°C). Using the logarithmic strength-maturity function, he proposed that the constants, a and b have specific values based on four strength ranges up to 10,000 psi. With this equation, Plowman found that any concrete strength could be estimated based on a given maturity, regardless of water-to-cement ratio, the curing temperature under 100°F, or aggregate-to-cement ratio, with an average error of 3%. Plowman's equation seemed to be valid, although his equation was only based on 26 different compressive strength values.

81. Minimum spacing between horizontal parallel reinforcement of different sizes should not be less than \_\_\_\_\_.

- A. one diameter of thinner bar  
B. one diameter of thicker bar  
C. sum of the diameters of thinner and thicker bars  
D. twice the diameter of thinner bar

Ans. B.

Minimum Distance Between Individual Bars main reinforcing bars shall usually be not-less than the greatest of the following:

1. The diameter of the bar if the diameter are equal,
2. The diameter of the larger bar if the diameters are unequal, and
3. 5 mm more than the nominal maximum size of coarse aggregate.

82. The minimum thickness of the cover at the end of a reinforcing bar should not be less than twice the diameter of the bar subject to a minimum of \_\_\_\_\_.

- A. 10 mm                                    B. 15 mm  
C. 20 mm                                    D. 25 mm

Ans. D.

(i) At each end of the longitudinal bars, concrete cover shall not be less than 25 mm or twice the diameter of the bar, whichever is more.

(ii) The longitudinal bars shall not have a cover less than 40 mm or the diameter of bar whichever is more.

83. The width of the flange of a T-beam, which may be considered to act effectively with the rib depends upon \_\_\_\_\_.

- A. breadth of the rib
- B. overall thickness of the rib
- C. center to center distance between T-beams
- D. all options are correct

Ans. D.

$$b_f = \frac{I_o}{6} + b_w + 6D_f$$

Where,  $b_f$  = width of flange

$I_o$  = Centre to center distance between Tee beams

$b_w$  = width of the rib

$D_f$  = Overall thickness of the rib

84. In a single reinforced beam, if the permissible stress in concrete reaches earlier than that in steel, the beam section is called \_\_\_\_\_.

- A. under-reinforced section
- B. over reinforced section
- C. economic section
- D. critical section

Ans. B.

Reinforced concrete beam sections in which the failure strain in concrete is reached earlier than the yield strain of steel is reached, are called over-reinforced sections.

85. Pick up the incorrect statement from the following:

Tensile reinforcement bars of a rectangular beam \_\_\_\_\_.

- A. are curtailed if not required to resist the bending moment
- B. are bent up at suitable places to serve as shear reinforcement
- C. are bent down at suitable places to serve as shear reinforcement
- D. are maintained at bottom to provide at least local bond stress

Ans. B.

Bent up bars is also used along with stirrups in the past to carry some of the applied shear forces. In case where all the tensile reinforcement is not needed to resist bending moment, some of the tensile bars were bent-up in the region of high shear to form the inclined legs of

shear reinforcement. The use of bent-up bars is not preferred nowadays. Due to difficulties in construction, bent-up bars are rarely used. In beams with small number of bars provided, the bent-up bar system is not suitable due to insufficient amount of straight bars left to be extended to the support as required by the code of practice

86. A part of the slab may be considered as the flange of the T-beam if \_\_\_\_\_.

- A. flange has adequate reinforcement transverse to beam
- B. it is built integrally with the beam
- C. it is effectively bonded together with the beam
- D. all options are correct

Ans. D.

A T-beam used in construction, is a load-bearing structure of reinforced concrete, wood or metal, with a t-shaped cross section. The top of the t-shaped cross section serves as a flange or compression member in resisting compressive stresses. The web (vertical section) of the beam below the compression flange serves to resist shear stress and to provide greater separation for the coupled forces of bending.

87. Though the effective depth of a T-beam is the distance between the top compression edge to the center of the tensile reinforcement for heavy loads it is taken as \_\_\_\_\_.

- A.  $1/8^{\text{th}}$  of span
- B.  $1/10^{\text{th}}$  of span
- C.  $1/12^{\text{th}}$  of span
- D.  $1/16^{\text{th}}$  of span

Ans. C.

The depth of the T-beam is taken between  $1/10$  to  $1/20$  of the span, contingent on the loads acting on it. It can be likewise accepted from the economy point by the given formula:

$$d = \frac{M \times r}{t J b_r}$$

88. For the design of a simply supported T-beam the ratio of the effective span to the overall depth of the beam is limited to \_\_\_\_\_.

- A. 10
- B. 15
- C. 20
- D. 25

Ans. C.

L/d ratio

simply supported = 20.

Continuous slab = 26.

Cantilever slab = 7.

89. The width of the rib of a T-beam is generally kept between \_\_\_\_\_.

- A. 1/7 to 1/3 of rib depth
- B. 1/3 to 1/2 of rib depth
- C. 1/2 to 3/4 of rib depth
- D. 1/3 to 2/3 of rib depth

Ans. D.

**DIMENSION OF T-BEAM:**

1. The effective width of the flange is adopted as the minimum of c/c distance of the nearby ribs or beams.

2. The overall thickness of the slab crossing over the beam is taken as flange thickness.

3. The breadth of the rib is taken on down earth ground. It should be adequate to hold the steel zone in it, effectively. It might be taken as between 1/3 to 2/3 of the general depth of the beam.

4. The depth of the T-beam is taken between 1/10 to 1/20 of the span, contingent on the loads acting on it.

90. The neutral axis of a T-beam exists \_\_\_\_\_.

- A. within the flange
- B. at the bottom edge of the slab
- C. below the slab
- D. all options are correct

Ans. D.

For a T-beam section, there are two cases (Figure 5.4-2) depending on where the neutral axis falls into:

- Case 1: flanged section when the neutral axis falls into the web

- Case 2: rectangular section when the neutral axis falls into the flange

91. As per ISI, rolled steel beam sections are classified into \_\_\_\_\_.

- A. two series
- B. three series
- C. four series
- D. five series

Ans. D.

The rolled steel beam sections are classified into five series.

- Indian standard junior beam (ISJB)
- Indian standard light beam (ISLB)
- Indian standard medium weight beam (ISMB)

- Indian standard wide flange beam (ISWB)

- Indian column section (SC)

92. The channels get twisted symmetrically with regard to its axis \_\_\_\_\_.

- A. parallel to flanges
- B. parallel to web
- C. perpendicular to flanges
- D. perpendicular to web

Ans. B.

When a channel section is subject to bending due to a point load that acts through the shear Centre and parallel to the web, the bending stress in the flanges is uniform across their width and the shear stress varies

93. Bulb angles are used in \_\_\_\_\_.

- A. column building
- B. bridge building
- C. ship building
- D. water tank building

Ans. C.

On a smaller scale, the same bulb flats are also used in U.S. Coast Guard Cutters and personal/corporate yachts, measuring in at a mere 65 feet. Again, using curved bulb angles might allow the ships to transport more goods including friends and family. The compact shape of a bulb flat provides easy access for welding, painting and inspection.

94. Live load \_\_\_\_\_.

- A. varies in magnitude
- B. varies in position
- C. is expressed as uniformly distributed load
- D. all options are correct

Ans. D.

A Live Load is defined as "Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load. Live loads, or imposed loads, are temporary, of short duration, or a moving load. These dynamic loads may involve considerations such as impact, momentum, vibration, slosh dynamics of fluids and material fatigue.

95. The permissible stress, to which a structural member can be subjected to, is known as \_\_\_\_\_.

- A. bearing stress
- B. working stress
- C. tensile stress
- D. compressive stress

Ans. B.

In the actual, the material is not subjected up to ultimate stress but only up to a fraction of ultimate stress. This stress is known as working stress. This stress is also known as allowable stress or permissible stress.

so, Working Stress = (Ultimate Stress) / (Factor of Safety).

96. The ratio of longitudinal stress to strain within elastic limit is known as \_\_\_\_\_.

- A. modulus elasticity
- B. shear modulus of elasticity
- C. bulk modulus of elasticity
- D. tangent modulus of elasticity

Ans. A.

Young's modulus is a material property that describes a materials' stiffness and is therefore one of the most important properties of solid materials. It is the ratio of stress to strain when deformation is totally elastic. Young's modulus, also known as the elastic modulus or modulus of elasticity.

97. Poisson's ratio for steel within elastic limit ranges from \_\_\_\_\_.

- A. 0.15 to 0.20
- B. 0.25 to 0.24
- C. 0.25 to 0.33
- D. 0.33 to 0.35

Ans. D.

$$\nu = -\frac{\epsilon_{lateral}}{\epsilon_{axial}}$$

Material	Poisson's ratio	Material	Poisson's ratio
Steel	0.25 - 0.33	Rubber	0.48 - 0.5
C.I	0.23 - 0.27	Cork	Nearly zero
Concrete	0.2	Novel foam	negative

98. Diameter of a rivet hole is made larger than the diameter of the rivet by \_\_\_\_\_.

- A. 1.0 mm for rivet diameter upto 12 mm
- B. 1.5 mm for rivet diameter exceeding 25 mm
- C. 2.0 mm for rivet diameter over 25 mm
- D. none of these

Ans. C.

The diameter of a rivet hole is made larger than the nominal diameter of the rivet by 1.5mm of rivets less than or equal to 25mm diameter and by 2mm for diameter exceeding 25mm

99. An imaginary line along which rivets are placed is known as \_\_\_\_\_.

- A. rivet line
- B. scribe line
- C. back line
- D. all options are correct

Ans. D.

The rivet line is also known as scribe line or back line or gauge line. The rivet line is the imaginary line along which rivets are placed.

100. The main type of butt joints is a double cover \_\_\_\_\_.

- A. shear riveted joint
- B. chain riveted joint
- C. zig-zag riveted joint
- D. all options are correct

Ans. D.

Rivets are loaded in shear the load is distributed in proportion to the shear area of the rivets is called shear riveted joint. Rows of rivets may lie exactly opposite to each other over straight lines. is said to be chain riveted.

In zig-zag riveting the rivet in one row is placed at the middle level of the two rivets in the adjacent row.