SSC JE FLT 4

SSC JE PRE 11 OCTOBER 2023

Q1 Which of the following is NOT a way by which traffic volume data is presented?
(A) Traffic Variation charts
(B) AADT in traffic engineering
(C) Model average
(D) The pattern of traffic

Q2 According to the Air (Prevention and Control of Pollution) Act 1981, how is the term 'Emission' defined?
(A) Only the solid particles coming out of an outlet
(B) Any solid or liquid or gaseous substance mcoming out of any chimney, duct orflue or any other outlet
(C) Only the gaseous substance coming out of an outlet
(D) Only the liquid substance coming out of an outlet

Q3 Which of the following methods is most accurate for the determination of the water content of cohesionless soil?
(A) Torsion Balance moisture meter method
(B) Calcium carbide method
(C) Pycnometer method
(D) Oven drying method

Q4 An RCC beam of width 250 mm and effective depth 450 mm is subjected to a nominal shear stress of 1.25 N/mm^2. What is the value of shear force due to design load coming on the section?
(A) 14.0625kN
(B) 1.40625kN
(C) 140.625kN
(D) 1406.25kN

Q5 Identify the correct statements regarding theodolite.
i. The axis of the plate level must lie in a plane parallel to the vertical axis.
ii. The horizontal axis must be perpendicular to the vertical axis.
iii. The vertical circle vernier must read zero when the line of collimation is horizontal.
iv. The axis of the altitude level must be perpendicular to the line of collimation
(A) i, ii, iii and iv
(B) Only i and iv
(C) Only i and iii
(D) Only ii and iii

Q6 What is the relation between the delivery head of the centrifugal pump and the shaft speed (N) ?
(A) The delivery head is directly proportional to N^2
(B) The delivery head is inversely proportional to N
(C) The delivery head is directly proportional to N
(D) The delivery head is inversely proportionalto N^2

Q7 Formation of _____ type(s) of rocks involves biological activity in addition to complex mechanical or chemical processes.
(A) sedimentary
(B) igneous
(C) sedimentary and metamorphic
(D) metamorphic

Q8 Which of the following test apparatus is used to determine initial setting time and final setting time ?
(A) Soundness test
(B) Sieve test
(C) Vicat's apparatus
(D) Air permeability test

Q9

Which of the following scales may NOT given accurate measurements of a plan drawn on a paper, due to shrinkage after few years?

(A) Representative fraction and graphical scale

(B) Engineer's scale and graphical scale

(C) Graphical scale

(D) Engineer's scale and representative fraction

Q10 Punching shear may occur in loose sand with density less than_____.

(A) 55% (B) 35%

(C) 45% (D) 65%

Q11 Which of the following statements about carbon footprint is incorrect?

(A) If you choose to walk or cycle, you lesser your carbon footprint.

(B) If you prefer to drive all the time, your carbon footprint will be higher

(C) Manufacturing and transportation of consumer goods form a part of the secondary carbon footprint.

(D) Carbon footprint is of the following three types: primary, secondary and tertiary.

Q12 Trapezoidal sections ith rounded corners for large canals or triangular sections with circular bottoms for small canals are the most suitable sections for _____ canals.

(A) lined (B) semi-lined

(C) unlined (D) earthen

Q13 Which of the following terms describes the location, type, mark, length and bending details of each bar in a structure's reinforce drawing?

(A) Bar bending schedule

(B) Material statement

(C) Work charged establishment

(D) Sundries

Q14 The angle of the divergent portion of a Venturimeter is kept less than the angle of the converging portion to

(A) decrease the pressure in the direction of the flow at the diverging part

(B) increase the velocity of the flow in the direction of the flow at the diverging part

(C) avoid a situation where in the flow may become compressible

(D) minimize the loss of energy caused by flow separation

Q15 In the double integration method for a simply supported beam subjected to UDL over its entire span, the slope and deflection calculation will require:

(A) the boundary condition as well as the symmetry condition

(B) the boundary condition as well as the continuity condition

(C) only symmetry condition

(D) only the boundary condition

Q16 The ration of the total length of streams of all orders within a basin to its area is called?

(A) drainage density

(B) stream density

(C) catchment density

(D) stream order

Q17 A BG track is laid with a sleeper density of N+3. The width of the sleeper is 20.25 cm. Find the minimum depth of the ballast cushion.

(A) 30.5 cm (B) 10.125 cm

(C) 61 cm (D) 20.375 cm

Q18 Which of the following is NOT a type of municipal solid waste based on source?

(A) House refuse

(B) Street refuse

(C) Trade refuse

(D) Industrial refuse

Q19 Which of the following options represents the satellite-based positioning systems run by Russia?

(A) TSIKADA and GPS

(B) TRANSIT and GLONASS

(C) TSIKADA and GLONASS

(D) GPS and GLONASS

Q20 A trapezoidal canal carries a discharge of 40 cumec and has the permissible mean velocity of 0.95m/s. The bed width of the canal is _____ Take the side slope of the canal as 1 : 1 and the width/depth ration as 6.5.

(A) 14.50 m (B) 17.40 m
(C) 15.40 m (D) 16.40 m

Q21 Which of the following types of soil have excellent workability as a construction material?

(A) Well graded gravel
(B) Silty sand
(C) Silty gravel
(D) Clayey sand

Q22 Determine the total pressure on a circular plate of diameter 2 m, which is placed vertically in water in such a way that the Center of placed vertically in water in such a way that the center of the plate is 2.5 m below the free surface of the water.

(A) 72058 N (B) 70058 N
(C) 71058 N (D) 77048 N

Q23 The type of signal in which the timings of the phase and cycle are changed according to traffic demand is called _____ .

(A) actuated traffic signal
(B) pedestrian signal
(C) fixed time signal
(D) manually operated signal

Q24 A simple U-tube manometer connected to a pipe in which liquid is flowing with a uniform speed will give _____ .

(A) vacuum pressure
(B) gauge pressure
(C) atmospheric pressure
(D) absolute pressure

Q25 For cast in situ lining, identify the false statement.

(A) It has a higher initial cost.
(B) It is most resistant to erosion
(C) The recurring maintenance charges are high.
(D) It has a longer life than that of any other type.

Q26 Arrange the following steps for painting of surfaces in a sequential manner.

1. First coat
2. Final coat
3. Prime coat
4. Surface preparation

(A) 4, 1, 3, 2
(B) 3, 2, 1, 4
(C) 4, 3, 1, 2
(D) 3, 1, 2, 4

Q27 A beam cross section has shape of an angle section as given below. Which of the following cross sections has the same nature of shear stress distribution as that of the below angle section?

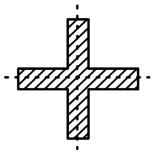
(A)

I-Section

(B)

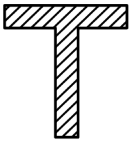
Triangular

(C)



Cross Section

(D)



T-Section

Q28 Which of the following is manufactured from particles of wood or other lignocellulose

materials, which are agglomerated, formed, and pressed together using an organic binder together in the presence of heat, pressure, or moisture?
(A) Block board
(B) Particle board
(C) Fibre board
(D) Plywood

Q29 The mantle layer exists from the base of the crust layer to a depth of about _____ .
(A) 2,900 km (B) 2,600 km
(C) 2,700 km (D) 2,800 km

Q30 The air vessel in a reciprocating pump is:
(A) fitted ahead of the pump
(B) fitted outside the system
(C) fitted in the delivery pipe
(D) not fitted

Q31 If the normal and shear stress corresponding the failure are plotted, then a curve is obtained. The plot or curve is called the____.
(A) failure line
(B) phreatic line
(C) strength envelope
(D) parabolic curve

Q32 The C_d value of an orifice of d/D = 0.5 (d = diameter of orifice and D = diameter of the pipe) lies in the range _____ .
(A) 0.95 to 0.98 (B) 0.60 to 0.62
(C) 0.70 to 0.80 (D) 0.81 to 0.94

Q33 A 0.3 m diameter pipe carries oil of specific gravity 0.8 at flow velocity of 1.5m/s and the pressure at a point A is 20kN/m^2 (gauge). If the point A is 3 m above the datum line, calculate the approximate total energy at point A in meters of oil.
(A) 5.25 m (B) 6.31 m
(C) 5.95 m (D) 5.65 m

Q34 Which of the following traffic sources will cause noise of the highest level during operation?
(A) Rail traffic
(B) Road traffic
(C) Jet aircraft at the take-off stage
(D) Inland water traffic

Q35 The type of pavement marking which is used as a hazard marking and guide marking for safe driving during night is known as _____ ?
(A) kerb marking
(B) reflector unit marking
(C) object marking
(D) pavement marking

Q36 During a cement mortar plastering of a brick wall, the ration of 1 : 4 corresponds to _____.
(A) Cement : Coarse aggregate
(B) Lime : Cement
(C) Cement : Sand
(D) Cement : Water

Q37 Rankine theory considers the stress in a soil mass when it reaches in the state of ____.
(A) plastic equilibrium
(B) local state of equilibrium
(C) limited equilibrium
(D) general state of equilibrium

Q38 Which of the following is NOT a retarding admixture?
(A) Starch
(B) Calcium chloride
(C) Sugar
(D) Calcium sulphate

Q39 Sprinkle irrigation is the best method of irrigation for standing crops in _____ in fields.
(A) heavy soil with low infiltration rate
(B) level surface
(C) alluvial soil
(D) undulating sandy soil

Q40 For field compaction of soil, in cohesive soil the combination of tamping action and kneading action on soil is achieved by:
(A) pneumatic-tyred rollers
(B) sheep foot rollers
(C) vibroflotation

(D) frog rammers

Q41 The following observations were made in an open-traverse compass survey. Bearing of Line AB is S 35° 30' E, whereas the included angles measured clockwise at stations B, C, D and E are 105°20', 265° 50', 20°10' and 325° 40', respectively. The bearing of Line CD is_____.
(A) S 65° 40' W
(B) S 65° 40' E
(C) S 24° 20' W
(D) S 24° 20' E

Q42 The maximum value of the radius of gyration is obtained if a material_____.
(A) is placed nearest the centroid
(B) has the maximum area
(C) is placed at the centroid
(D) is placed farthest from the centroid

Q43 In plane table surveys, the orientation of the table only by back sighting is preferred when_____ .
(A) the traverse is too long
(B) speed is more important than accuracy
(C) the plane table can be set on a point already plotted on the sheet
(D) there is no second point for orientation

Q44 Select the correct option for the given statements.
Statement 1 : Due to their low strength, particle boards are less durable than plywood or solid wood. However, using laminates or veneers on the surface can aid to improve durability.
Statement 2: A layer of melamine can be applied to the top surface of particle boards to make them fire-resistant.
(A) Both statement 1 and statement 2 are true
(B) Both statement 1 and Statement 2 are false
(C) Statement 1 is false and statement 2 is true
(D) Statement 1 is true and statement 2 is false

Q45 In which process of manufacturing of cement are the raw materials ground, mixed and fed to the rotary kiln in the dry state?
(A) Wet process
(B) Moist process
(C) Grinding process
(D) Dry process

Q46 Register of arrears of wages due to work people is recorded in _____.
(A) part II of the muster roll
(B) part III of the muster roll
(C) part II of the wage record
(D) part III of the wage record

Q47 Which of the given options does NOT include solid waste?
(A) Garbage
(B) Sewage
(C) Street sweepings
(D) Plastic waste

Q48 Which of the following statements is INCORRECT?
(A) Welding operations may release nitrogen oxide.
(B) Thermal power houses are the main contributors to SO_2 emissions.
(C) Municipal drainage systems emit H_2S gas.
(D) Incomplete combustion of carbonaceous fuels releases carbon dioxide as the major pollutant.

Q49 A rectangular channel 3 m wide carries water at a depth of 1.2 m. The bed slope of the channel is 0.0025 Calculate the hydraulic radius of the channel.
(A) 0.627 m (B) 0.667 m
(C) 0.637 m (D) 0.617 m

Q50 Which of the following is NOT a property of coir fibers?
(A) Resistance to dynamic loading
(B) Elasticity
(C) Ease to carry
(D) Long service span

Q51 An underground water tank is to be designed. Which of the following cases is considered most

appropriate for the analysis of its wall?
(A) The underground water tank is 3/4 full
(B) The underground water tank is half full
(C) The underground water tank is empty
(D) The underground water tank is full

Q52 The maximum shear stress (in N/mm^2) in a reinforced concrete beam of M-25 grade as per IS 456-2000 is given as:
(A) 3.1 (B) 2.8
(C) 3.4 (D) 3.5

Q53 As per IS 456, the stripping time of the soffit formwork to slabs (props to be refixed immediately after removal of formwork) is_____ .
(A) 28 hours (B) 3 days
(C) 2 days (D) 1 day

Q54 Which of the following is NOT a disadvantage of using rods and bars as a tension member of steel structures?
(A) Inadequate stiffness
(B) High slenderness ratio
(C) Sag under own weight
(D) Tensile strength

Q55 Which of the following compounds is responsible for slow hardening, less heat of hydration, and greater resistance to the chemical attack in OPC Cement?
(A) C_3S (B) C_3A
(C) C_4AF (D) C_2S

Q56 When designing steel structures, the effective length of battened compression members should be _____.
(A) increased by 20%
(B) decreased by 20%
(C) decreased by 10%
(D) increased by 10%

Q57 Which of the following materials is a sustainable and green building material that can be used in construction?
(A) Mortar (B) Bamboo
(C) Concrete (D) Brick

Q58 The carbon credit system helps _____.
(A) reduce noise pollution
(B) reduce soil pollution caused by agricultural wastes
(C) reduce water pollution caused by chemicals
(D) reduce greenhouse gas emissions

Q59 Which term indicates the stages in which the total predetermined cost of construction of the project is to be spread over?
(A) Financial planning
(B) Cost determination
(C) Cost planning
(D) Budget planning

Q60 Minimum shear reinforcement is provided in an RCC beam under which of the following conditions?
(A) Nominal shear stress is less than design shear strength of concrete
(B) Nominal shear stress is greater than design shear strength of concrete.
(C) Nominal shear stress is greater design shear strength of concrete but less than maximum shear stress
(D) Nominal shear stress is greater than maximum shear stress

Q61 If the cohesion value of soil is zero, the Mohr envelope will pass through:
(A) some distance on positive y-axis
(B) The origin
(C) some distance on negative x-axis
(D) some distance on positive x-axis

Q62 A new system of sanitation is needed over the old conservancy system because:
(A) the new system pollutes the city's water supplies
(B) both the systems of sanitation have an equal chance of polluting water supplies
(C) the system of sanitation has no relation with the city's water supplies
(D)

the old system may pollute the city's water supplies

Q63 As a precaution in cold weather concreting, cement containing _____ should be selected.
(A) lower C_3S and higher C_2S
(B) higher C_3S and lower C_2S
(C) lower C_3S and lower C_2S
(D) higher C_3S and higher C_2S

Q64 Hollow pre-cast concrete blocks possess good thermal insulation because of the:
(A) air entrapped within the block
(B) seepage resistance
(C) outside air near the block
(D) resistance to efflorescence

Q65 The distance travelled by an electromagnetic wave in one second is called_____.
(A) wave velocity
(B) wave length
(C) frequency
(D) period

Q66 Which of the following is a purpose served by lintel?
(A) To join the column at sill level
(B) To support the wall above the opening
(C) To join the foundation
(D) To support the slab

Q67 In expansion joints, the loads are transferred through:
(A) aggregates
(B) dowel bars
(C) longitudinal bars
(D) tie bars

Q68 A current meter is a device used for measuring the
(A) viscosity of the fluid
(B) velocity of the flow of the fluid
(C) surface tension of the fluid
(D) pressure of the fluid

Q69 A vehicle was stopped by fully jamming the breaks in 1.8s and the skid marks measured 9m. Determine the average skid resistance. Take g = $10m/s^2$
(A) 0.15 (B) 2.78
(C) 0.278 (D) 0.556

Q70 The gross command area for a distributory is 10,000 ha and 80% of this is culturable. The intensity of irrigation is 50% for wheat and 30% for rice. Determine the total area cultivated by wheat and rice.
(A) 2400 ha (B) 8000 ha
(C) 6400 ha (D) 4000 ha

Q71 Which of the following statements regarding Portland Pozzolana Cement (PPC) is INCORRECT?
(A) PPC is useful in marine and hydraulic structures.
(B) PPC produces more heat of hydration than ordinary Portland cement.
(C) The long-term strength of PPC beyond a couple of months is higher than that of ordinary Portland cement if enough moisture is available for continued pozzolanic action.
(D) Fly ash is a pozzolanic material used for the manufacture of PPC.

Q72 The painting of walls, doors and windows is measured in _____.
(A) gram
(B) cubic metre
(C) square metre
(D) pound

Q73 The least count of a theodolite is_____ .
(A) 1 second
(B) 1 millisecond
(C) 1 minute
(D) 1 hour

Q74 In case of a turbulent flow in a pipe, the shear stress is:
(A) maximum at the wall and decreases linearly to zero at the centre

(B) maximum at the centre and decreases linearly towards the wall
(C) maximum at the midway between the centre line and the wall
(D) maximum at the centre and decreases logarithmically towards the wall

Q75 A magnetic compass can be used to measure_____.
(A) magnetic meridian, magnetic bearing and arbitrary bearing
(B) both magnetic meridian and magnetic bearing
(C) magnetic bearing only
(D) magnetic meridian only

Q76 For a railway track, the width of the formation depends upon which of the following?
i. Type of sleepers
ii. Type of ballast
iii. Type of gauge
iv. Number of tracks, i.e. single or double track
(A) Both iii and iv
(B) Both ii and iii
(C) Both i and iv
(D) Both i and ii

Q77 A tacheometer was set at a station and the readings were taken on two points, which were 100 m and 150 m apart and had staff intercepts of 3.98 m and 5.98 m, respectively. If an externally focusing tacheometer was used for the observation, then the values of focal length (f), stadia interval (i), and distance (d) between the objective and the vertical axis of the instrument could be_____.
(A) f = 0.2m, i = 12mm, d = 30cm
(B) f = 0.3m, i = 1.2mm, d = 20cm
(C) f = 0.3m, i = 12mm, d = 20cm
(D) f = 0.3m, i = 0.12mm, d = 20cm

Q78 If the pipes are connected in parallel, the total loss of head is:
(A) equal to the sum of the squares of head losses in each pipe
(B) the same in each pipe
(C) equal to the sum of head losses in each pipe
(D) equal to the reciprocal of the sum of head losses in each pipe

Q79 As per IS 456:2000, which of the statement regarding longitudinal reinforcement in the RCC column is INCORRECT?
(A) Minimum 6 longitudinal bars is to be provided in a circular column
(B) Minimum 4 longitudinal bars is to be provided in a rectangular column.
(C) Minimum 8 longitudinal bars is to be provided in a column having helical reinforcement within the helical region.
(D) Minimum diameter of longitudinal bars shall not less than 12 mm.

Q80 As per Indian Standard code (IS - 456), what should be the minimum clear cover provided during the design of a water tank during moderate exposure conditions?
(A) 75 mm (B) 30 mm
(C) 10 mm (D) 45 mm

Q81 Miscellaneous expenses such as office expenses, stationery, postal expenses, etc., falls under_____.
(A) extra expenses
(B) overhead expenses
(C) surcharge expenses
(D) additional expenses

Q82 For _____, measuring is required individually in order to provide extra rates of associated components.
(A) honeycomb brickwork
(B) brickwork in arches
(C) reinforced brickwork
(D) earthwork

Q83 When the precipitation of a storm reaches the ground, it must fill up a basin, which is lower than its surrounding, before it can flow over the surface. The volume of water trapped in the

basin, which is lower than its surroundings, is called _____.
(A) dead storage
(B) basin storage
(C) sub-surface storage
(D) depression storage

Q84 Which of the following options represents an Incorrect relation between the fundamental axis of a theodolite?
(A) the axis of the altitude level must be parallel to the line of collimation
(B) the axis of the altitude level must be parallel to the line of collimation
(C) the axis of the striding level must be perpendicular to the transit axis.
(D) the trunnion axis must be perpendicular to the line of sight.

Q85 Which of the following accelerating admixtures is harmful for reinforced concrete and pre-stressed concrete?
(A) Silicates
(B) Calcium chloride
(C) Carbonates
(D) Fluorosilicates

Q86 To measure vertical angles, the theodolite must be leveled with reference to _____.
(A) the bubble tube on the plate level
(B) the altitude bubble on the index frame
(C) the altitude buddle on both the telescope and the index frame
(D) the altitude bubble on the telescope

Q87 Based on the slenderness ratio, a steel column is found to be an intermediate column. The failure of such a column is visible as:
(A) The steel column will not fail but remain unstable
(B) a mixed mode of buckling and crushing
(C) only buckling
(D) only crushing

Q88 As per IS 456-2000, the flexural strength of a rectangular section of a singly reinforced RCC beam does NOT depend on which of the given options?
(A) Grade of concrete
(B) Depth of beam
(C) Grade of steel
(D) Temperature

Q89 The number of days for which a crop remains in a field is known as crop period. The crop period is also defined as the number of days between _____.
(A) preparation of land and last watering before harvesting a crop
(B) sowing and the last watering before harvesting a crop
(C) sowing and harvesting of a crop
(D) preparation of land and sowing

Q90 Defects due to fungi occur when the moisture content of timber is above_____.
(A) 20% (B) 25%
(C) 10% (D) 15%

Q91 Select the correct option for the given statements.
Statement 1: Direction of the movement of a storm over the catchment area has a definite effect on the runoff.
Statement 2: If the storm moves against the flow direction, then the base period will be comparatively more and less peak flow may be expected.
(A) Both statement 1 and statement 2 are true, but statement 2 is not the correct explanation of statements 1
(B) Statement 1 is false and statement 2 is true
(C) Statement 1 is true and statement 2 is false
(D) Both statement 1 and statement 2 are true, and statement 2 is the correct explanation of statement 1.

Q92 Select the correct statement regarding the 1st and 2nd moment of area of circular lamina with radius 'R'.
(A) 1st moment of area is always +ve and 2nd moment of area is always -ve.

(B) 1st moment of area and 2nd moment of area are always +ve.
(C) 1st moment of area is may be either -ve or +ve based on the chosen reference axes, but 2nd moment of area is always +ve.
(D) 1st moment of area is always -ve and 2nd moment of area is always +ve.

Q93 Consider the following distances:
d_1 = distance travelled by the vehicle after applying the breaks.
d_2 = distance travelled by overtaking vehicle, during reaction time for overtaking.
d_3 = distance travelled by overtaking vehicle, during total overtaking time.
d_4 = distance travelled by overtaken vehicle, during total overtaking time.
The Overtaking Sight Distance, on a road with one-way traffic will be equal to:
(A) $d_3 + d_4$
(B) $d_1 + d_2 + d_3 + d_4$
(C) $d_2 + d_3$
(D) $d_1 + d_2 + d_3$

Q94 Consider the given statements.
I: Rate of material used for construction includes the cost of transport.
II: For material that is supplied departmentally, cost of carriage from godown to work rate shall be added.
Which of the statements is/are true?
(A) Both statements I and II are true
(B) Only statement I is true
(C) Both statements I and II are false
(D) Only statement II is true

Q95 The value of slope at fixed support of a cantilever beam of length-L, flexural rigidity- EI, subjected to a point load 'P' at its mid-span, and another point load 'P' at its free end, is:
(A) $\frac{PL}{4EI}$ (B) $\frac{3PL}{4EI}$
(C) $\frac{PL}{2EI}$ (D) zero

Q96 In the design of T beam, If $M_u > M_{u,lim}$ then the section is designed as a _____
Where
M_u = ultimate flexural strength of beam
$M_{u,lim}$ = limiting moment of resistance of beam
(A) Doubly reinforced section
(B) under reinforced section
(C) Singly reinforced section
(D) Over reinforced section

Q97 Proper experimental knowledge about the porosity and water absorption capacity of a coarse aggregate is required as its affects the durability of concrete because of:
I. Freezing and thawing
II. Reaction with chemically reactive fluids
III. Increasing the workability of concrete
(A) Both (i) and (ii)
(B) Only (i)
(C) (i), (ii), and (iii)
(D) Only (ii)

Q98 The geographical information system is capable of integrating_____to capture, store, retrieve, analyze and display the spatial data.
(A) only a multi-sector database system
(B) multi-sector, multi-level and multi-period database systems
(C) only multi-level and multi-period database systems
(D) only multi-sector and multi-level database systems

Q99 Consider the following statements with respect to long wall-short wall method. Which of the following statement is/are correct?
I. The wall that is taken first is treated as the length, though the length may be lesser.
II. The wall with longer length has to be taken as the long wall.
(A) Only statement II is true
(B) Both statements I and II are true
(C) Both statements I and II are false
(D) Only statement I is true

Q100 If the actual velocity of jet at the vena contracta in an orifice meter is 'V', the depth of the centre of orifice below the free surface is 'h'

and 'g' is the gravitational acceleration, then the coefficient of velocity 'C_V' is:

(A) $2Vgh/300$
(B) $2gh/(V)^{1/2}$
(C) $4V/(2gh)^{3/2}$
(D) $V/(2gh)^{1/2}$

Answer Key

Q1	(C)
Q2	(B)
Q3	(D)
Q4	(C)
Q5	(D)
Q6	(A)
Q7	(A)
Q8	(C)
Q9	(D)
Q10	(B)
Q11	(D)
Q12	(A)
Q13	(A)
Q14	(D)
Q15	(A)
Q16	(A)
Q17	(A)
Q18	(D)
Q19	(C)
Q20	(C)
Q21	(A)
Q22	(D)
Q23	(A)
Q24	(B)
Q25	(C)
Q26	(C)
Q27	(D)
Q28	(B)
Q29	(A)
Q30	(C)
Q31	(C)
Q32	(B)
Q33	(D)
Q34	(C)
Q35	(B)
Q36	(C)
Q37	(A)
Q38	(B)
Q39	(D)
Q40	(B)
Q41	(D)
Q42	(D)
Q43	(C)
Q44	(A)
Q45	(D)
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Q59	(C)
Q60	(A)

Q61 (B)
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Q92 (C)
Q93 (C)
Q94 (A)
Q95 (D)
Q96 (A)
Q97 (C)
Q98 (B)
Q99 (D)
Q100 (D)

Hints & Solutions

Q1 Text Solution:

Traffic Volume Study: Traffic volume or flow is the number of vehicles crossing a point on a road in unit time. It is used to measure the quantity of traffic flow and is expressed as Vehicle/hr or PCU/hr.

Complete traffic volume study includes:

1. Classified volume study: The number of different types of vehicles is counted,
2. Directional study: Distribution of traffic on different lanes is calculated.
3. Turning movement study at intersection: It is done for intersection design.
4. Pedestrian volume study: This study helps in planning, subways, footbridge and in pedestrian signal timing.

Presentation of Traffic Volume Data:

1. Annual Average Daily Traffic (AADT)
2. Average Daily Traffic (ADT)
3. Trend Chart
4. Traffic flow map along the route
5. 30th highest hourly volume

Q2 Text Solution:

The Air (Prevention and Control of Pollution) Act of 1981 offers definitions crucial to understanding air quality. It defines "air pollutant" as any solid, liquid, or gaseous substance found in the atmosphere in concentrations that could harm human health. This statute also highlights the significance of "emission", which refers to any solid, liquid, or gaseous substance discharged from chimneys, ducts, or other outlets.

Q3 Text Solution:

Methods	Properties
Oven drying method	Most accurate method and is astandard laboratory method
Pycnometer method	More suitable for cohesionless soil as removal of entrapped air from cohesive soil is difficult
Sand bath method	It is a rapid method hence not very accurate
Torsion balance method	Drying and weighing are done simultaneously with the help of infrared rays, hence one of the accurate methods
Calcium carbide method	Takes just 5-7 minutes and is used as a field test
Alcohol test	It is a quick field test and is not used for soils containing calcium or organic compound
Radiation method	Gives water content in an in-situ condition

Q4 Text Solution:

Given that,

Width (b) = 250 mm

Effective depth (d) = 450 mm

Nominal shear stress (τ_v) = 1.25 N/mm^2

$\tau_v = \frac{V}{bd}$

Shear force (V) = $\tau_v$bd

V = 1.25 × 250 × 450

V = 140625 N = 140.625 kN

Q5 Text Solution:

Fundamental lines in a Theodolite:

Vertical axis (Azimuth axis): It is the axis about which instrument rotates in the horizontal plane.

Horizontal Axis (Trunnion axis): It is the axis about which instrument rotates in the vertical plane.

• The striding level is attached to the trunnion,parallel with the horizontal axis.

• It is advantageous to employ the striding level for the accurate adjustment of the vertical axis and measurement of the inclination of the horizontal (trunnion) axis.

• Hence, Some theodolite are fitted with striding level which is used to test the horizontally of the trunnion axis.

Line of Collimation (Line of Sight):

• It is the line that passes through the intersection of horizontal and vertical crosshairs and the optical center of object-glass.

Bubble Line (Level tube axis or Altitude level axis):

• It is a straight line tangential to the longitudinal curve of the level tube at its center. It is horizontal when the bubble is center.

Plate level axis:

• It is perpendicular to the vertical axis when the bubble is at the center.

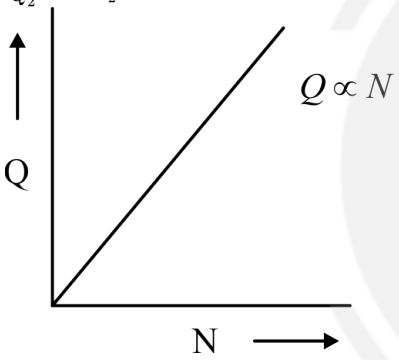
Q6 Text Solution:

Various relation between the pumps and shaft speed

(i) Flow rate is proportional to shaft speed

$Q \propto N$

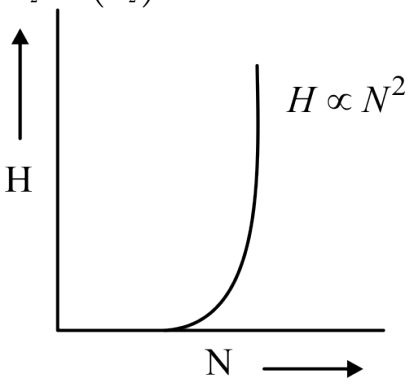
$\frac{Q_1}{Q_2} = \frac{N_1}{N_2}$



(ii) Pressure or head is proportional to the square of shaft speed

$H \propto N^2$

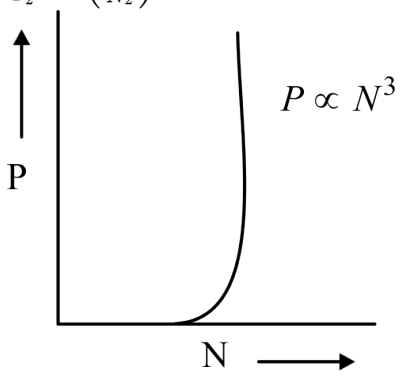
$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$



(iii) Power is proportional to the tube of shaft speed

$P \propto N^3$

$\frac{P_1}{P_2} = \left(\frac{N_1}{N_2}\right)^3$



Q7 Text Solution:

Classification of Rocks:

1. Sedimentary rocks

Sedimentary rocks are formed by the deposition of sediments obtained by the weathering of pre-existing rocks and these sediments are transported by various agents such as water, wind, frost, gravity, etc. These transported sediments form layered structures and give rise to sedimentary deposits. Examples: Sandstone, limestone, lignite, etc

2. Igneous rocks

Igneous rocks are formed by the solidification of magma below the earth's surface. When the magma is unable to erupt through the earth surface during its upward journey, it is held up below the earth's surface and unable to descend. This magma cools down gradually and solidifies into igneous rocks. Examples: Granite, Dolerite, Basalt,etc.

3. Metamorphic rocks

Metamorphic rocks are formed by the metamorphism process. Metamorphism is the process of changing the characteristics of pre-existing rocks under the influence of heat and pressure. The pre-existing rocks may be of the sedimentary or igneous type of rocks. Examples: Slate, Gneiss, Schist, marble, soapstone etc

Q8 Text Solution:

Setting Time:

• On addition of water to cement the paste thus resulted undergoes stiffening and starts to gain strength and loses consistency simultaneously

• This stiffening occurs in two stages and these stages are referred to as initial and final setting time.

• When water is added to cement and mixed properly the chemical reaction soon starts and the cement paste remains plastic for a short period During this period it is possible to remix the poste and this period is called initial setting time.

• It is assumed that no hardening will start in this period As time passes the reaction continues and cement begins to harden time elapses from the time of mixing with water to hardening is known as the final setting time

• In the initial setting time test a cement paste is prepared by gauging cement with 0.85 times the water required to prepare a paste of standard consistency.

Q9 Text Solution:

Plain Scale: This scale is used to represent two successive units, such as 'kilometer, hectometer', 'meter, decimeters', 'meters, 1/10th of meter' etc.

Diagonal Scale: This is a scale used to represent three successive units or one unit and its fraction up to the second place of decimals, such as 'kilometers, hectometres, decametres

Engineer's scale: An engineer's scale is an instrument that is similar to a ruler and is used to measure scale on technical drawings. It is shaped like a long triangular prism, about 12 inches (30.5 cm)long, with each side of each point marked with a different scale for measuring. This scale is represented by a statement like 1cm = 10m

• Here 1cm on the plan represents & 10m represents ground distance.

Representative fraction: Here one unit of length on the plan represents some number of the same units of length on the ground.

1cm = 10m is represented in RF as 1:1000

Q10 Text Solution:

Punching Shear Failure of foundation soils

This type of failure is seen in loose and soft soil and at deeper elevations. The following are some characteristics of general shear failure.

1. This type of failure occurs in soil of very high compressibility.
2. A failure pattern is not observed.
3. Bulging of soil around the footing is absent.
4. Failure is characterized by a very large settlement.
5. Punching shear may occur in relatively loose sand with a relative density less than 35%

Q11 Text Solution:

Carbon footprint: "A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product."

Ways to Reduce Carbon Footprint:

- Reduce meat in your diet and avoid wasting food.
- Ensure car tires are properly inflated.
- Fuel efficiency decreases by 0.2% for each 1 PSI decrease.
- Whether you hand wash dishes or use a dishwasher, follow recommended practices to decrease water and energy use and reduce emissions.
- Energy consumed by devices in standby mode accounts for 5-10% of residential energy use, adding up to $100 per year for the average American household.
- Unplug electronic devices when not in use or plug them into a power strip and turn the power strip off.
- Choose energy-efficient lighting.
- Switching from incandescent to LED light bulbs saves an average household more than $200/year.
- Reduce what you send to a landfill by recycling, composting, and buying products with minimal packaging.

Carbon footprints are typically divided into three scopes:

Scope 1: Direct emissions from sources you own or control, such as your car or home heating.

Scope 2: Indirect emissions from purchased energy, like electricity or heating for your apartment.

Scope 3: All other indirect emissions associated with your activities, including manufacturing, transportation, and disposal of goods and services you use.

Q12 Text Solution:

Lining of canal: By lining of canal we mean that the earthen surface of the canal is lined with a stable lining surface (such as concrete, tiles, asphalt etc.) In general, We adopt two types of lined canal section:

- Triangular-shaped channel with circular bottom (for smaller discharge)
- Trapezoidal-shaped channel with rounded corner (for larger discharge)

Advantage of lining of the canal:

(i) Prevents seepage loss and hence more area can be employed for irrigation.

(ii) Helps in the prevention of water-logging.

(iii) Increased velocity in a canal prevents silting of the canal.

Disadvantage of lining canal:

(i) It requires heavy initial investment.

(ii) It is difficult to repair initial investment

Q13 Text Solution:

Material statement: The total quantities of all the items of materials required for the completion of the construction is shown in Material statement.

Bar bending schedule: Bar Bending Schedule, commonly referred to as "BBS" is a comprehensive list that describes the location, mark, type, size, length and number and bending details of each bar or fabric in a Reinforcement Drawing of a Structure.

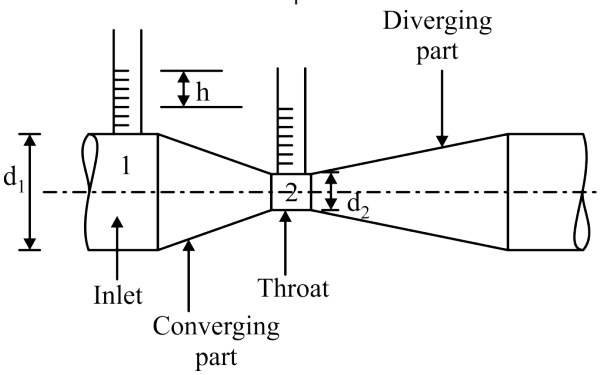
Work charged establishment: The work charged establishment will include the temporary establishment as are employed for the execution or the immediate technical supervision or departmental stores in connection with the specific work.

Sundries: Sundries is the column used to add prices for miscellaneous items which are not listed in the bow. For example, binding wire used to tie rebar, cover blocks etc.

Q14 Text Solution:

Venturimeter:

- It is a device commonly used to measure the flow rate of a fluid flowing through a pipe. It is based on Bernoulli's principle.
- The venturimeter always has smaller convergent portion and a larger divergent portion. This is done to ensures a rapid converging passage and a gradual diverging passage in the direction of flow to avoid the loss of energy due to separation.
- In the course of flow through the converging part, the velocity increases in the direction of flow according to the principle of continuity, while the pressure decreases according to Bernoulli's theorem.
- The velocity reaches its maximum value and pressure reaches its minimum value at the throat. Subsequently, a decrease in the velocity and an increase in the pressure take place in the course of flow through the divergent part.
- The angle of convergence is 20° and the angle of divergence is 6°-7°, It should not be greater than 7° to avoid flow separation



Actual discharge $Q = \frac{C_d a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \sqrt{2gh}$

Q15 Text Solution:

Method of determining deflection of beams:

- Double integration method

• Moment area method
• Strain energy method
• Conjugate beam method
• Macaulay's method
• Unit load method

Double integration method: It is also known as integration method, it uses the equation of the deflection curve in terms of bending moment.

$$EI = \frac{d^2y}{dx^2} = -M$$

Integrating

$$EI = \frac{dy}{dx} = EI\theta = -\int M$$

Integrating again

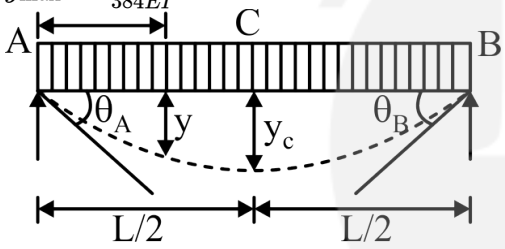
$$EIy = -\int\int M$$

Case 1: Simply supported beam with UDL over the entire length

$$EI = \frac{d^2y}{dx^2} = -M = \left[\frac{wL}{2}x - \frac{wx^2}{2}\right]$$

$$\theta_A = \frac{wL^3}{24EI}$$

$$y_{max} = \frac{5WL^4}{384EI}$$



Therefore, in the double integration method for a simply supported beam subjected to UDL over its entire span, the slope and deflection calculation will require the boundary condition as well as the symmetry condition.

Q16 Text Solution:

Drainage density: It is defined as the sum of the lengths of all the streams divided by the catchment area.

Drainage Density = (Total Length of Channels/Catchment Area)

• In general as drainage density increases, flow velocity increases, infiltration decreases, base period decreases and peak discharge increases.

The study area is divided into three classes:

Class	Drainage Density
High drainage density	> 4 km/km^2
Moderate drainage density	2-4 km/km^2
Low drainage density	< 2 km/km^2

Q17 Text Solution:

Given that,

Sleeper density = N + 3

Width of sleeper (W) = 20.25 cm

For BG track length of one rail = 13 m

No. of sleepers = 13 + 3 = 16

Spacing of sleepers (S) $= \frac{13\times100}{16} = 81.25$ cm

Depth of ballast cushion $= \frac{S-W}{2} = \frac{81.25-20.25}{2} = 30.5$ cm

Q18 Text Solution:

MUNICIPAL SOLID WASTES

MSW is also called refuse. Refuse is the organic and inorganic waste materials such as product packaging, grass clippings, furniture, clothing, bottles, kitchen refuse, paper, appliances, paint cans, batteries, etc.

Municipal Solid Wastes Classified on the Basis of Source are as follows:

(a) House refuse: This consists of vegetable and animal waste matters, ashes, rubbish, and debris from cleaning and demolition of structures.

(b) Street refuse: This consists of empty packets and bottles, empty matches and cigarette boxes, fruit, peels, tree leaves, street sweepings etc.

(c) Trade refuse: This consists of solid wastes from factories, commercial and business centers, slaughter houses etc .

INDUSTRIAL WASTES

• Industrial wastes are generated from the industrial activities or manufacturing processes.

• All the three types of wastes, solid, liquid and gaseous are generated

• The solid wastes produced by industries can be broadly divided into the following two categories

(a) Non hazardous solid wastes

(b) Hazardous solid wastes

Q19 Text Solution:

GLONASS - Russia

• This system is meant to provide radio navigation satellite services.

• GLONASS (Global Navigation Satellite) is a Russian space-based satellite navigation system.

• It supports with ensured performances on a competitive level GLONASS development towards capability enhancement aimed at achieving parity with international navigation satellite systems and leadership of the Russian Federation in satellite navigation

TSIKADA - Russia

Tsikada is a Russian satellite navigation system including ten Low Earth Orbit (LEO) satellites. It transmits the same two carrier frequencies as the U.S. TRANSIT satellite system.

Q20 Text Solution:

Discharge (Q) = 40 cumec

Permissible mean velocity (V) = 0.95 m/s

Side slope = 1:1

$\frac{B}{D} = \frac{Width}{Depth} = 6.5$

B = 6.5 D

$\because$ Q = AV

40 = A × 0.95

$A = \frac{40}{0.95} = 42.11\ m^2$

Cross sectional area (A) = (B + D)D

42.11 m^2 = (6.5D + D)D

42.11 m^2 = 7.5 D^2

D^2 = 5.62 m^2

D = 2.36 m

Bed width of canal (B) = 6.5 D

B = 6.5 × 2.36 = 15.40 m

Q21 Text Solution:

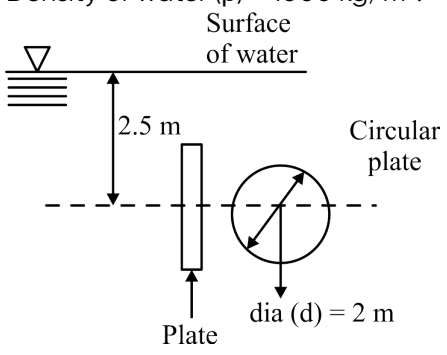
Typical name of soil groups	Permeability when compacted and saturated	Shearing strength when compacted	Workability as a construction material
Well-graded gravel, gravel-sand mixtures, little or no fines (GW)	Pervious	Excellent	Excellent
Poorly graded gravels, gravel-sand mixtures (GP)	Very pervious	Good	Good
Silty gravel (GM)	Semi-pervious to impervious	Good	Good
Clayey gravel (GC)	Impervious	Good to fair	Good
Well-graded sand (SW)	Pervious	Excellent	Excellent
Silty sands (SM)	Semi-pervious to impervious	Good	Fair

Q22 Text Solution:

Diameter of circular plate (d) = 2 m

$\bar{x}$ = 2.5m

Density of water (ρ) = 1000 kg/m^3.



$Area\ (A) = \frac{\pi}{4} \times d^2 = \frac{\pi}{4} \times 2^2 = 3.14\ \text{m}^2$

Total horizontal force $F_H = \rho g A \bar{x}$

$F_H = 1000 \times 9.81 \times 3.14 \times 2.5$

$F_H = 77008.5$ N

Q23 Text Solution:

Actuated signals.

• In this type of signal system, signal timings are completely influenced by the traffic volume as detected on all approach roads(where as it is not influenced as per the time of the day)

• Initial cost is very high for the installation of traffic signals.

• Sensors and detectors are used to operate the signals.

Semi actuated signal

• In this type of signal system, timings are affected when vehicles are detected.

• Suitable only when low volume Road intersects, high volume Road.

Fixed time signal

• The timing of each phase of the cycle is fixed based on the traffic studies.

• Signals time cycle does not change with respect to the change in traffic flow at the intersection.

Q24 Text Solution:

U tube manometers: A U-tube manometer is the simplest pressure measurement device. Its name comes from the U-shape formed when the two ends of a flexible tube full of liquid are raised to keep the liquid from coming out the ends. A simple U tube manometer connected to a pipe in which liquid is flowing with uniform speed will give Gauge pressure.

Q25 Text Solution:

Cast In Situ Lining: While the initial cost of lining canals may be higher, the long-term benefits often outweigh this investment. Reduced water seepage, **lower maintenance charge requirements**, and increased water efficiency result in long-term cost savings for water management authorities and users.

Q26 Text Solution:

Steps for painting of surfaces:

1. Surface preparation
2. Prime coat
3. First coat
4. Final coat

Surface preparation: Before painting, it's essential to prepare the surface by cleaning, sanding, and repairing any imperfections. This step ensures that the paint adheres well and provides a smooth finish.

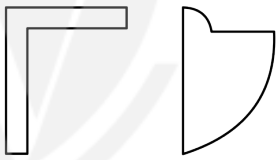
Prime coat: After preparing the surface, applying a primer coat helps seal the surface, provides better adhesion for the paint, and improves the durability of the final finish.

First coat : Once the primer is dry, the first coat of paint is applied. This layer establishes the base color and coverage.

Final coat : Lastly, the final coat of paint is applied to achieve the desired color depth and finish. This coat enhances the appearance and provides additional protection to the surface.

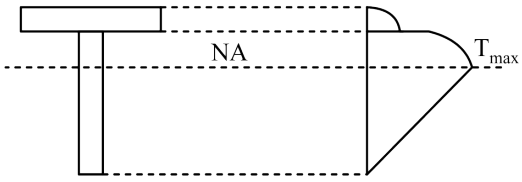
Q27 Text Solution:

Shear stress distribution of L section

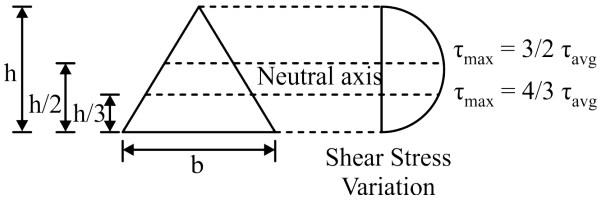


L Section

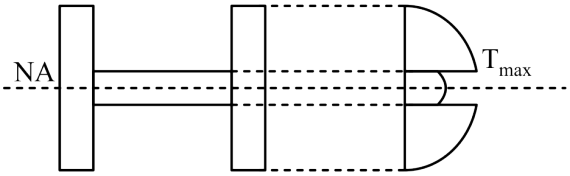
Shear Stress distribution in T section.



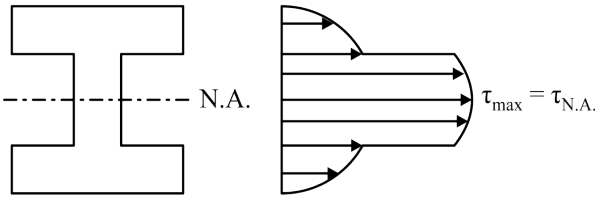
Shear stress distribution for a triangular section is given by



Shear Stress distribution in H section.



Shear Stress distribution in I section.



Q28 Text Solution:

Particle board, also known as chipboard, is manufactured from particles of wood or other lignocellulose materials. These particles are agglomerated, formed, and pressed together using an organic binder in the presence of heat, pressure, or moisture. This process results in a dense and uniform panel material suitable for various applications in construction, furniture manufacturing, and interior design.

Q29 Text Solution:

Starting at the center, Earth is composed of four distinct layers. They are from deepest to shallowest, the inner core, the outer core, the mantle and the crust.

The inner core

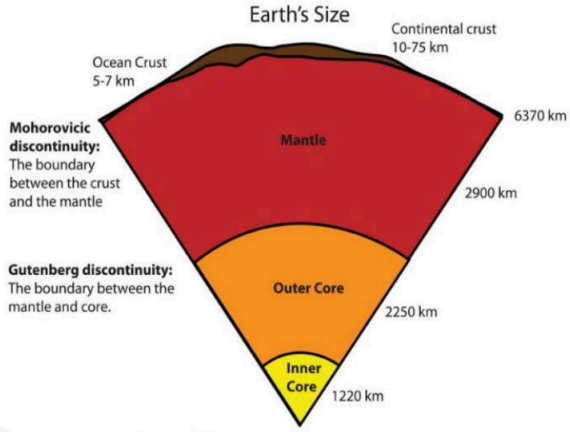
This solid metal ball has a radius of 1,220 kilometers (758 miles), or about three-quarters that of the moon. It's located some 6,400 to 5,180 kilometers (4,000 to 3,220 miles) beneath Earth's surface. It would likely consist almost entirely of iron.

The outer core

This part of the core is also made from iron and nickel, just in liquid form. It sits some 5,180 to 2,880 kilometers (3,220 to 1,790 miles) below the surface. Heated largely by the radioactive decay of the elements uranium and thorium, this liquid churns in huge, turbulent currents.

The mantle

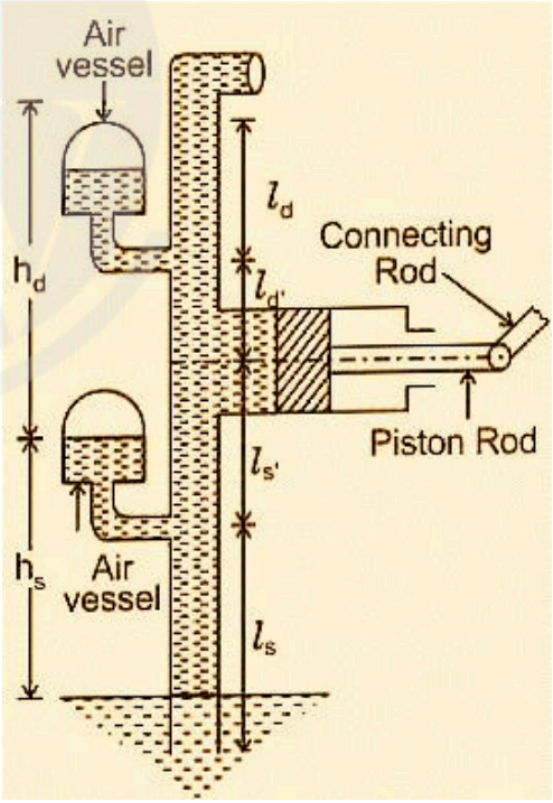
At close to 3,000 kilometers (1,865 miles) thick, this is Earth's thickest layer. It starts a mere 30 kilometers (18.6 miles) beneath the surface. Made mostly of iron, magnesium, and silicon, it is dense, hot and semi-solid (think caramel candy).



Q30 Text Solution:

Air vessels

Air vessels is a large closed chamber fitted in suction and delivery pipes close to the cylinder.



Functions of air vessel:

Advantages of using air vessel on suction side

(1) Chances of cavitation will be less.

(2) Length of suction pipe can be increased (due to friction not occurs).

(3) Power expended in pumping will be reduced for a given min press head.

(4) For a given min pressure head, head running speed of pump can be increased and hence discharge con be increased.

Advantage of using air vessel on delivery side

(1) Steady discharge in the delivery pipe is assured.

(2) If the pipe is to be designed on the basis of max discharge there would be considerable saving the pipe diameter.

(3) Due to reduction in frictional losses power can be saved and for a given min press Running speed of pump can be increased producing greater discharge.

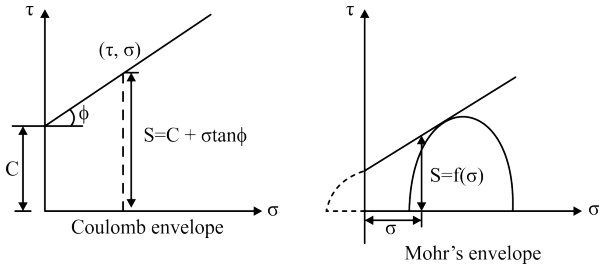
Q31 Text Solution:

Mohr Coulomb Failure Theory:

The theory was first given by coulomb (1776) and later generalized by Mohr (1900). According to Mohr coulomb failure theory, the failure occurs when shear stress on the failure plane reaches some unique function of the normal stress on that plane and can be expressed algebraically by the equation

$$\tau_f = S = f(\sigma_t)$$

The shear stress at failure, τf is called the shear strength. If the shear stress and normal stress at failure are plotted then a curve is obtained. This curve is called failure envelope or strength envelope. The failure envelope suggested by coulomb is a straight line



Q32 Text Solution:

Coefficient of discharge: Coefficient of discharge is the ratio of actual discharge to the theoretical discharge.

Venturimeter	0.95 to 0.98
Orifice meter	0.62 to 0.65
Nozzle meter	0.93 to 0.98

Q33 Text Solution:

Given, Diameter of pipe (d) = 0.3

Specific gravity (G) = 0.8

Flow velocity (v) = 1.5 m/s

Gauge pressure (P) = 20 kN/m^2

Datum head (z) = 3 m

ρ = Specific gravity × ρ_{water}

ρ = 0.8 × 1000 = 800 kg/m^3

We know that,

Total energy at point A $= Z + \frac{V^2}{2g} + \frac{P}{\rho g}$

$= 3 + \frac{1.5^2}{2\times 9.81} + \frac{20\times 10^3}{800\times 9.81} = 5.644$ m

Q34 Text Solution:

Traffic Noise:- Noise produced by traffic has always been a nuisance to society. The intensity and nature of the traffic noise depend on various factors. The disturbance due to aircraft noise depends very much on the type of aircraft. A jet aircraft at take-off produces more noise than a propeller type and a heavy truck carrying loose luggage may have a greater nuisance value than a private car. In the case of automobile traffic, the condition of the road and the maintenance of the vehicles play an important part.

The noise produced by trains also depends upon the type of train, for typical values of train noise, the rails, and their bending. As in the case of road, rail, and air traffic, the noise produced by sea traffic is more at the harbor where the loading and unloading takes place.

Source of noise	**dB**
Air traffic	100-110
1. Jet aircraft at take-off stage at about 300 m	100-110
2. Propeller aircraft at take-off stage at	90-110

about 300 m	
Rail traffic (at about 30 m)	90-110
Heavy road traffic (highway)	80-90
Medium road traffic (main streets)	70-80
Light road traffic (side streets)	60-70

Q35 Text Solution:

Road markings

Road markings or traffic markings are made on the road to control, warn, guide, or regulate the traffic.

The markings may be in the form of lines, patterns, words, symbols, or reflectors on the pavement, kerb, side of islands, or on fixed objects within or near the roadway.

The road markings are classified as:

1. Pavement markings,
2. Kerb markings,
3. Object markings, and
4. Reflector Unit markings.

1. Pavement markings: The white color paint is generally used for pavement markings whereas the yellow color paints are used to indicate parking restrictions, and for the continuous centre line and barrier line markings. The longitudinal solid lines being used as guiding or regulatory lines, are not supposed to be crossed by the drivers. The stop lines for vehicular traffic are indicated by transverse solid lines.

2. Kerb marking:- It is used to indicate certain regulations like parking regulations.

3. Object markings :– It indicate the hazardous objects such as signs and signals, level crossing gates,supports for bridge, traffic islands, narrow bridges, culvert head wall, etc., on or near the roadway.

4. Reflector Unit markings :–It is used as hazard markers and guide markers for safe driving at nights. The reflecting yellow light is used for such markings to make them visible from a long distance of about 150 m.

Road Delineators or some arrangements to provide visual assistance to drivers about the alignment of the road ahead,

especially at night to avoid accidents. The delineators may be of three types as Roadway Indicators, Hazard Markers, and Object Markers. All the three have different shapes, designs, and color patterns.

Q36 Text Solution:

Recommended cement and sand mix ratio for plastering:

For external wall prone to severe climate condition and for repair work = 1:3

External brick wall plastering and ceiling plastering = 1 : 4

Internal brick wall plastering when fine sand is not available = 1:5

Internal brick wall plastering when fine sand is available = 1:6

Q37 Text Solution:

Rankine Theory

Rankine's theory considered stress in soil mass when it attains plastic equilibrium. Here, by plastic equilibrium we infer that every point in the soil mass experiences shear failure, under the effect of shear stress developed.

Assumptions in Rankine's Theory:

1. Soil is semi-infinite, homogeneous, isotropic, dry, and cohesionless.
2. Soil is in a state of plastic condition at the time of active and passive pressure generation.
3. The backfill soil is horizontal. (although it does not necessarily need to be horizontal)
4. Back of wall is vertical and smooth.
5. Rupture surface is a planar surface which is obtained by considering the plastic equilibrium of soil.

Q38 Text Solution:

Type of Admixture	Examples	Function
Plasticizers	Lignosulphate, polyglycol ester, carbohydrates, hydroxylated carboxylic acid	Reduce water-to-cement ratio while maintaining workability, or increase workability at the same water-to-cement ratio
Superplasticizers	Modified lignosulphonate, sulphonated malanie formaldehyde (SMF), sulphonated napthalene formaldehyde	Same as plasticizers in terms of function, but different in chemical reaction
Retarders	Calcium sulphate, tartaric acid, starch, sugar cellulose	Slow down the chemical reaction of hydration so that concrete remains plastic and workable for longer
Accelerators	**Calcium chloride**, silicates, flousilicate	Increase the rate of strength gain in concrete
Air-entraining agents	Natural wood resin, plant and animal fatty oil, stearic acid, oleic acid, hydrogen peroxide, aluminium powder	Entrap millions of air bubbles in the concrete, which improve workability, frost resistance, segregation, and bleeding

Q39 **Text Solution:**

Sprinkler Irrigation Method: In this method, the irrigation water is applied to the land in the form of a spray, somewhat as in ordinary rain through a network of pipes and pumps. Sandy fields are the field of light soils in which the percolation of water is very deep. So to avoid the loss of water, the sprinkler method is preferred, and also no need for land leveling that's why this method is suitable for undulating fields.

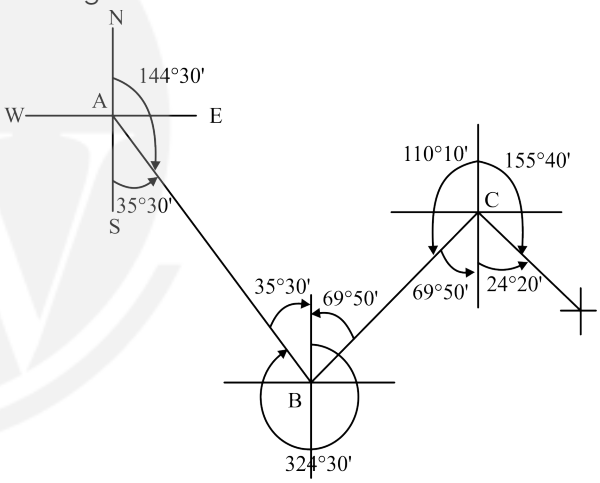
Q40 **Text Solution:**

Sheep foot roller: Sheep foot roller also named tamping roller. The front steel drum of the sheep foot roller consists of many rectangular-shaped boots of equal sizes fixed in a hexagonal pattern. In sheep foot, roller compaction is by static weight and kneading of the respective layer. This makes the tamping roller better suited for cohesive soils.

Q41 **Text Solution:**

Given that,

Bearing of line AB = S35°30'E



The bearing line of CD = S24°20'E

Q42 **Text Solution:**

Radius of gyration: It is the radial distance from the point to the axis of rotation where whole area of the body is supposed to be concentrated, so that the moment of inertia of system is same as given situation. Maximum radius of gyration is obtained when material is farthest from the centroid hence box section is best.

The radius of gyration of a body depends on

1. On the shape and size of the body.

2. Position and direction of the axis of rotation.
3. Distribution of area about the axis of rotation.

It is given by

Radius of gyration $r = \sqrt{\frac{I}{A}}$

Where A = Area of cross section

I = Moment of inertia

Q43 Text Solution:

Methods of Orientation of Plane table:

1. Orientation by trough compass
2. Orientation by mean of back sighting

1. Orientation by trough compass: Orientation by trough compass is less accurate and used for approximate orientation of plane table prior to the final adjustment.

• The plane table can be oriented by compass under the following conditions:

1. When speed is more important than accuracy,
2. When there is no second point available for orientation,
3. When the traverse is so long that accumulated errors in carrying the azimuth forward might be greater than the orientation of the compass,
4. For approximate orientation prior to final adjustment.

2. Orientation by mean of back sighting: Orientation in plane table surveying can be done precisely by sighting the points already plotted on the sheet.

The plane table can be oriented by mean of back sighting the following conditions:

1. When it is possible to set the plane table on the point already plotted on the sheet by way of observation from the previous section.
2. When it is not possible to set the plane table on the point.

Q44 Text Solution:

Particle boards or chip boards

• They are manufactured from particles of wood or other lingo cellulose materials which are agglomerated formed and pressed together by the use of an organic binder together in the presence of heat, pressure or moisture.

• These are cheaper, denser and more uniform than conventional wood and plywood and is substituted for them when appearance and strength are less important than cost.

• A major disadvantage is that it is prone to expansion and discoloration due to moisture. Therefore rarely used at outdoor, bathroom and kitchen.

• Due to their low strength, particle boards are less durable than plywood or solid wood. However, using laminates or veneers on the surface can aid to improve durability.

• A layer of melamine can be applied to the top surface of particle boards to make them fire-resistant.

• Particle boards are ideal for usage in recording studios and performance venues because of their outstanding sound insulation capabilities.

• Particle boards are extensively used for partitions doors, furniture making, etc.

Q45 Text Solution:

Dry process of cement manufacturing:

• Dry process is adopted when raw materials are quite hard.

• The process is slow and product is costly.

• Limestone and clay are ground to fine powder separately and are mixed.

• Water is added to make a thick paste. Cakes of this paste containing about 14% of moisture are dried and charged into the rotary kiln and the product obtained after calcination in the rotary kiln is called a clinker.

• Clinker is obtained as a result of incipient fusion (the process of joining two or more things together to form a single entity) and sintering (fusing together without melting to the point of liquefaction) at a temperature of about 1400°C-1500°C. because ferric oxide has a lower melting point than other oxide, it acts as a flux (the process of flowing).

• Aeration of cement clinker, which is commonly practiced to slake free lime, also causes absorption of moisture and carbon dioxides.

• Absorption of moisture tends to decrease the setting.

• Clinker is cooled rapidly to preserve the metastable compounds (nearly stable or easily prone to degradable) and their solid solutions dispersion of one solid in another, which are made as the clinker is heated.

• Clinker (3 to 20 mm size) is then cooled and ground in tube mills, where 2-3% gypsum is added Purpose of adding gypsum is to coat the cement particles by interfering with the process of hydration of the cement particles.

Q46 Text Solution:

Muster Roll: Muster Roll is used for keeping a complete record of attendance, payment made, unpaid wages, and work done by daily labour engaged in the execution of works. It is the basic record of payment made to daily labour. After the payment is made, the muster roll is kept as a voucher. It is very important to record strictly in accordance with the rules.

Muster Roll consists of the following three parts:

• **Part-1 (Nominal Roll) -** In this part of the Muster Roll full information about the labour employed is recorded and daily attendance of the labour is marked.

• **Part -2 (Register of arrears of wages due to Worked People) -** This part of the muster group is used for keeping a record of all unpaid wages.

• **Part -3 (Details of measurement of work done by labour) -** This part of the muster group is used for full particulars of the work done and the reference to pages and nos of the measurement book are recorded.

Q47 Text Solution:

Solid wastes: Solid wastes are the total wastes arising from human and animal activities that are normally solid and hence are useless or unwanted. It encompasses the heterogeneous mass of throw away from houses of commercial centers as well as the nearby homogeneous accumulation of a single industrial activity. Garbage, street sweepings, and plastic waste are all examples of solid waste. They are discarded materials with a semi-solid or solid consistency

Q48 Text Solution:

Combustion of coal in coal-fired power plants releases emissions of

• Sulfur dioxide (SO_2),

• Nitrogen oxides (NOx),

• Particulate matter (PM),

• Carbon monoxide (CO), and

• Volatile organic compounds (VOCs)

Welding operations can produce the following emissions

• Carbon monoxide

• Nitrogen oxides

• Ozone, dusts and metallic fumes

Incomplete combustion of fuels generally releases carbon monoxide gas (CO). Carbon monoxide is a poisonous gas as it reduces oxygen carrying capacity of our blood, when inhaled.

Municipal drainage systems emit H_2S gas. Municipal drainage system means the system operated and maintained by the city for the purpose of transporting, disposing, treating using or discharging drainage etc.

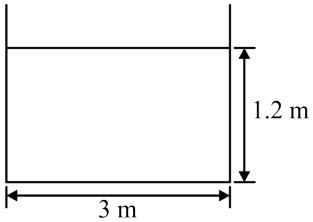
Q49 Text Solution:

Given that

Width (b) = 3 m

Depth (d) = 1.2 m

Bed slope = 0.0025



Area (A) = 1.2 × 3

A = 3.6 m^2

Wetted perimeter (P) = b + 2d

P = 3 + 2 × 1.2 = 3 + 2.4

P = 5.4 m

Hydraulic radius of channel $= \frac{A}{P}$

$R = \frac{3.6}{5.4} = 0.6666 = 0.667\ \text{m}$

Q50 Text Solution:

Coir fibers are natural fibers derived from the outer husk of coconuts.

Properties of Coir fibers :

1. Elasticity: Coir fibers have limited elasticity compared to some synthetic fibers like nylon or elastane. While they can flex to some extent without breaking, their elasticity is not as pronounced as that of certain other materials.

2. Ease to Carry: Coir fibers are lightweight and relatively easy to handle and transport, especially in comparison to heavier materials like steel. This property makes them convenient for use in applications where ease of handling is important, such as in packaging materials or in construction.

3. Long Service Span: Coir fibers are highly durable and resistant to degradation from environmental factors such as moisture, sunlight, and microbial activity. As a result, products made from coir fibers often have a long service life, making them a sustainable choice for various applications. Overall, coir fibers are valued for their strength, durability, and versatility, making them suitable for a wide range of applications including textiles, agriculture, landscaping, and environmental engineering.

Q51 Text Solution:

Underground water tank: It is a water tank that is constructed beneath the ground level to store the water. It is also used for rainwater harvesting. They are generally used all over the world for storage of water for various domestic as well as industrial uses. A pump is normally attached to the connecting line of the underground tank to get water into the required area.

For the design of the underground water tank, the following factors should be considered:

1. Soil pressure surrounding the tank
2. Water pressure
3. Ground water table

• The empty tank is the worst condition of loading for the design of an underground water tank because the soil around with water tank is charged with water acts as a critical condition of outside loading, that's why it is designed in empty condition.

• On the other hand, full filling or partial filling condition, the hydrostatic pressure of water counteract the earth pressure of the soil.

Q52 Text Solution:

The shear strength of reinforced concrete with the reinforcement is restricted to some maximum value τ_{max} depending on the grade of concrete.

Grade of concrete	$\tau_{\max}$ (in MPa)
M20	2.8
M25	3.1
M30	3.5
M35	3.7
M40	4

Q53 Text Solution:

In normal circumstances, where ambient temperature does not fall below 15°C and where ordinary portland cement is used and adequate curing is done, following striking period can be considered sufficient as per IS 456 of 2000.

Type of formwork	**Minimum period before striking formwork**
Vertical formwork to columns, beams, and walls	16-24 hours

Soffit formwork to slabs (props to be refixed immediately after removal of formwork)	3 days
Soffit formwork to beams (props to be refixed immediately after removal of formwork)	7 days
Props to slab	
Spanning up to 4.5 m	7 days
Spanning over 4.5 m	14 days
Props to beams	
Spanning up to 6 m	14 days
Spanning over 6 m	21 days

Q54 **Text Solution:**

Advantages and disadvantages of using rods and bars as tension members in steel structures-

Advantages:

High tensile Strength: Rods and bars made of steel offer high tensile strength, making them capable of withstanding significant loads without failing.

Ductility: Steel is highly ductile, meaning it can deform considerably before failing. This property allows tension members to absorb energy and undergo significant deformation before failure, providing warning signs of impending failure.

Ease of Fabrication: Steel rods and bars can be easily fabricated into various shapes and sizes to suit the design requirements of tension members.

Corrosion Resistance: Steel can be treated to improve its corrosion resistance, ensuring the longevity and durability of tension members in different environmental conditions.

Disadvantages:

Inadequate Stiffness: Rods and bars may exhibit inadequate stiffness, leading to excessive deflection or deformation under load. This can affect the overall stability and performance of the structure.

High Slenderness Ratio: When tension members have a high slenderness ratio (length-to-diameter ratio), they become prone to buckling. Buckling can reduce the load-carrying capacity and stability of the tension member.

Sag under Own Weight: Long rods or bars can sag under their weight, especially in applications where they are suspended or spanning long distances. Sagging can affect the appearance and functionality of the structure.

Cost: While steel offers high strength and durability, it can be relatively expensive compared to other materials. The cost of steel rods and bars, along with fabrication and installation expenses, can contribute to the overall cost of the structure.

Q55 **Text Solution:**

The four major compounds which are constituents of cement are:

a) Tricalcium silicate (C_3S): $3CaO.SiO_2$

b) Dicalcium silicate (C_2S): $2CaO.SiO_2$

c) Tricalcium Aluminate (C_3A): $3CaO.Al2O_3$

d) Tetra-calcium Alumino Ferrite (C_4AF): $4CaO.Al_2.Fe2O_3$

Dicalcium Silicate (C_2S) (25-40%):

• It hydrates and hardens slowly and takes a long time to add to the strength (after a year or more) i.e. it is responsible for ultimate strength.

• It imparts resistance to chemical attack.

• Raising of C_2S content renders clinkers harder to grind, reduces early strength, decreases resistance to freezing and thawing at an early age and decreases heat of hydration.

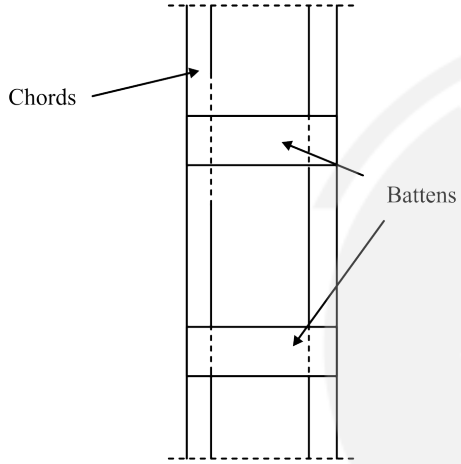
• At an early age, less than a month, C_2S has little influence on strength and hardness. While

after one year, its contribution to the strength and hardness is proportionately almost equal to C_3S.

• The heat of hydration is 260 J/g.

Q56 Text Solution:

Batten plate: The batten plates are also called as the plates and these are also used in lateral system. The angle sections, channels and I sections are also used as battens. The components of built-up column sharing the load are connected together by batten plates. The battening of columns shall not be done where the columns are subjected in the plane of batten to eccentric loading.



• If battens are provided effective length of the column is increased by 10%. (To take shear deformation effects in column). Shear deformation is more when battens are provided as compared to lacing members, so the effective length is increased by 10%.

• Compression members composed of two main components battened should preferably have these components of the same cross-section and symmetrically disposed about their X - X axis.

Q57 Text Solution:

Green building materials are composed of renewable, rather than non-renewable resources. Green materials are environmentally responsible because impacts are considered over the life of the product .The aim of using green building materials is to construct energy-efficient structures and to build those structures one should be aware of different green building materials, their properties and how they contribute into saving energy.

Following are the materials used in green buildings–

1. Wood brick
2. Sustainable concrete
3. Bamboo
4. Clay
5. Cork
6. Recycled rubber
7. Straw
8. Fly ash bricks

Q58 Text Solution:

Carbon credits were devised as a mechanism to reduce greenhouse gas emissions by creating a market in which companies can trade in emissions permits. Under the system, companies get a set number of carbon credits, which decline over time.

Q59 Text Solution:

Cost planning:

• Cost planning involves estimating, allocating,and controlling costs throughout the lifecycle of a project.

• It includes activities such as budgeting, cost estimation, value engineering, risk management, and cost control.

• Cost planning aims to ensure that resources are allocated efficiently and effectively to achieve project objectives within the allocated budget.

• In construction projects, cost planning helps stakeholders manage expenses, minimize financial risks, and optimize the use of available resources.

Q60 Text Solution:

Minimum shear reinforcement:

When, Nominal shear stress is less than design shear strength of concrete minimum shear reinforcement shall be provided.

Minimum shear reinforcement in beams is provided to ensure the following:

• To prevent sudden failure of the beam due to loss of bond between steel and concrete due to bursting of concrete cover.

• To prevent brittle shear failure due to diagonal principal tension.

• To prevent cracks due to shrinkage of concrete and thermal stresses.

• To hold the main reinforcement and increases the confinement.

Minimum shear reinforcement in the form of stirrups shall be provided such that

$$\frac{A_{Sv}}{b_{Sv}} \geq \frac{0.4}{f_y}$$

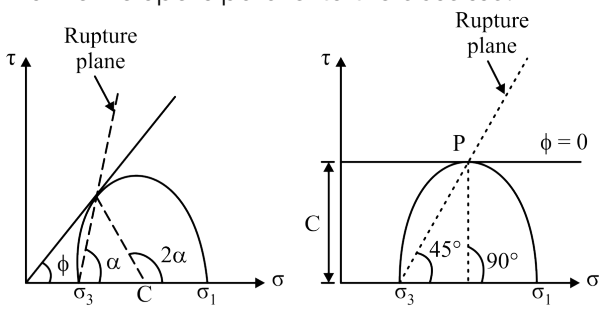
Q61 Text Solution:

MOHR-COULOMB THEORY

The soil is a particulate material. The shear failure occurs in soils by slippage of particles due to shear stresses. The failure is essentially by shear, but shear stresses at failure depend upon the normal stresses on the potential failure plane. According to Mohr, the failure is caused by a critical combination of the normal and shear stresses.

• Cohesionless soils, such as sands and gravels, possess internal friction, and when they are completely lacking in cohesion, their Coulomb or Mohr envelopes tend to pass through the origin.

• If the soil is purely cohesive with ϕ = 0, the Mohr envelope is parallel to the abscissa.



Q62 Text Solution:

Conservancy system:

• This is an old system in which various types of wastes, such as night soil, garbage, etc.

• Waste is collected separately in a vessel or deposited in pools or pits and then removed periodically at least once in 24 hours.

• The conservancy system is highly unhygienic and causes insanitary conditions.

• In this system, the collection conveyance, and disposal of various wastes are carried out with the help of water.

• Thus water is used as a medium to convey the waste from its point of production to the point of final disposal.

• A sufficient quantity of water is required to be mixed with waste so that the dilution ratio is so great that the mixture may flow just like water.

• This system is very hygienic as night soil and other waste are carried out through a closed conduit that is not directly exposed to the atmosphere.

Q63 Text Solution:

Cold Weather Concreting:

Cold Weather Concreting is defined by ACI 306 as a period when for more than three successive days the average daily air temperature drops below 4°C. There are two main problems with pouring concrete in cold winter weather.

Tricalcium silicate hardens rapidly and is largely responsible for the initial set and early strength. It is also called alite. It has the best cementitious property among all the other Bogue compounds. The cement that has more C_3S content is good for cold weather concreting and lower C_2S. C_2S will undergo a reaction slowly. C_2S is responsible for the progressive strength of concrete. It is also called bellite.

Q64 Text Solution:

Hollow pre-cast concrete blocks: Hollow concrete blocks are manufactured in various shapes and sizes. Blocks of concrete are moulded in a machine.

Hollow concrete blocks - 39 cm × 19 cm × 30 cm

Hollow building tiles - 39 cm × 19 cm × 20 cm

The use of precast concrete blocks in the construction:

• It has high compressive strength.

• It has a good fire and abrasion resistance and very good stability.

• Hollow units have low self weight.

• Air space provides good thermal insulation

• Hollow precast concrete blocks posses good thermal insulation because of the air entrapped within the blocks

Q65 Text Solution:

Velocity of wave:- The distance traveled by a wave in one second is called the velocity of the wave. The SI unit for the velocity of a wave is meters per second (m/s).

Wavelength:- The distance between the two nearest crests of a wave is called its wavelength.

Frequency:- The number of complete waves produced in one second is called the frequency of the wave. The unit of frequency is hertz.

Q66 Text Solution:

A lintel is one type of beam which used to support the above wall when openings like doors, windows etc. The main function of the lintel is to take loads coming from above wall and transfer its load to the side walls.

Following are the purposes of lintel beams:

• to support the walls above the openings like doors, windows.

• to provide a safeguard of the windows and doors.

• to transfer its load to the side walls.

Q67 Text Solution:

Expansion joint: It is provide to allow expansion due to rise in temperature w.r.t. construction temperature.

• These are provided at 50-60 m spacing if construction is in winter.

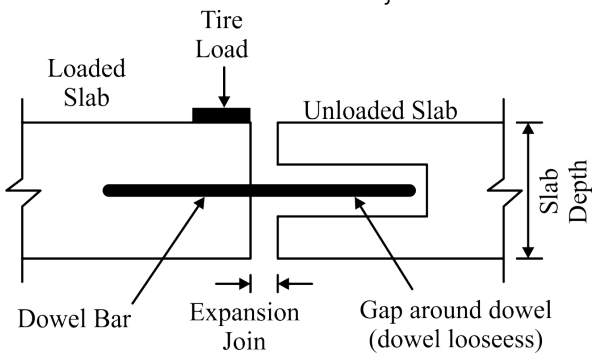
• As per IRC, maximum spacing between the expansion joint is 140 m and thickness is 2.5 cm.

• For load transference across the transverse joint, dowel bars are placed

Dowel bar:

• Dowel bar is steel bar provided in rigid pavements in the direction of traffic i.e. in longitudinal direction.

• Dowel bars are provided at expansion joints and sometimes at contraction joints also.



Q68 Text Solution:

Current meter: It is the device that is used to measure the velocity of the flow of fluid. The relation between velocity and the number of revolutions completed by current meter is

V= aN + b

Where,

V = velocity in m/s, and N = Number of revolutions done by current meter in 1 second a & b = current meter constant.

Device	**Purpose**
Hot wire anemometer	Air & gas velocity
Current meter	**Velocity in open channels**
Surface float	Velocities of flow
Rotameter	Discharge measurement
Elbow meter	Discharge measurement
Bend meter	Discharge measurement

Q69 Text Solution:

Given that,

Time (t) = 1.8 s

Skid measured marks (S) = 9 m

g = 10 m/s^2

We know that,

$S = ut + \frac{1}{2}at^2$

$9 = 0 \times 1.8 + \frac{1}{2} \times a \times 1 \cdot 8^2$

$a = \frac{50}{9} m/s^2$

Average skid resistance (f) $= \frac{a}{g}$

$f = \frac{50/9}{10} = 0.556$

Q70 Text Solution:

Given that,

Gross command area = 10,000 ha

Culturable command area = GCA of 80%

$= 10000 \times \frac{80}{100} = 8000$

Total area cultivated by wheat and rice

$= \frac{8000 \times 50}{100} + \frac{8000 \times 30}{100} = 6400 \text{ hac}$

Q71 Text Solution:

Portland pozzolana cement: (IS 1489-1991)

• Manufactured by grinding portland cement clinker and pozzolana (usually fly ash 10 to 25% by mass of PPC), or by intimately and uniformly blending portland cement and fine pozzolana.

• Pozzolana is a volcanic powder found and (brunt clay, shale or fly ash) has no cementing properties itself, but has the property of combining with lime to produce a stable lime pozzolana compound which has definite cementitious properties.

• Since the pozzolanic action is very slow, with replacement of fly ash up to 25% may result in lower strength at 7 days and 28 days but may be about equal at 3 months and may further increase at ages greater than 3 months provided curing is continued.

• Initial setting time, final setting time and compressive strength requirements are the same as that of OPC.

• Fineness should not be less than 300 m^2/kg, when tested by air permeability method.

Drying shrinkage should not be more than 0.15%.

• Free lime present in the cement is thus removed and hence, resistance to chemical attack increases making it suitable for marine works, It has low heat evolution and is used in the places of mass concrete such as dams and in places of high temperature.

Q72 Text Solution:

The painting of walls, doors, and windows is typically measured in square metres. This is because painting is a surface activity and the amount of paint required depends on the area of the surface to be painted.

Name of items	Unit of measurement
Painting of doors and windows	m^2
Half brick wall	m^2
Earth excavation	m^3
RCC work for staircase	m^3
Damp proof course	m^2

Q73 Text Solution:

Theodolite

A theodolite is an important instrument used for measuring horizontal and vertical angles in surveying. It can also be used for a number of surveying operations, such as prolonging a line, measuring distances indirectly and levelling.

Instrument	Least count
Prismatic compass	30 minute
Survey or compass	15 minute
Vernier scale	0.1 mm
Micrometer	0.01 mm

Levelling staff	5 mm
Vernier Theodolite	20 second
Optical Theodolite	**1 second**

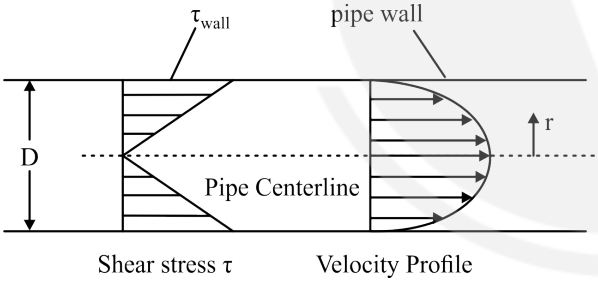
Q74 **Text Solution:**

Turbulent Flow :

• Turbulent flow is the random, disordered and dis-organised flow which has bulk and or macroscopic mixing. It occurs at higher flow velocities compared to laminar flow. In turbulent flow, inertia forces are significant as compared to viscous forces.

• For flow in the pipes if Reynold's number is less than 2000 the flow is called the laminar and if it is more than 4000, the flow is called turbulent flow. If the Reynolds number lies between 2000 and 4000 the flow may be laminar or turbulent (also known as transition period).

• In case of turbulent flow in a pipe, the shear stress is maximum at the wall and decreases linear to zero at the center



Q75 **Text Solution:**

Magnetic meridian: When the magnetic needle is suspended freely and balanced properly, unaffected by magnetic substances, it indicates a direction. This direction is known as the magnetic meridian. The angle between the magnetic meridian and a line is known as the magnetic bearing or simple bearing of the line. To measure it we need a Magnetic Compass.

Arbitrary bearing: The horizontal angle made by the survey line with reference to an arbitrary meridian passing through one of the extremities. A theodolite or sextant can be used to measure it.

True Bearing: It is a horizontal angle between the true meridian and the survey line measured in a clockwise direction.

Azimuth: it is the horizontal angle or direction of a compass bearing.

Q76 **Text Solution:**

The track or permanent way is the railroad on which trains run. It consists of two parallel rails fastened to sleepers with a specified distance between them. The sleepers are embedded in a layer of ballast of specified thickness spread over level ground known as formation.

For a railway track, the width of the formation depends upon:

• Numbers of tracks to be laid over it
• Gauge of the track
• Width of ballast layer
• Width of drains provided

Gauge	**Type of Formation**	**Width of formation (m)**
BG	Embankment	6.1
	Cutting	5.4
MG	Embankment	4.88
	Cutting	4.27

Q77 **Text Solution:**

Given,

Staff intercepts of 100 m apart staff (S_1) = 3.98m

Staff intercepts of 150 m apart staff (S_2) = 5.98m

Focal distance (f) =? Stadia interval (i) = ?

We know that–

$D = ks + c$

$100 = k \times 3.98 + c$ ...(i)

$150 = k \times 5.98 + c$ ...(ii)

From eq.(i) & eq. (ii)

$150 - 100 = k(5.98 - 3.98) + c - c$

$k = 25$

$\therefore c = 0.5$

$k = \frac{f}{i}$

$25 = \frac{f}{i}$

$R.H.S = \frac{f}{i}$

$$\begin{cases} \text{According} \\ f = 0.2m \\ i = 12mm = 12 \times 10^{-3}m \end{cases}$$

$= \frac{0.2}{12 \times 10^{-3}} = \frac{50}{3}$

$R.H.S. \neq L.H.S.$

$R.H.S. = \frac{f}{i}$

$$\begin{cases} f = 0.3m \\ i = 12mm = 12 \times 10^{-3}m \end{cases}$$

$= \frac{0.3}{12 \times 10^{-3}} = 25$

$\boxed{R.H.S. = L.H.S.}$

Hence option (C) will be right.

$\boxed{f = 0.3m}$, $\boxed{i = 12mm}$

We know that,

c = f + d

0.5 = 0.3 + d

d = 0.2m

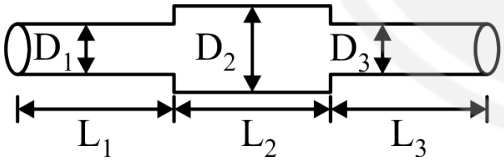
d = 20cm

Q78 Text Solution:

Pipe connection:

(i) Equivalent pipe or series connection–

In this condition loss of head and discharge is equal to the loss of head and discharge of a compound pipe consisting of different length.

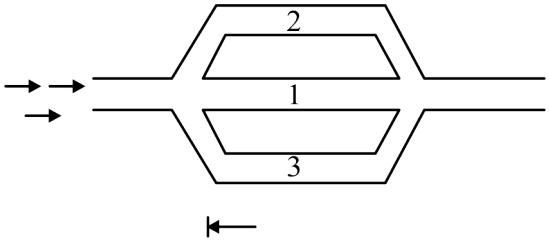


$\Rightarrow \frac{L}{D^5} = \frac{L_1}{D_1^5} + \frac{L_2}{D_2^5} + \frac{L_3}{D_3^5} + ...$

$\Rightarrow$This equation is known as Dupit's equation.

(ii) Pipe in parallel –

Discharge in main pipe = Sum of discharge in parallel pipes



$Q = Q_1 + Q_2 + Q_3$

Then, $h_f = \frac{4f_1L_1v_1^2}{2gD_1} = \frac{4f_2L_2v_2^2}{2gD_2} = \frac{4f_3L_3v_3^2}{2gD_3}$

Hence, the total loss of head in the parallel connection pipe is the same in each pipe.

Q79 Text Solution:

As per IS 456:2000 for longitudinal reinforcement–

• It is 6% of the gross cross-sectional area of the column.

• It can be reduced to 4% at lapped splice locations for better placement and compaction.

• Minimum diameter of longitudinal bar = 12 mm

• Minimum number of bars for rectangular columns is 4 and for circular columns is 6.

• Maximum center to center spacing of reinforcement = 300 mm.

Q80 Text Solution:

According to IS 456 (Clause 26.4.1), Nominal concrete cover (clear cover) can be defined as the distance from the outer surface of the concrete members to the outer surface of steel (either main reinforcement or stirrups) reinforcements, including links.

Minimum concrete grade and nominal cover requirements based on exposure conditions are:

Expose conditions	Nominal cover (mm)	Minimum concrete Mildgrade
Mild	20	M20
Moderate	30	M25
Severe	45	M30
Very severe	50	M35
Extreme	75	M40

Q81 Text Solution:

Overhead expenses:

Overheads are business costs that are related to the day-to-day running of the business. Unlike operating expenses, overheads cannot

be traced to a specific cost unit or business activity. Instead, they support the overall revenue-generating activities of the business.

Types of Overhead expenses:

• **Fixed overheads:** Fixed overheads are costs that remain constant every month and do not change with changes in business activity levels. Examples of fixed overheads include salaries, rent, property taxes, depreciation of assets, and government licenses.

• **Variable overheads:** Variable overheads are expenses that vary with business activity levels, and they can increase or decrease with different levels of business activity. Examples of variable overheads include shipping costs, office supplies, advertising and marketing costs, consultancy service charges, legal expenses, as well as maintenance and repair of equipment.

• **Semi-variable overheads:** semi-variable overheads possess some of the characteristics of both fixed and variable costs. Examples of semi-variable overheads include sales commissions, vehicle usage, and some utilities such as power and water costs that have a fixed charge plus an additional cost based on the usage.

Q82 Text Solution:

For brickwork in arches measuring is required individually in order to provide extra rates of associated components. Arch is a curved structural member which provides horizontal support. It is stronger than a beam.

Q83 Text Solution:

Depression Storage: When the precipitation of a storm reaches the ground it must first fill up all depressions before it can flow over the surface. The volume of water trapped in these depressions is called depression storage.

• Depression storage ranges from 1 to 8 mm (0.04 to 0.3 in) with some values as high as 15 mm (0.6 in) per event.

• Depression storage varies greatly with the land use (A paved surface will not detain as much water as a recently furrowed field).

Q84 Text Solution:

Fundamental lines in a Theodolite:

Vertical axis (Azimuth axis): It is the axis about which instrument rotates in the horizontal plane. Horizontal Axis (Trunnion axis): It is the axis about which instrument rotates in the vertical plane.

• The striding level is attached to the trunnion,parallel with the horizontal axis.

• It is advantageous to employ the striding level for the accurate adjustment of the vertical axis and measurement of the inclination of the horizontal (trunnion) axis.

• Hence, Some theodolite are fitted with striding level which is used to test the horizontally of the trunnion axis.

Line of Collimation (Line of Sight):

• It is the line that passes through the intersection of horizontal and vertical crosshairs and the optical center of object-glass.

Bubble Line (Level tube axis or Altitude level axis):

• It is a straight line tangential to the longitudinal curve of the level tube at its center. It is horizontal when the bubble is center.

Plate level axis:

• It is perpendicular to the vertical axis when the bubble is at the center.

Q85 Text Solution:

Accelerating admixture

• These are the admixtures that increase the rate of gain of development of strength in the cement or concrete.

• They find application in cold weather concreting, prefabricated constructions, emergency repair work, pavement construction, where formwork is reutilized for speedy construction.

• Their dose varies in the range of 0.1 to 0.2% by the weight of cement.

• Examples: Calcium chloride, Calcium formate,silicates, Silica fume, fluorosilicates, and

tri ethanolamine

Note:- With the availability of such powerful accelerator the underwater concreting has become easy. In the past one of the commonly used materials as an accelerator was calcium chloride. But now days it is not used. The recent studies have shown that calcium chloride is harmful for reinforced concrete and pre-stressed concrete. It may be used for plain cement concrete in comparatively high dose

Q86 Text Solution:

Measurement of vertical angle:

• A vertical angle is an angle between the inclined line of sight and the horizontal plane through the trunnion axis of the instrument.

• The vertical angle is measured in a vertical plane containing the inclined line of sight.

• The vertical angle is the angle of elevation when the line of sight is inclined upwards from the horizontal line.

• For measurements of the vertical angle, the instrument should be leveled with the help of altitude level.

• Prior to the measurement of vertical angle, instrument is required to be leveled with reference to the altitude level.

• To measure a vertical angle, the instrument should be leveled with reference to the altitude bubble when the altitude bubbleis on the index frame

• The altitude level should be more sensitive than the plate level produced on the upper plate.

Q87 Text Solution:

Short Column:

• Short columns are those whose slenderness ratio is less than 32 or length to diameter ratio is less than 8.

• In the case of a short column, the failure occurs by crushing the material under the compression yield stress.

• Such columns are always subjected to direct compressive stress only.

Intermediate column

• Intermediate columns are those whose slenderness ratio is between 32 to 120 or length to diameter ratio is between 8 to 30

• Intermediate column fails in combined buckling and crushing.

Long Column:

• Long columns have a slenderness ratio of more than 120 or a length to diameter ratio of more than 30.

• In the case of the long column, the failure occurs by buckling. i.e by lateral deflection of the bar.

Q88 Text Solution:

Factor effecting flexural strength of concrete:

(a) Grade of Concrete: The strength of the concrete, typically denoted by its grade (e.g., M20, M25), directly affects the flexural strength of the beam. Higher grades of concrete have greater compressive strength, which results in higher flexural strength of the beam.

(b) Depth of Beam: The depth of the beam, often denoted by the symbol "d," plays a crucial role in determining its flexural strength. Deeper beams can resist higher bending moments, thus exhibiting greater flexural strength.

(c) Grade of Steel: The grade of steel reinforcement used in the beam, often denoted by the symbol "Fe," significantly

influences its flexural strength. Higher grades of steel have greater tensile strength, which enhances the overall capacity of the beam to resist bending.

(d) Temperature: Temperature does not directly affect the flexural strength of a singly reinforced RCC beam according to IS 456-2000. While extreme temperatures may impact the behavior of concrete and steel (e.g., thermal expansion or contraction), these effects are typically considered separately from the determination of flexural strength.

Q89 Text Solution:

Crop period

Crop period is defined as total time that elapses b/w the sowing of the crop and its harvesting. Thus, crop period represents the total time during which the crop remains in the field.

Base period

Base period is defined as the total time between the first watering done for the preparation of the land for sowing of a crop and the last watering done before its harvesting.

Note: Crop period is slightly more than the base period for any crop but for calculation purpose they are taken same.

Q90 Text Solution:

Defects due to Fungi, Bacteria and Insects

• Timber can have a long service life if it is protected from the weathering effects and attacks from bioorganism

• Most of the defects causes are related to moisture.

• Bacteria do not cause any serious damage to timber except for some discolourations, where as fungi are a system of plant organisms which live in and attack timber causing rot.

Fungi attack timber only when the following two conditions are satisfied simultaneously.

(1) Moisture content of timber is above 20 percent,

(2) Presence of air and warmth for the growth of fungi.

• If any of the two given conditions is absent, then decay of wood due to fungi would not occur.

Therefore dry wood having moisture content less than 20% will remain sound for centuries and wood submerged in water will not be attacked by fungi because of absence of air.

Q91 Text Solution:

Runoff: Runoff means the draining or flowing off of precipitation from a catchment area through a surface channel. Runoff represents the response of a catchment to precipitation. It reflects the integrated effects of a wide range of catchment, climate, and rainfall characteristics such as magnitude, intensity, distribution according to time and space, and variability. The various factors which affect the runoff from a drainage basin depend upon the following characteristics.

Rainfall characteristics:

a. Type of storm and season -

• It significantly affects runoff. Precipitation that falls in the form of rain begins to cause surface runoff immediately, whereas precipitation that falls as snow does not.

b. Intensity-

• If the rainfall intensity is greater than the infiltration rate of soil then runoff starts immediately after rainfall. Whereas in the case of low rainfall intensity runoff starts later.

c. Duration-

• Because the pace at which soil infiltrates decreases with the length of rainfall, it is directly correlated with runoff volume.

• Therefore, if the duration of the rainfall is prolonged, medium-intensity rainfall even produces a significant amount of runoff.

d. Direction of storm movement:

A storm moving in the direction of flow direction produces a higher peak in a shorter period of time than a storm moving in the opposite direction.

Q92 Text Solution:

1st Moment of Area(Q): it measures how a shape's area is distributed in reference to an axis. Used to find out the centroid of a shape.

Q = perpendicular distance (d) x Area(A)

The axis can be chosen as per the requirement and hence, the perpendicular distance can be either positive or negative. Hence 1st moment of area can be either +ve or -ve depending on the location from the reference axis.

2nd Moment of Area: It is also called the moment of inertia(I) which is the capacity of a body to resist bending or angular rotation about a certain axis.

Using the parallel axis theorem we can find the moment of inertia of any C/S using the below expression

$$I_x = I_{xc} + Ad_1^2$$
$$I_y = I_{yc} + Ad_2^2$$

Where

I_x and I_y = moment of inertia about any random x-axis and y-axis respectively, I_{xc} and I_{yc} = moment of inertia about the shape's centroidal x-axis and y-axis respectively, A = area of shape, d_1 = distance of reference x-axis and centroidal x-axis , d_2 = distance of refrence y-axis and centroidal y-axis.

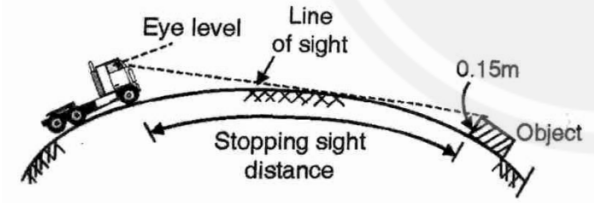
Q93 Text Solution:

Sight Distance: The distance along the centre line of the road at which a driver has visibility of an object, stationary or moving at a specified height above the carriageway is known as sight distance.

Types of Sight Distance:

1. Stopping or Non-passing Sight Distance :

The clear distance ahead needed by a driver to bring his vehicle to a stop before meeting a stationary object on the road is called as stopping or non-passing sight distance.



2. Overtaking Sight Distance (OSD) :

The minimum distance open to the vision of the driver on a two-way road to enable him to overtake another vehicle ahead with safety against the traffic from the opposite direction is called overtaking or passing sight distance.

OSD = $d_1 + d_2 + d_3 + d_4$

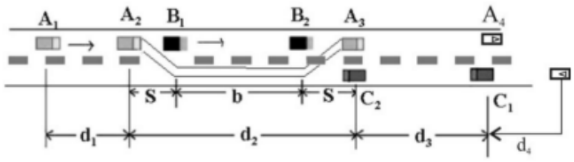
Where,

d_1 = distance travelled by the vehicle after applying the breaks.

d_2 = distance travelled by overtaking vehicle, during reaction time for overtaking.

d_3 = distance travelled by overtaking vehicle, during total overtaking time.

d_4 = distance travelled by overtaken vehicle, during total overtaking time.



For one way traffic OSD = d2 + d3

When no vehicle is expected from opposite directions (on divided highways and on roads with one-way traffic).

Q94 Text Solution:

Material cost: The rate of various materials as per specifications for the items under consideration can be chalked out from the market survey. The costs of materials are taken as delivered at the side of work.

This is inclusive of–

- The first class (cost at origin)
- Cost of transport, railway freight (if any) etc.
- Local taxes and other charges

Q95 Text Solution:

For a cantilever beam, the bending moment will be zero at the free end. This is because the free end is not supported, and there is no force acting on it to cause bending.

The bending moment will be maximum at the fixed end of the beam. This is because the fixed end is where the beam is attached to the support, and the support prevents the beam from rotating.

The bending moment will also be zero at the center of the beam if the beam is symmetrically loaded. This is because the forces acting on the beam will be balanced, and there will be no net force causing bending. We know that in case of cantilever beam, the value of slope at fixed support of a cantilever beam is zero.

Q96 Text Solution:

Doubly reinforced concrete beam in flexure

$$Mu = 0.36 f_{ck} b.\, x_u (d - 0.42.x_u) + (f_{sc} - f_{cc}) A_{sc} (d - d')$$

where,

A_{sc} = Area of the compression reinforcement

x_u = Depth of neutral axis at ultimate state

f_{cc} = Stress in concrete at the level of the compression reinforcement.

f_{sc} = Stress in compression reinforcement.

d' = Effective cover to compression reinforcement.

d = Effective depth of the beam section.

• If $M_u > M_{u,lim}$ the beam section has to be designed as a doubly reinforced section For T-beam

• When the neutral axis lies within the flange

$$Mu = 0.36 f_{ck} b x_u (d - 0.42 x_u) = 0.87 f_y A_{st} (d - 0.42 x_u)$$

Q97 Text Solution:

Porosity: The entrapped air bubbles in the rocks during their formation lead to minute hales or cavities known as pores. The porosity of the aggregate will also affect the durability of the concrete when the concrete is subjected to chemically aggregated liquids. The pores may become reservoirs of free moisture inside the aggregate resulting in loss of workability of concrete. The percentage of water absorbed by an aggregate when immersed in water is termed the absorption of aggregate. The porous aggregate absorbs more moisture, resulting in the loss of workability of concrete at a much faster rate.

Q98 Text Solution:

Geographical information system is defined as a system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data, which are spatially referenced to the earth.

APPLICATIONS OF GIS:

• GIS finds its application in all those area where professionals are involved in management and planning utilizing analysis of large amount of geographical data that relates to space, typically involving positional data. Positional data determine where things are or perhaps, where they were or will be.

• The areas of GIS applications are unlimited as it can be used for management and planning that may be required in any field, e.g., civil engineering, urban planning, forestry, environmental management, flood control, natural disaster management, natural resources management, military, biology, geology, mining, hydrology, etc.

• GIS has distinct application in feasibility studies such as site suitability and simulation studies in erosion modeling.

Q99 Text Solution:

- In long wall and short wall method, The wall along the length of the room is considered to be long wall and the wall perpendicular to the length of the room is considered to be short wall.
- The wall that is taken first is treated as the length(long wall), though the length (long wall) may be lesser.
- It is not mandatory that wall with longer length has to be taken as long wall.
- It can be calculated as short wall too.

therefore statement 1 is true and statement 2 in false.

Q100 Text Solution:

Coefficient of velocity (C_V): It is defined as the ratio of actual velocity of jet at vena-contracta to the theoretical velocity at vena-contracta. It is denoted by C_V.

$$C_v = \frac{\text{Actual velocity of jet at vena-contracta}}{\text{Theoretical velocity of jet at vena-contracta}}$$

$$C_v = \frac{V}{Vth}$$

Theoretical velocity of jet at vena contracta:

$V_{th} = \sqrt{2gH}$ is also called velocity of the spout

$$C_v = \frac{V}{\sqrt{2gH}}$$

The value of C_V varies from 0.95 to 0.99. The variation in value depends upon size, shape of orifice and head of liquid under which flow take place.