ME1315 CIVIL ENGINEERING
Paper - 2

501

Series A

Sl.No. 218645

Duration : 150 Minutes *Max. Marks : 300*

INSTRUCTIONS TO CANDIDATES

1. Please check the Test Booklet immediately on opening and ensure that it contains all the 150 multiple choice questions printed on it.
2. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you along with the Question Paper Booklet. The OMR Answer sheet consists of two copies i.e., the Original Copy (Top Sheet) and Duplicate Copy (Bottom Sheet). The OMR sheet contains Registered Number/Hall Ticket Number, Subject/ Subject Code, Booklet Series, Name of the Examination Centre, Signature of the Candidate and Invigilator etc.,
3. If there is any defect in the Question Paper Booklet or OMR answer sheet, please ask the invigilator for replacement.
4. Since the answer sheets are to be scanned (valued) with Optical Mark Scanner system, the candidates have to USE BALL POINT PEN (BLUE/BLACK) ONLY for filling the relevant blocks in the OMR Sheet including bubbling the answers. Bubbling with Pencil / Ink Pen Gel Pen is not permitted in the examination.
5. The Test Booklet is printed in four (4) Series, viz. A or B or C or D. The Series A or B or C or D is printed on the right-hand corner of the cover page of the Test Booklet. Mark your Test Booklet Series in Part C on side 1 of the Answer Sheet by darkening the appropriate circle with Blue/Black Ball point pen.

Example to fill up the Booklet series

If your test Booklet Series is A, please fill as shown below :

● (B) (C) (D)

If you have not marked the Test Booklet Series at Part C of side 1 of the Answer Sheet or marked in a way that it leads to discrepancy in determining the exact Test Booklet Series, then, in all such cases, your Answer Sheet will be invalidated without any further notice.

6. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer sheet by darkening the appropriate circle for the question. If more than one circle is darkened, the answer will not be valued at all. Use Blue/Black Ball point pen to make heavy black marks to fill the circle completely. Make **no** other stray marks.

e.g. : If the answer for Question No. 1 is Answer Choice (2), it should be marked as follows :

1 (1) ● (3) (4)

7. Mark Paper Code and Roll No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in Part A of side 1 of the Answer Sheet. Incorrect/not encoding will lead to ***invalidation*** of your Answer Sheet.

Example : If the Paper Code is 500 and Roll No. is 1309102001 fill as shown below :

Paper Code

5	0	0
0	●	●
1	1	1
2	2	2
3	3	3
4	4	4
●	5	5
6	6	6
7	7	7
8	8	8
9	9	9

Registered Number/ Hall Ticket Number

1	3	0	9	1	0	2	0	0	1
0	0	●	0	0	●	0	●	●	0
●	1	1	1	●	1	1	1	1	●
2	2	2	2	2	2	●	2	2	2
3	●	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	●	9	9	9	9	9	9

ii) Writes irrelevant matter, including the religious symbols, words, prayers or any communication whatsoever, in any place of the OMR answer sheet.

iii) Uses other than Blue/Black ball point pen to darken the circles.

iv) Forgets to bubble the Test Booklet series or bubbling the other TEST booklet series code than supplied to him/her.

v) Bubbles the circles incompletely or using ✓or × in the circles.

vi) Uses whitener on the answer sheet.

vii) If attempts any type of tampering (rubbing the circles with chalk powder/scratching the circles with razors etc) on the OMR Answer Sheet.

viii) Adopts any method of malpractice.

17. No correspondence will be entertained in this matter by the Commission, if the Answer Sheet of the candidate is invalidated/rejected due to the above reasons.

1) If θ be the angle of slope and the length of chain is 30m, then the correction to be applied per chain length is
(1) 30 (1- sec θ) m (2) 30 (1 - cos θ) m
(3) 30 (sec θ -1) m (4) 30 (cos θ - 1) m

2) Which one of the following angles can be set out with the help of French cross staff?
(1) 180° (2) 90° (3) 45° (4) any angle

3) A lamp at the top of a light house is visible just above the horizon from a station at sea level, the distance of the lamp from the station is 30 km, find the height of the light house.
(1) 2.019 m (2) 0.57 m (3) 20.19 m (4) 6.057 m

4) The line Joining points of equal dip is called
(1) Isoclinic lines (2) Aclinic lines (3) Isogonic lines (4) Agonic lines

5) If the forebearing of a line AB is 50° and that of line BC is 20°, then the included angle between the lines is
(1) 70° (2) 120° (3) 220° (4) 150°

6) When contours of different elevations cross each other, it indicates
(1) Level surface (2) Overhanging cliff
(3) Saddle (4) Vertical cliff

7) In theodolite survey, the telescope is said to be inverted, if the
(1) Vertical circle is to the right of the observer and the bubble of the telescope is up
(2) Vertical circle is to the right of the observer and the bubble of the telescope is down
(3) Vertical circle is to the left of the observer and the bubble of the telescope is up
(4) Vertical circle is to the left of the observer and the bubble of the telescope is down

8) In Geographic information system, line in polygon method is characteristic of
(1) Buffer operation (2) Raster overlay
(3) Intersecting operation (4) Vector overlay

9) If the RL of a BM is 100m, the back sight is 1.415m and the foresight is 1.670m, the RL of the forward station is

(1) 101.670m (2) 101.415m (3) 99.745m (4) 98.585m

10) In functional classification of highways, which one of the following highway type have highest mobility and less accessibility

(1) National Highways (2) State Highways
(3) Major District roads (4) Street and Village Roads

11) Webster's equation for computing saturation flow rate in signal design (S= saturation flow rate PCU/hour; W = carriage way width in meters.)

(1) S= 225 W PCU/hour (2) S= 525 W PCU/hour
(3) S= 550 W PCU/hour (4) S = 250 W PCU/hour

12) For the calculation of stopping distance, the longitudinal friction co-efficient values of _____ have been recommended by Indian Roads Congress.

(1) 0.35 to 0.40 (2) 0.15 to 0.20 (3) 0.40 to 0.45 (4) 0.45 to 0.50

13) In total reaction time of the driver, the time required for the sensations received by the eyes/ears to be transmitted to the brain through the nervous system and spinal chord is called _____.

(1) Intellection time (2) Emotion time
(3) Volition time (4) Perception time

14) Calculate the value of lag distance in SSD for a highway with a design speed of 65 kmph ?

(1) 45.18 m (2) 36.14 m (3) 32.50 m (4) 451.80 m

15) The psychological widening of pavement is calculated using which one of the following formula (take V= speed of vehicle in kmph; R = radius of the curve in m)

(1) $\frac{V^2}{9.5\sqrt{R}}$ (2) $\frac{V}{9.5\sqrt{R}}$ (3) $\frac{V}{9.5R}$ (4) $\frac{V^3}{9.5R^2}$

16) Find out the rate of change of centrifugal acceleration for a design speed of 75 kmph, using IRC recommended formula.

(1) 0.63 m/sec^3 (2) 0.53 m/sec^3 (3) 0.48 m/sec^3 (4) 0.73 m/sec^3

17) Estimate the theoretical capacity of a traffic lane with traffic flow stream speed of 50 kmph (take average centre to centre spacing of vehicles as 10 m)
(1) 500 vehicles /hour/lane (2) 5000 vehicles /hour/lane
(3) 3000 vehicles /hour/lane (4) 300 vehicles /hour/lane

18) In a flexible pavement, the different materials with the CBR values are available as follows: 80%, 60%, 15% and 4%. Indicate the order (top to bottom) in which the materials are to be placed for making a good pavement
(1) 4% , 15% , 60% , 80% (2) 4%, 60% , 80%, 15%
(3) 80%, 60%, 15%, 4%. (4) 4%, 80%, 15%, 60%

19) Calculate the Equivalent Axle load factor (EALF) for single axle load of 10 tons using fourth power formula.
(1) 2.26 (2) 22.60 (3) 1.23 (4) 11.23

20) The hardness and toughness properties of a road aggregate will be obtained from
(1) Aggregate Impact Test (2) Aggregate crushing test
(3) Los Angeles Abrasion Test (4) Aggregate Shape test

21) In the rigid pavement fatigue analysis, the ratio of flexural stress due to load and the flexural strength due to concrete is less than 0.45 indicates
(1) the allowable number of repetitions of the axle loads is infinity
(2) the allowable number of repetitions of the axle loads is zero
(3) the allowable number of repetitions of the axle loads is 4500
(4) the allowable number of repetitions of the axle loads is 45000

22) The gauge widths (in meter) for broad , standard and narrow gauges respectively are
(1) 1.767, 1.650 and 0.760 (2) 1.676, 1.500 and 0.676
(3) 1.676, 1.435 and 0.762 (4) 1.876, 1.656 and 0.800

23) For airports serving big aircrafts, ICAO recommends the cross wind component should not exceed _____.
(1) 25 kmph (2) 35 kmph (3) 15 kmph (4) 23 kmph

24) The monthly mean of average daily temperature for the hottest month of the year is 30°C and the monthly mean of the maximum daily temperature for the same month of the year is 45°C, Find out the airport reference temperature
(1) 25°C (2) 35°C (3) 40°C (4) 15°C

25) The minimum value of Composite Sleeper Index (CSI) prescribed on Indian railways for track sleeper is
(1) 783 (2) 1352 (3) 1455 (4) 873

26) The formula used for calculation of superelevation on railways is _____ (take G = gauge in meters, V = Speed in kmph; R= radius of curve in meters)
(1) $\frac{GV^2}{127R}\ m$ (2) $\frac{GV^2}{127R}\ cm$ (3) $\frac{GV^3}{127R}\ m$ (4) $\frac{GV^2}{225R}\ m$

27) Cornice and coping is measured in _____
(1) Running meter & Square meter (2) Running meter & Running meter
(3) Square meter & Square meter (4) Square meter & Running meter

28) In Simpson's formula for areas calculation, the line joining the top of the ordinates is considered as
(1) elliptical (2) circular (3) parabolic (4) straight

29) To obtain the correct volume using the trapezoidal rule, the prismoidal correction should always be
(1) Multiplied (2) Added (3) Subtracted (4) Zero

30) In earth work excavation, normally lead and lift is considered for preparation of road estimate
(1) 30 m and 1.5 m (2) 20 m and 1.5 m
(3) 20 m and 2.0 m (4) 30 m and 2.0 m

31) The unconfined compressive strength of a clay in un-disturbed and disturbed state was found to be 180 kN/sqm and 10 kN/sqm respectively. Based on Sensitivity, the soil may be classified as:
(1) In-sensitive (2) Sensitive
(3) Quick Clays (4) Extra Sensitive Clays

32) If R_1 and R_2 are the radii of curvature of a non-uniform meniscus in two orthogonal planes, the capillary rise is given by:
(1) $h_c = (\sigma / Y_W) \{R_1 + R_2\}$ (2) $h_c = (\sigma / Y_W) \{(1/R_1) + (1/R_2)\}$
(3) $h_c = (\sigma / Y_W) \{R_1 \times R_2\}$ (4) $h_c = (\sigma / Y_W) \{R_1 / R_2\}$

33) The coefficient of permeability of a soil sample having its void ratio as 0.50 and co-efficient of percolation as 3.00×10^{-4} cm/s is:
(1) 3.00×10^{-4} cm/s (2) 1.50×10^{-4} cm/s
(3) 6.00×10^{-4} cm/s (4) 1.00×10^{-4} cm/s

34) In a Laboratory, to perform IS Heavy Compaction Test, it was required to use a mould of 1400 cc capacity in place of standard 1000 cc capacity mould. All other parameters remaining same, the number of blows to be applied per layer to ensure the designated compaction energy is:
(1) 56 (2) 25 (3) 35 (4) 50

35) The magnitude of total primary consolidation settlement of a 6m thick clay with single drainage was estimated as 96 mm. Later it was found that, the medium has double drainage. Then, the magnitude of total primary consolidation settlement will be:
(1) 48 mm (2) 192 mm (3) 384 mm (4) 96 mm

36) The shear strength of a pure clay specimen when tested in Unconfined compression Test was found to be 100 kPa. If the same specimen was tested in Tri-axial Compression Test, the deviatoric stress at which specimen will undergo failure when the confining stress was 50 kPa, will be:
(1) 50 kPa (2) 100 kPa (3) 200 kPa (4) 400 kPa

37) A 3 m high retaining wall with vertical face is resisting a moist back fill with horizontal top surface having Y= 20 kN/cum. The percentage increase in Total Active Earth Pressure, if the back fill gets submerged with Y_{sat} = 22 kN/cum and Y_w = 10 kN/cum, is:
(1) 20 (2) 40 (3) 60 (4) 100

38) The factor of safety of a slope of given inclination of 6 m high constructed using a soil with c=60 kPa, y=20 kN/cum and its Taylor's stability number=0.20, will be:
(1) 2.50 (2) 5.00 (3) 1.00 (4) 2.00

39) According to Boussinesque's theory, under the application of a point load of 100 kN on the surface, the pressure bulb corresponding to an increment in vertical stress of 47.75 kN/sqm will extend to a depth of:
(1) 0.50 m (2) 1.00 m (3) 2.00 m (4) 4.00 m

40) The ultimate bearing capacity of a shallow foundation laid on a cohesion-less soil medium was estimated as 200 kN/sqm, when the water table was far below. All other conditions remaining the same, the ultimate bearing capacity of the foundation, when the water table was risen to ground level, is:
(1) 400 kN/sqm (2) 200 kN/sqm (3) 100 kN/sqm (4) 50 kN/sqm

41) The observations of a Standard Penetration Test are reported as 10/15/20. Assuming correction for overburden is not required and correction for dialatancy only is required, the corrected N-value is:
(1) 45 (2) 35 (3) 25 (4) 15

42) The ultimate load carrying capacity of an end bearing type of bored cast-in-situ circular pile is estimated as 100 kN. All other parameters remaining the same, the capacity of the Pile if the diameter is doubled, is:
(1) 100 kN (2) 200 kN (3) 300 kN (4) 400 kN

43) Which of the following type of Piles is more appropriate as foundation of structures constructed on Expansive Clays:
(1) Batter Piles (2) Sheet Piles
(3) Under-reamed Piles (4) Compaction Piles

44) The type of Caissons preferred in sites where high upward seepage exists, is:
(1) Pneumatic Caissons (2) Open Caissons
(3) Box Caissons (4) Open caissons and Box caissons

45) Coffer Dams are :
(1) Permanent structures meant for storage of water
(2) Structures built across drains to act as check dams
(3) Temporary structures build to reserve water in side to cure foundation concrete
(4) Temporary structures build to reserve water outside to facilitate construction of foundation

46) The dimensions for Kinematic Viscosity is
(1) $FL^{-2}T$ (2) $ML^{-1}T^{-1}$ (3) L^2T^{-2} (4) L^2T^{-1}

47) The stream function for a potential flow field is given by $\psi=x^2-y^2$, the corresponding potential function (Φ), assuming zero potential at the origin is
(1) x^2+y^2 (2) $2xy$ (3) x^2-y^2 (4) $x-y$

48) Water flows through a large size pipe. The stagnation pressure and static pressures measured by a pitot tube are 0.3m and 0.24m of water. The velocity of flow in, m/minute is
(1) 1.08 (2) 65.00 (3) 10.8 (4) 0.65

49) A rectangular channel has a width of 1.8m and carries a discharge of $1.8m^3$/sec at a depth of 0.20m. The specific energy is
(1) 1.03m (2) 1.47m (3) 1.87m (4) 2.0m

50) In a catchment there are six rain gauge stations with average depth of rainfall of 92.8cm and standard deviation of the rainfall is recorded in these rain gauge stations is 30.7cm. For a 10% degree of error in the measurement of mean rainfall, the optimum number of stations required is
(1) 5 nos (2) 6 nos (3) 10 nos (4) 11 nos

51) The area between the two isohyets 45cm and 55cm is $100km^2$ and that between 55cm and 65cm is $150km^2$. What is the average depth of annual precipitation over the basin of $250km^2$
(1) 50cm (2) 52cm (3) 56cm (4) 60cm

52) The total observed runoff volume during a 4hr storm with a uniform intensity of 2.8cm/hr is 25.2×10^6 m^3 from a basin of 280 km^2 area. What is the average infiltration rate for the basin
(1) 3.6mm/hr (2) 4.8mm/hr (3) 5.2mm/hr (4) 5.5mm/hr

53) A volume of 3×10^6 m^3 of groundwater was pumped out from an unconfined aquifer, uniformly over an area of $5km^2$. The pumping lowered the water table from initial level of 102m to 99m. The specific yield of the aquifer is
(1) 0.20 (2) 0.30 (3) 0.40 (4) 0.50

54) A hyetograph is a plot of
(1) Cumulative rainfall Vs time (2) Rainfall intensity Vs time
(3.) Rainfall depth Vs duration (4) Discharge Vs time

55) The unit of intrinsic permeability is
(1) cm/day (2) m/day (3) Darcy/day (4) cm^2

56) If S_y = specific yield and S_r = specific retention then
(1) S_y+S_r = void ratio (2) S_y+S_r = porosity
(3) S_y+S_r = 1.0 (4) S_y+Sr = permeability

57) If duty (D) is 1428 hectare/cumec and base period (B) is 120 days for an irrigated crop, then delta (Δ) in metres is given by
(1) 102.8 (2) 0.73 (3) 1.38 (4) 0. 01

58) Which one of the following equations represents the downstream profile of Ogee spillway with vertical upstream face? (X, Y) are the coordinates of the point on the downstream profile with origin at the crest of the spillway and H_d is the design head.

(1) $Y/H = -0.5(X/H_d)^{1.85}$ (2) $Y/H_d = -0.5(X/H_d)^{1/185}$

(3) $Y/H_d = -2.0(X/H_d)$ (4) $Y/H_d = -2.0(X/H_d)^{1/185}$

59) For no tension to develop in the gravity dam the eccentricity 'e' of the resultant force should be

(1) Less than $b/3$ (2) Less than $b/6$

(3) Less than $b/4$ (4) Less than $b/12$

60) Lacey's equations can be used for the design of

(1) Unlined channels only (2) Lined channels only

(3) Both lined and unlined channels (4) Neither lined nor unlined channels

61) Syphon aqueduct is a cross drainage work provided to carry canal over a natural drain when

(1) Canal bed is well above the HFL of the natural drain

(2) Canal bed is at the same level as the bed of the natural drain

(3) Canal bed is below the HFL of the natural drain

(4) Canal bed is below bed of the natural drain

62) Poise is the CGS unit of

(1) Kinematic viscosity (2) Dynamic viscosity

(3) Mass Density (4) Weight Density

63) The velocity gradient is 1000/s. The viscosity is 1.2×10^{-4} N-s/m^2. The shear stress is

(1) 0.12N/m^2 (2) 1.2×10^{-7} N/m^2 (3) 12N/m^2 (4) 12×10^{-5} N/m^2

64) If Z is measured vertically upwards, dp is given by

(1) dp = ydz (2) dp = ρdz (3) dp = - ydz (4) dp = - ρDz

65) If $\psi = 3x^2y-y^3$, the values of u and v are

(1) 6xy, $3x^2-3y^2$ (2) $3x^2-3y^2$, 6xy

(3) $(3x^2-3y^2)$, -6xy (4) $3y^2-3x^2$, 6xy

66) In a three dimensional motion of a fluid, the component of rotation about the x-axis, ω_x is

(1) $\frac{1}{2}\left(\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z}\right)$ (2) $\frac{1}{2}\left(\frac{\partial u}{\partial z}-\frac{\partial w}{\partial y}\right)$ (3) $\frac{1}{2}\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right)$ (4) $\frac{1}{2}\left(\frac{\partial v}{\partial x}-\frac{\partial w}{\partial y}\right)$

67) Existence of velocity potential implies that
(1) Fluid is in continuum
(2) Fluid is irrotational
(3) Fluid is ideal
(4) Fluid is compressible

68) Piezometric head is the summation of
(1) Velocity head and elevation head
(2) Velocity head and pressure head
(3) Pressure head and elevation head
(4) Total head

69) The Bernoulli's equation is written with usual notation as $p/y + v^2/2g + z =$ Constant. In this equation each of the terms represents
(1) Energy in kg.m/kg mass of fluid
(2) Energy in Nm/kg mass of fluid
(3) Energy in Nm/N weight of fluid
(4) Energy in KW/kg mass of fluid

70) A 50mm diameter jet having a velocity of 25m/s strikes a flat stationary plate, the normal of which is inclined at 60^0 to the axis of the jet. The normal force exerted on the plate in Newtons is
(1) 460N (2) 360 N (3) 640 N (4) 630 N

71) Reynolds number of a flow is the ratio of
(1) Gravity forces to viscous forces
(2) Gravity forces to pressure forces
(3) Inertia forces to viscous forces
(4) Viscous forces to pressure forces

72) Ratio of the average velocity to maximum velocity for steady laminar flow in circular pipe is
(1) 1/2 (2) 2/3 (3) 3/2 (4) 2

73) Difference in elevation between TEL and HGL of pipe flow at a point is equal to
(1) Datum head
(2) Velocity head
(3) Pressure head
(4) Piezometric head

74) Boundary layer separation takes place when
(1) $\partial p/\partial x > 0$
(2) $\partial v/\partial y \leq 0$
(3) $\partial p/\partial x > 0$ & $\partial v/\partial y \leq 0$
(4) $\partial p/\partial x < 0$

75) For a uniform flow with a depth of 0.6m and Froude number of 2.0 in a rectangular channel, the specific energy will be
(1) 2.4m (2) 0.8m (3) 2.6m (4) 1.8m

76) A water turbine of expected efficiency 85% operates under 36m at a flow rate of $10m^3/s$. The unit weight of water is $10kN/m^3$. The nearest shaft power in MW is
(1) 3.06 (2) 3060 (3) 3600 (4) 850.

77) A sedimentation tank 6m wide, 15m long and 3m water depth is treating 2MLD of water. The surface overflow rate in lt/hr/m^2 is
(1) 858 (2) 926 (3) 1028 (4) 748

78) The efficiency of a sediment removal in a continuous sedimentation tank does not depend upon the
(1) Discharge through the tank (2) Width of the tank
(3) Length of the tank (4) Depth of the tank.

79) The disinfection efficiency of chlorine in water treatment
(1) Is not dependant on p^H value (2) Is increased by increase in p^H value
(3) Remains constant at all p^H values (4) Is reduced by increase in p^H value.

80) A 2% solution of a sewage sample is kept at an incubation temperature of 20^0C. If initial DO and final DO values after 5 days of incubation period are 8.5 mg/lit and 5.5 mg/lit respectively, then the BOD will be
(1) 50mg/lit (2) 150mg/lit (3) 250mg/lit (4) 350mg/lit

81) If total hardness of water is less than its total alkalinity the non-carbonate hardness will be equal to
(1) Total alkalinity (2) Total hardness
(3) Total alkalinity - total hardness (4) Zero

82) If for diluting 25ml of water sample 175ml of taste free water is required to be added to make the water sample to just lose its taste then the Flavour Threshold Number (FTN) will be
(1) 6 (2) 7 (3) 8 (4) 9

83) In network of pipes
(1) The algebraic sum of discharges around each circuit is zero
(2) The algebraic sum of head losses around each circuit is zero
(3) The elevation of hydraulic grade line is assumed for each junction point
(4) Elementary circuits are replaced by equivalent pipes

84) The dispersion of pollutants in atmosphere is maximum when
(1) Environmental lapse rate is greater than adiabatic lapse rate
(2) Environmental lapse rate is less than adiabatic lapse rate
(3) Environmental lapse rate is equal to adiabatic lapse rate
(4) Maximum mixing depth is equal to zero

85) Which one of the following pollutant (or) pairs of pollutants is formed due to photochemical reactions
(1) CO alone (2) O_3 and PAN (3) PAN and NH_3 (4) NH_3 and CO

86) If a sewer carrying a discharge of 3 cumecs outfalls into a river having a discharge of 10 cumecs and DO equal to 9.1mg/lt, the resultant DO of the mix will be equal to
(1) 5mg/lt (2) 6mg/lt (3) 7mg/lt (4) 8mg/lt

87) The natural process under which the flowing river gets cleaned is known as
(1) Oxidation (2) Photosynthesis
(3) Reduction (4) Self-purification

88) Recirculation in activated sludge process is done to
(1) Dilute the incoming sewage
(2) Dampen the effect of the flow variation
(3) Operate the plant continuously
(4) Supply seed materials to the aeration tank

89) Lower Food to Micro-organism (F/M) ratio in a conventional activated treatment plant will mean
(1) Lower BOD removal (2) Higher BOD removal
(3) No effect on BOD removal (4) Medium BOD removal

90) The relative stability of a sewage sample whose dissolved oxygen levels equals the total oxygen required to satisfy its BOD is
(1) Zero (2) 1% (3) 100% (4) Infinity

91) A rectangular box made with thin uniform plate measures 2000mm x 1000mm x 1000mm. When the box is subjected to certain internal pressure, the dimensions in respective directions have changed by +2.0mm, -1mm and +1mm. The change in the volume of the box is _____.
(1) 2.0×10^6 mm^3 (2) 1.0×10^6 mm^3
(3) 2.0×10^3 mm^3 (4) 2.0×10^5 mm^3

92) A rectangular section of a beam is acted upon by certain amounts of shear force and bending moment. Whereas the shear stress varies _____, the variation of bending stress is _____ along the depth.
(1) linear with zero value at centroid, linear with zero value at centroid
(2) parabolic with zero value at centroid, linear with zero value at centroid.
(3) parabolic, with zero value at top & bottom, linear with zero value at middle.
(4) linear with zero value at centroid, parabolic with zero value at top & bottom.

93) A simply supported beam of span L, carries a UVL with intensity varying from w/unit downward at left support to w/unit upward at right support. The reactions at left and right supports are respectively:
(1) wL/4 upward and wL/4 downward
(2) wL/4 downward and wL/4 upward
(3) wL/6 upward and wL/6 downward
(4) wL/8 upward and wL/8 downward

94) A cantilever beam of span L, uniform flexural rigidity EI is subjected to a unit couple at its free end. The deflection at the centre of the beam is:
(1) $L^2/2EI$ (2) $L^2/8EI$ (3) $L^2/4EI$ (4) $L^2/16EI$

95) For the L bent shown in Fig.1, the flexural rigidity of both arms AB and BC is EI carries a vertical downward load W at C. The deflection and rotation at B (neglecting axial deformations) are _____ and _____.

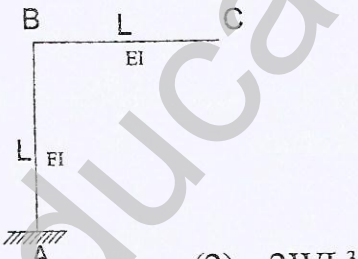

Fig.1

(1) $WL^2/2EI\rightarrow, WL/EI$ (2) $2WL^3/EI\downarrow, WL^2/3EI$
(3) $WL^3/EI\downarrow, WL^2/EI$ (4) $WL^2/2EI\rightarrow, WL^2/EI$

96) A simply supported beam of span L, carries two couples of magnitude M each acting at both middle third locations of the beam. While one of them is acting clockwise the other is acting counter clockwise. Magnitude of the maximum shear force acting in the beam _____.
(1) 2M/L (2) M/L (3) 1.5M/L 4) 0

97) The plane truss shown in Fig.2 carries a point load W and a moment M at the location B. Force carried by member AB is _____.

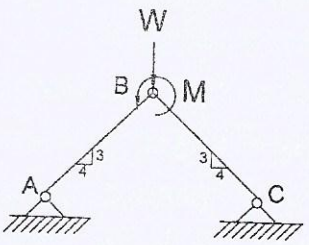

Fig.2

(1) 5W/6 (compressive) (2) W/2 (compressive)
(3) 5W/6 + M/L (compressive) (4) W/2 – M/2 (compressive)

98) Analysis of trusses is based on the following assumptions. The correct combination of assumptions is _____.

(i) All loads act at joints

(ii) All joints are smooth friction less pin joints.

(iii) Truss is made with material which is homogeneous, elastic and isotropic.

(iv) The axis of all members is straight and their self weights are ignored.

(1) i, ii and iv (2) i, ii, iii (3) i, iv (4) i, iii, iv

99) The correct combination of conditions that defines a rigid joint is _____

i) All members meeting at the joint are rigid.

ii) All deflections and rotations at the joint are zero.

iii) All members meeting at the joint undergo same defections at that joint.

iv) All members meeting at the joint undergo same rotations at that joint.

(1) i, ii (2) i, iii (3) ii, iv (4) iii, iv

100) The kinematic indeterminacy of the 2-D portal frame shown in Fig.3 including axial deformations is _____.

Fig.3

(1) 6 (2) 11 (3) 8 (4) 9

101) In the moment distribution method of plane frame analysis, the distribution factor for a member at a joint depends on _____ combination of conditions.

i) The slenderness ratio of all the members meeting at the joint.

ii) The flexural rigidity of all the members meeting at the joint.

iii) The I/L values of each member meeting at the joint.

iv) Support conditions at the farther ends of members meeting at the joint.

(1) ii, iii (2) i, iii (3) iii, iv (4) i, iv

102) A cantilever beam of uniform flexural rigidity with span L and depth D is subjected to temperatures T_1 on the upper face and T_2 on the lower face. If $T_1 < T_2$ and α is the coefficient of linear expansion for the material, the deflection at the free end of the beam is _____.

(1) $\alpha (T_2 - T_1) L^2 / 2D$ (upward) (2) $\alpha (T_2 - T_1) L^2 / D$ (upward)

(3) $\alpha (T_2 - T_1) L / 2D$ (upward) (4) $\alpha (T_2 - T_1) L^2 / 2D$ (downward)

103) At a point in elastic medium normal stresses in two mutually perpendicular directions are 120 MPa, 40 MPa (both tensile) associated with a tangential stress of 30 MPa. The principal stresses at the location are _____.

(1) 120 MPa, 40 MPa (both tensile)

(2) 130 MPa, 30 MPa (both tensile)

(3) 130 MPa, 30 MPa (both compressive)

(4) 130 MPa (tensile) , 30 MPa (compressive)

104) A weight W falls freely on a body from a height of h. If the instantaneous deformation of the body in the direction of weight is δ, the work done by the force is _____.

(1) $\frac{1}{2} W (h + \delta)$ (2) $W (h + \delta)$

(3) $\frac{1}{2} W h + W \delta$ (4) $W h + \frac{1}{2} W \delta$

105) In a beam, where the variation of shear force is a second degree parabola and the variation of loading is _____, the variation of bending moment is _____

(1) constant, cubic parabola (2) linear, square parabola

(3) cubic parabola, square parabola (4) linear, cubic parabola

106) A force of magnitude 5 N moves through a distance of 4mm in a direction, inclined at 60^0 to the direction of force. The magnitude of the work done by the force is _____.

(1) $10\sqrt{3}$ N.mm (2) 0 N.mm (3) 10 N.mm (4) 20 N.mm

107) The shear centre for an angle section is located _____.

(1) at the tip of the flange (2) at the intersection of flanges

(3) at the centroid of the angle (4) at the rigidity centre of the angle

108) A beam has a circular cross section. If the plane of loading on the beam does not coincide with the centroidal axis of the beam, the member is subjected to _____.

(1) axial force, shear force and bending moment
(2) torque, shear force
(3) torque, shear force and bending moment
(4) axial force, shear force and torque

109) The stiffness of a close coiled spring is more when _____.

(1) wire diameter, rigidity modulus are more and mean radius, number of turns are lesser
(2) number of turns, rigidity modulus are more and mean radius, wire diameter are lesser
(3) mean radius, rigidity modulus are more and wire diameter, number of turns are lesser
(4) rigidity modulus is more and wire diameter, mean radius, number of turns are lesser

110) A pressure vessel in the form of a thin cylinder of 1m diameter and 1mm plate thickness is subjected to an internal fluid pressure of 0.2 MPa. The maximum shear stress in the material is _____.

(1) 50 MPa (2) 0 MPa (3) 25 MPa (4) 37.5 MPa

111) Two circular shafts of same length, weight and material are compared for strength. The first one is a solid shaft and the other is a hollow shaft of outer to inner diameter ratio as 2. The ratio of the torque carrying capacity of the hollow shaft to solid shaft considering the shear stress criterion alone is _____.

(1) $2.5/\sqrt{3}$ (2) $5\sqrt{3}/6$ (3) $\sqrt{3}$ (4) $\sqrt{3}/2$

112) For a circular cross section subjected to shear force, the ratio of maximum shear stress to average shear stress is _____.

(1) 1.0 (2) 2.0 (3) 1.5 (4) 4/3

113) A cantilever beam of span L and flexural rigidity EI carries a point load W, vertically downwards at its free end. The free end of the beam is resting at the centre of another simply supported beam of span L and flexural rigidity EI. The support reactions for the simply supported beam are _____ and _____.

(1) W/4, W/4 (2) W/2, W/2
(3) 8W/17, 8W/17 (4) 8W/3, 8W/3

114) A simply supported beam of span L and flexural rigidity EI carries a UDL of intensity w/unit run all along its span. The beam is supported at its centre by a linear spring of stiffness k. The force carried by the spring is _____.

(1) $5kwL^4/(kL^3+8EI)$ (2) $5kwL^4/8(kL^3+48EI)$

(3) $5wL^4/8(kL^3+8EI)$ (4) $5wL^4/8(kL^3+48EI)$

115) The three member plane truss A-B-C-D, shown in Fig.4 supports a vertical load W at B. The magnitude of the force carried by member BD is _____.

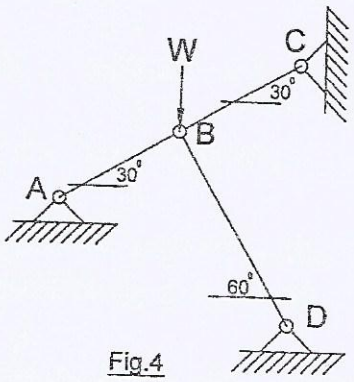

Fig.4

(1) W (compressive) (2) 0.5 W (compressive)

(3) $(\sqrt{3}/2)$ W (compressive) (4) 0.5W (tensile)

116) The symmetry of flexibility matrix is due to _____.

(1) Betty's theorem (2) Maxwell's reciprocal theorem

(3) Eddy's theorem (4) Castigliono's theorem

117) A fixed beam of span L and uniform flexural rigidity EI carries a vertical downward load W at its mid span. If a hinge is introduced in the beam at the location of the load, the deflection under the load is _____.

(1) $WL^3/12EI$ (2) $WL^3/24EI$ (3) $WL^3/16EI$ (4) $WL^3/48EI$

118) A stepped bar A-B-C of total length 2L carries an axial load P at B as shown in Fig.5. Axial rigidity of segment AB is 2AE and that of BC is AE. The displacement at B is _____.

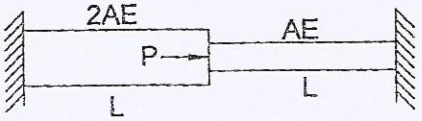

Fig.5

(1) PL/3AE (2) 0 (3) PL/2AE (4) PL/AE

119) The static indeterminacy for the continuous beam shown in Fig.6 is _____.

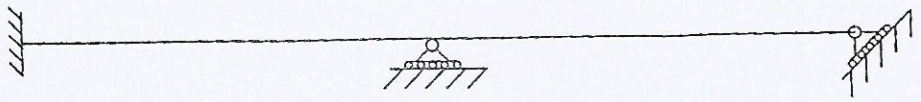

Fig.6

(1) 6 (2) 3 (3) 2 (4) 4

120) A simply supported girder of span 10m is traversed by a 5m long UDL segment of intensity 10kN/m. The magnitude of absolute maximum moment in the beam is _____.

(1) 93.75kN.m (2) 98.75kN.m (3) 90.25kN.m (4) 88.75kN.m

121) For a simply supported girder, EUDLL is defined as the intensity of the UDL acting on full span whose _____.

(1) intensity is larger than all other loads acting on the span.
(2) moment diagram is above the bending moment ordinates caused by all loads on the span.
(3) bending moment diagram just envelops bending moment caused by all loads on the span.
(4) intensity is larger than the sum of intensities of all loads on the span.

122) A simply supported beam of span L and uniform flexural rigidity EI is subjected a pre-stressing force of magnitude P, at an eccentricity e below the neutral layer, parallel to the axis of the member. The displacement of the beam at a location L/4 from the support is _____.

(1) $PeL^2/4EI$ (2) $PeL^2/8EI$
(3) $PeL^2/2EI$ (4) PeL^2/EI

123) For a member subjected to loads on its span, equivalent joint loads are determined in such a way that _____.

(1) The member end actions caused by equivalent joint loads are same as those caused by loads on the member.
(2) The equivalent joint loads cause same set of nodal displacements as caused by the member loads.
(3) The equivalent joint loads together with member loads ensure the equilibrium of the structure.
(4) The equivalent joint loads together with member loads ensure the compatibility of displacements for the structure.

124) An orthogrid structure is one which satisfies following combinations of conditions _____.

i) A two dimensional framed structure consisting of members oriented in different directions.
ii) Loading plane perpendicular to the plane of structure.
iii) Member end actions are the axial forces, shear forces and bending moments.
iv) Angle between members is always 90^0.
v) Member end actions are the shear forces, torques and bending moments.

(1) i , ii, iii, iv, v (2) i, ii, iii, iv
(3) ii, iii, iv, v (4) i, ii, iv, v

125) In the stiffness matrix method, the boundary conditions are needed to avert _____.

(1) divergent solution (2) singularity
(3) irrational solution (4) zero displacement vector

126) In the direct element method of structural analysis, the transformation matrices are needed for following combinations of actions _____.

i) They facilitate the transformation of element stiffness and element load matrices to global stiffness and global load matrices respectively.
ii) They are useful for determining the displacement matrices.
iii) They facilitate the conversion of resultant displacement matrices into member oriented displacement matrices.
iv) The are useful for determining member end actions.

(1) i , iii (2) ii, iii (3) iii, iv (4) i, ii

127) For a fixed beam of span L and uniform flexural rigidity EI, with both supports at same level, the support at right rotate by α radians anti clockwise. The support reactions at left and right supports (assuming upward displacement and anti clockwise rotations as positive) respectively are _____.

(1) $6EI\alpha/L^2$, $2EI\alpha/L$, $6EI\alpha/L^2$, $2EI\alpha/L$
(2) $6EI\alpha/L^2$, $4EI\alpha/L$,- $6EI\alpha/L^2$, $2EI\alpha/L$
(3) $6EI\alpha/L^2$, $2EI\alpha/L$,- $6EI\alpha/L^2$, $4EI\alpha/L$
(4) $6EI\alpha/L^2$, $2EI\alpha/L$,- $6EI\alpha/L^2$, $2EI\alpha/L$

128) Using slope deflection method, the end rotations at A and B for a horizontal member 4m long with flexural rigidity EI are found as EI/1000 and – EI/2000 respectively. The beam carries a 80kN vertical downward load of 1m from A. The support moments at A and B are (assuming clockwise moments and rotations as positive) taking $EI = 5 \times 10^4$ kN.m are _____ respectively.

(1) +30 kN.m, -15 kN.m (2) +45 kN.m, +15 kN.m
(3) -7.5 kN.m, +15 kN.m (4) +15 kN.m, -15 kN.m

129) Three members AB, BC and BD 3m, 3m and 4m long each, with uniform flexural rigidity are rigidly connected at B. If the supports at A and C are fixed while at D it is hinged the distribution factors in directions of BA, BC and BD at the joint B are _____ respectively.

(1) 3/11, 4/11, 4/11
(2) 4/11, 3/11, 4/11
(3) 4/11, 4/11, 3/11
(4) 1/3, 1/3, 1/3

130) In a three hinged parabolic arch, the third hinge is located at the crown. The beam moment coinciding with H-moment indicates _____

(1) Arch all along carries only radial shear.
(2) Arch all along carries only beam moment
(3) Arch all along carries only normal thrust.
(4) Arch all along carries only H- moment.

131) A cable carrying a load of w/unit run is stretched between supports L apart. The supports are at the same level and the central dip is h. The greatest and least tensions in the cable are_____.

(1) $wL/2$, $wL^2/8h$
(2) $\sqrt{((wL/2)^2+(wL^2/8h))}$, $wL^2/16h$
(3) $\sqrt{((wL/2)^2+(wL^2/8h))}$, $wL^2/8h$
(4) $\sqrt{((wL/2)^2+(wL^2/2h))}$, $wL^2/8h$

132) A cantilever beam AB is fixed at left end A and free at B. The corresponding conjugate beam will supports _____.

(1) fixed at A and free at B
(2) free at A and simple support at B
(3) free at A and fixed at B
(4) simple supports at both A and B

133) In a steel tension member, it's maximum strength in case of adequately designed bolted connections is governed by _____.

(1) The slenderness of the member
(2) The tensile strength of net sectional area of the member.
(3) The strength of the bolted connection.
(4) The section modulus of the member

134) The principal reason for adding stiffeners to the web of a steel beam is to _____.

(1) Increase its moment carrying capacity.
(2) Reduce the deflection of the beam.
(3) Increase the stiffness of the web.
(4) Improve aesthetics.

135) In the built-up steel columns, the lacing is provided _____.

i) to keep all individual sections together.

ii) to take-up lateral shear to an extent of 2.5% of axial force.

iii) to increase the bending strength of the section.

iv) to increase the compressive strength of the section.

(1) i , iii (2) ii, iii (3) iii, iv (4) i, ii

136) The list of principal components of a plate girder is _____.

i) Top and bottom flange plates and web plates.

ii) Horizontal stiffeners, Intermediate and bearing stiffeners.

iii) Cleat angles and seat angels.

iv) Web splicing and flange splicing.

(1) i , iii, iv (2) i, ii, iii (3) i, ii, iv (4) ii, iii, iv

137) The requirements to be satisfied in the design of a gantry girder are that it has to withstand effects due to _____.

(1) Moving loads, impact effects and fatigue.

(2) Moving loads, longitudinal loads, lateral loads, impact effects and fatigue.

(3) Lateral loads, longitudinal loads, impact effects and fatigue.

(4) Dynamic loads, longitudinal loads, impact effects and fatigue.

138) The Lug angle is a member which _____.

(1) is connected to the main tension member to transfer the tensile force economically to the joint.

(2) is connected to the main tension member for erection purpose.

(3) is connected to the main tension member to increase its strength locally.

(4) is connected to the main tension member to increase its stiffness

139) The expression working out the thickness of slab base is given by _____. If t = thickness of slab base, w = pressure under slab base, σ_{bs} = permissible bending stress in slab base, a , b = longer and shorter projections of the slab base edge to the column member, Poisons ratio = 0.25.

(1) $t = ((3w/\sigma_{bs})(a-b/4))^{1/2}$ (2) $t = ((3w/\sigma_{bs})(a^2-b^2/4))^{1/2}$

(3) $t = ((3w/\sigma_{bs})(a^2-b^2))^{1/2}$ (4) $t = ((3w/\sigma_{bs})(a-b^2/4))^{1/2}$

140) A fixed beam of span L carries a UDL of intensity w/unit run. If the plastic moment of the beam section is M_p, collapse occurs when _____ number of plastic hinges are formed and wL = _____.

(1) 2 and $8M_p/L$ (2) 3 and $8M_p/L$

(3) 3 and $16M_p/L$ (4) 2 and $16M_p/L$

141) A cantilever beam of span L carries a point load W at its free end. Plastic moment of the section from support to middle of span is 1.5 M_p and from there to free end is M_p. Collapse occurs when W = _____.

(1) $1.5M_p/L$ (2) M_p/L (3) $2M_p/L$ (4) $0.75M_p/L$

142) According to IS: 456-2000, in the design of isolated RCC column footing using RCC with an effective depth d, the critical sections to be checked are _____.

(1) Bending moment at the face of the column, one-way shear at d/2 away from the face of column and two-way shear at d around the column.

(2) Bending moment at the face of the column, one-way shear at d away from the face of column and two-way shear at d around the column.

(3) Bending moment at d/2 away from the face of the column, one-way shear at d away from the face of column and two-way shear at d/2 around the column.

(4) Bending moment at the face of the column, one-way shear at d away from the face of column and two-way shear at d/2 around the column.

143) Minimum amount of high strength deformed bar reinforcement used in solid slabs shall not be less than _____ of the total cross sectional area of the slab according to IS: 456-2000.

(1) 0.15% (2) 0.12% (3) 0.20% (4) 0.25%

144) When the depth of the web of beam is more than _____ mm, side face reinforcement of _____ % of the web area is needed to be provided according to IS:456-2000.

(1) 600, 0.1% (2) 750, 0.15% (3) 600, 0.15% (4) 750, 0.1%

145) Maximum spacing of vertical shear reinforcement measured along the axis of the RCC beam shall not exceed _____, whichever is lowest.

(1) 0.75d or 300mm (2) 0.75d or 400mm

(3) 0.50d or 250mm (4) 0.5d or 300mm

146) The bearing stress check for column footing in limit state design specifies that the value _____ subjected to a maximum of 2 multiplied by bearing stress _____ shall be more than the compressive stress at the base of the column. A_1 = supporting area for bearing of footing, which in sloped or stepped footing maybe taken as the area of the lower base of the largest frustum of a pyramid or cone contained wholly within the footing and having for its upper base, the area actually loaded and having side slope of one vertical to two horizontal; and, A_2 = loaded area at the column base.

(1) $\sqrt{(A_1/A_2)}$, $0.30\ f_{ck}$ (2) $\sqrt{(A_1/2A_2)}$, $0.45\ f_{ck}$

(3) $\sqrt{(A_1/A_2)}$, $0.45\ f_{ck}$ (4) $\sqrt{(A_1/A_2)}$, $0.60\ f_{ck}$

147) The functionality of a wall, retaining wall and a shear wall in order is _____.

i) resist predominantly vertical loads

ii) resist lateral loads perpendicular to the plane of wall

iii) resist lateral loads in the plane of wall

(1) ii, iii, i (2) i, ii, iii (3) iii, ii, i (4) ii, i, iii

148) Splicing of reinforcement in flexure members is taken-up at a location where bending moment is less than _____ the moment of resistance at that section and not more than _____ of bars are spliced at any particular section.

(1) 75%, 50% (2) 50%, 75% (3) 25%, 50% (4) 50%, 50%

149) The loss stress due to creep in steel in a pre-stress problem is given by the formula _____, where α = creep coefficient, f_c = stress in concrete, E_c = modulus of elasticity of concrete and E_s = modulus of elasticity of steel.

(1) $\alpha(f_c/E_c)E_s$ (2) $\alpha(f_c/2E_c)E_s$ (3) $\alpha(f_c/E_s)E_c$ (4) $2\alpha(f_c/E_c)E_s$

150) The principal reason for adopting pre-stressing cable profiles in flexure members as parabolic is due to the fact that _____.

(1) They need to resist both bending moments and shear forces in members.

(2) The strength of pre-stressing cables is maximum in parabolic shapes only.

(3) The profile of moment caused by self weight of structure is parabolic and to counter this, the cable profile also needs to be parabolic.

(4) Its a regular practice