

MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF LEGAL METROLOGY UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2018

CIVIL ENGINEERING PAPER - III

Time Allowed : 2 hours

Full Marks : 200

*All questions carry equal marks of two (2) each.
Attempt all questions.*

- Coefficient of curvature of a well graded gravel is
 - Less than 1
 - Greater than 6
 - Lies between 1 and 3
 - Lies between 3 and 6
- An undisturbed soil sample has a plastic limit of 25%, a natural moisture content of 40% and a liquidity index of 50%. Its liquid limit is
 - 50%
 - 55%
 - 60%
 - 75%
- The width of a square footing and the diameter of a circular footing are equal. If both the footings are placed on the surface of sandy soil, the ratio of the ultimate bearing capacity of circular footing to that of square footing will be
 - 4/3
 - 1
 - 3/4
 - 2/3
- The effective stress friction angle of a saturated, cohesionless soil is 38° . The ratio of shear stress to normal effective stress on the failure plane is
 - 0.781
 - 0.616
 - 0.488
 - 0.438
- In a shear box test, the failure plane is the
 - Weakest plane
 - Horizontal plane
 - Vertical plane
 - Major principal plane
- In an expansive soil under a structure, during summer, the settlement pattern is
 - Bow shaped
 - Uniform
 - Saucer shaped
 - Sinusoidal
- As per the Indian Standard soil classification system, a sample of silty clay with liquid limit of 40% and plasticity index of 28% is classified as
 - CH
 - CI
 - CL
 - CL-ML
- Likelihood of general shear failure for an isolated footing in sand decreases with
 - decreasing footing depth
 - decreasing inter-granular packing of the sand
 - increasing footing width
 - decreasing solid grain compressibility

9. Quick sand condition occurs when
- (a) the void ratio of the soil becomes 1.0
 - (b) the upward seepage pressure in soil becomes zero
 - (c) the upward seepage pressure in soil becomes equal to the saturated unit weight of the soil
 - (d) the upward seepage pressure in soil becomes equal to the submerged unit weight of the soil
10. Terzaghi and Peck's settlement chart is based on the fact that N-value represents
- (a) Density
 - (b) Moisture content
 - (c) Relative density
 - (d) Surcharge
11. Deposit with flocculated structure is formed when
- (a) clay particles settle on sea bed
 - (b) clay particles settle on fresh water lake bed
 - (c) sand particles settle on river bed
 - (d) sand particles on sea bed
12. Dilatancy correction is required when a strata is
- (a) cohesive and saturated and also has N value of SPT > 15
 - (b) saturated silt/fine sand and N value of SPT < 15 after the overburden correction
 - (c) saturated silt/fine sand and N value of SPT > 15 after the overburden correction
 - (d) coarse sand under dry condition and N value of SPT < 10 after the overburden correction
13. The bearing capacity of footing on sand depends mainly on
- (a) Width of footing
 - (b) Thickness of footing
 - (c) Length of footing
 - (d) Shape of footing
14. The relationship among specific yield (S_y), specific retention (S_r) and porosity (h) of an aquifer is
- (a) $S_y = S_r + h$
 - (b) $S_y = S_r - h$
 - (c) $S_y = h - S_r$
 - (d) $S_y = S_r + 2h$
15. When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as
- (a) passive earth pressure
 - (b) swelling pressure
 - (c) pore pressure
 - (d) active earth pressure
16. Compaction by vibratory roller is the best method of compaction in case of
- (a) moist silty sand
 - (b) well graded dry sand
 - (c) clay of medium compressibility
 - (d) silt of high compressibility
17. The addition of coarser particles soil like sand or silt today, causes
- (a) Decrease in liquid limit as well as in plasticity index
 - (b) Decrease in liquid limit and increase in plasticity index
 - (c) Increase in liquid limit as well as in plasticity index
 - (d) Decrease in liquid limit and no change in plasticity index
18. Increase in effective stress on a soil mass
- (a) Increases the void ratio and decreases the permeability
 - (b) Increases the void ratio and increases the permeability
 - (c) Decreases the void ratio and decreases the permeability
 - (d) Decreases the void ratio and increases the permeability

19. The stress, which is responsible for retaining water in a capillary tube above the free water surface of the water body in which the capillary tube is inserted, is called the
- (a) Capillary compression (b) Capillary tension
(c) Capillary pore pressure (d) None of these
20. Coefficient of consolidation for clays generally
- (a) Decreases with increase in liquid limit
(b) Increases with increase in liquid limit
(c) Initially increases and then decreases with the increase in the liquid limit
(d) Remains constant at all values of liquid limit
21. The liquid limit (LL), plastic limit (PL) and shrinkage limit (SL) of a cohesive soil satisfy the relation
- (a) $LL > PL < SL$ (b) $LL > PL > SL$
(c) $LL < PL < SL$ (d) $LL < PL > SL$
22. Root time method is used to determine
- (a) T, time factor (b) C_v , coefficient of consolidation
(c) a_v , coefficient of compressibility (d) m_v , coefficient of volume compressibility
23. Negative skin friction in a soil is considered when the pile is constructed through a
- (a) fill material (b) dense coarse sand
(c) over consolidated stiff clay (d) dense fine sand
24. Coefficient of compressibility is
- (a) Constant for any type of soil
(b) Different for different type of soils and is different for a soil under different states of consolidation
(c) Different for different type of soils but same for a soil under different states of consolidation
(d) Independent of the type of soil but depends on the stress history of the soil
25. Base failure of a finite slope
- (a) Is a most common failure and occurs in relatively steep slopes
(b) Occurs when soil below the level of toes is strong
(c) Occurs when there is a relatively weak zone in upper part of slope
(d) Occurs when the soil below the toe is relatively soft and weak
26. The net ultimate bearing capacity of a purely cohesive soil
- (a) Depends on width of footing and is independent of depth of footing
(b) Depends on width of footing and is independent of width of footing
(c) Depends on both depth and width of footing
(d) Is independent of both depth and width of footing
27. The net ultimate bearing capacity of the soil is 25 t/m^2 and density 1.7 t/m^3 . The safe bearing capacity at 1m below ground surface taking a FOS = 2.5 will be
- (a) 10 t/m^2 (b) 11.7 t/m^2
(c) 25 t/m^2 (d) 62.5 t/m^2
28. The ratio of saturated unit weight of dry unit weight of soil is 1.25. If the specific gravity of solids (G_s) is 2.65, the void ratio of the soil is
- (a) 0.625 (b) 0.663
(c) 0.944 (d) 1.325

29. There are two footings resting on the ground surface. One footing is square of dimension B. The other is strip footing of width B. Both of them are subjected to loading intensity of Q. The pressure intensity at any depth below the base of the footing along the centerline would be
- (a) Equal in both footings
 - (b) Large for square footing and small for strip footing
 - (c) Small for square footing and Large for strip footing
 - (d) More for strip footing at shallow depth (\leq) and more for square footing at a large depth ($>B$)
30. The best indication of the behavior of a deposit of sand under load can be obtained from its
- (a) Bulk density
 - (b) Dry density
 - (c) Grading
 - (d) Relative density
31. A well-designed signalized intersection is one in which the
- (a) crossing conflicts are increased
 - (b) total delay is minimized
 - (c) cycle time is equal to the sum of red and green times in all phases
 - (d) cycle time is equal to the sum of red and yellow times in all phases
32. As per IRC:37-2012, in order to control subgrade rutting in flexible pavements, the parameter to be considered is
- (a) horizontal tensile strain at the bottom of bituminous layer
 - (b) vertical compressive strain on top of subgrade
 - (c) vertical compressive stress on top of granular layer
 - (d) vertical deflection at the surface of the pavement
33. The initial concavity in the load-penetration curve of a CBR test is NOT due to
- (a) uneven top surface
 - (b) high impact at start of loading
 - (c) inclined penetration plunger
 - (d) soft top layer of soaked soil
34. Select the strength parameter of concrete used in design of plain jointed cement pavement from the following choices:
- (a) Tensile strength
 - (b) Compressive strength
 - (c) Flexural strength
 - (d) Shear strength
35. Aggregate impact value indicates which one of the following property of aggregates?
- (a) Durability
 - (b) Toughness
 - (c) Hardness
 - (d) Strength
36. As per IRC : 67-2001, a traffic sign indicating the Speed Limit on a road should be of
- (a) circular shape with white background and red border
 - (b) triangular shape with white background and red border
 - (c) triangular shape with red background and white border
 - (d) circular shape with red background and white border
37. The value of lateral friction or side friction used in the design of horizontal curve as per Indian Roads Congress guidelines is
- (a) 0.40
 - (b) 0.35
 - (c) 0.24
 - (d) 0.15

38. During a CBR test, the load sustained by a remolded soil specimen at 5.00 penetration is 50 kg. The CBR value of the soil will be
- (a) 10.0% (b) 5.0%
(c) 3.6% (d) 2.4%
39. The specific gravity of paving bitumen as per IS:73-1992 lies between
- (a) 1.10 and 1.06 (b) 1.06 and 1.02
(c) 1.02 and 0.97 (d) 0.97 and 0.92
40. A combined value of flakiness and elongation index is to be determined for a sample of aggregates. The sequence in which the two tests are conducted is
- (a) elongation index test followed by flakiness index test on the whole sample
(b) flakiness index test followed by elongation index test on the whole sample
(c) flakiness index test followed by elongation index test on the non-flaky aggregates
(d) elongation index test followed by flakiness index test on non-elongated aggregates
41. The extra widening required for a two-lane National Highway at a horizontal curve of 300 m radius, considering a wheel base of 8 m and a design speed of 100 kmph is
- (a) 0.42 m (b) 0.62 m
(c) 0.82 m (d) 0.92 m
42. In case of governing equation for calculating wheel load stresses using Westergaard's approach, the following statements are made :
1. Load stresses are inversely proportional to wheel load.
 2. Modulus of subgrade reaction is useful for load stress calculation.
- (a) Both statements are TRUE (b) 1 is TRUE and 2 is FALSE
(c) Both statements are FALSE (d) 1 is FALSE and 2 is TRUE
43. Name the traffic survey data which is plotted by means of Desire lines.
- (a) Accident (b) Classified volume
(c) Origin and Destination (d) Speed and Delay
44. For normal landing, the pilot should cross the threshold of runway at the height of
- (a) 10 m (b) 15 m
(c) 30 m (d) 100 m
45. The stopping distance of an aircraft is given by
- (a) $\frac{V^2}{125f}$ (b) $\frac{V^2}{127R}$
(c) $\frac{\sqrt{V}}{125f}$ (d) $\frac{V^2}{25.5d}$
46. Which of the following is not a repair dock
- (a) Floating dock (b) Lift dock
(c) Marine railway (d) Wet dock
47. The best direction of runway is
- (a) Along the direction of the longest line on wind rose diagram
(b) Along the direction perpendicular to the largest line on wind rose diagram
(c) Along 30° to the direction of the longest line on wind rose diagram
(d) Along NW-SE line

48. While driving at a speed of 30kmph (with available friction of 0.4) down the grade, the driver requires a braking distance twice that required for stopping the vehicle when he travels up the same grade. The grade is
- (a) 7% (b) 13.3%
(c) 30% (d) 33.3%
49. Assuming an acceleration of 0.53m/sec^2 for a highway with design speed of 180kmph, the safe overtaking sight distance is
- (a) 180m (b) 320m
(c) 470m (d) 750m
50. Bankelman beam deflection method is used for design of
- (a) Flexible overlay on flexible pavement (b) Flexible overlay on rigid pavement
(c) Rigid overlay on rigid pavement (d) None of these
51. The stopping sight distance depends upon
- (a) Efficiency of brakes (b) Speed of vehicle
(c) Total reaction time of driver (d) All of these
52. Maximum number of vehicle can be parked with
- (a) 30° angle parking (b) 45° angle parking
(c) 90° angle parking (d) Parallel parking
53. When a number of roads are meeting at a point and only one of the roads is important, then the suitable shape of rotary is
- (a) Circular (b) Elliptical
(c) Tangent (d) Turbine
54. The drain which is provided parallel to roadway to intercept and divert the water from hill slopes is known as
- (a) Catchwater drain (b) Cross drain
(c) Side drain (d) Sloping drain
55. The minimum design speed for hairpin bends in hill road is taken as
- (a) 10kmph (b) 20kmph
(c) 30kmph (d) 40kmph
56. Penetration test on bitumen is used for determining its
- (a) Ductility (b) Grade
(c) Temperature susceptibility (d) Viscosity
57. The slope of the stair should not be flatter than
- (a) 10° (b) 15°
(c) 20° (d) 25°
58. In quadrantal bearing system, bearing of a line varies from
- (a) 0° to 360° (b) 0° to 180°
(c) 0° to 90° (d) 0°N to 90°S
59. The type of surveying in which the curvature of the earth is taken into account is called
- (a) Geodetic surveying (b) Plane surveying
(c) Preliminary surveying (d) Topographical surveying

60. The plan of a map was photo copied to a reduced size such that a line originally 100 mm, measures 90 mm. The original scale of the plan was 1 : 1000. The revised scale is
- (a) 1 : 900 (b) 1 : 1111
(c) 1 : 1121 (d) 1 : 1221
61. The permissible error in chaining on hilly ground is
- (a) 1 in 15 (b) 1 in 100
(c) 1 in 250 (d) 1 in 400
62. The smallest length that can be drawn on a map is
- (a) 0.2 mm (b) 0.6 mm
(c) 1.0 mm (d) 1.0 cm
63. In curves, a chainage of 370 + 10 implies
- (a) 370.10 m (b) 370 chains and 10 links
(c) 370 links and 10 chains (d) None of these
64. The rise and fall method of levelling provides a complete check on
- (a) Back sight (b) Fore sight
(c) Intermediate sight (d) All of these
65. Bench Mark is establish by
- (a) Barometric levelling (b) Spirit Levelling
(c) Trigonometric levelling (d) None of these
66. A 100 m tape is held 1 m out of line. The true length is
- (a) 99.9800 m (b) 99.9950 m
(c) 100.0050 m (d) 100.0100 m
67. A river is an obstacle to
- (a) Chainingbut not ranging. (b) Ranging but not chaining.
(c) Both chaining and ranging. (d) None of these
68. If the distance between two points A and B is 1km. The combine correction for curvature and refraction will be
- (a) 0.0673m (b) 0.673m
(c) 1.0673m (d) 1.673m
69. Two contour lines, having the same elevation
- (a) cannot cross each other (b) can cross each other
(c) cannot unite together (d) can unite together
70. The curve composed of two arcs of different radii having their centres on the opposite side of the curve, is known
- (a) a reverse curve (b) a compound curve
(c) a simple curve (d) a vertical curve
71. If Δ is the angle of deflection of a simple curve of radius R, the length of the curve is:
- (a) $\frac{\pi R\Delta}{90^\circ}$ (b) $\frac{\pi R\Delta}{180^\circ}$
(c) $\frac{\pi R\Delta}{270^\circ}$ (d) $\frac{\pi R\Delta}{360^\circ}$

72. Direct cost of the project is due to
(a) Delaying project (b) Establishment charges
(c) Loss or gain of project (d) Men power and material cost
73. Critical path
(a) Is time wise shortest path (b) Has the minimum slack
(c) Has zero slack (d) Is the time wise longest path.
74. A project is expected to take 15 months along the critical path, having a standard deviation of 3 months. The probability of completing the project within 12 months is
(a) 15.87% (b) 17.85%
(c) 50.00% (d) 84.13%
75. If PERT is X oriented and CPM network is Y oriented, then X & Y stand respectively for
(a) Activity, time (b) Event, Activity
(c) Activity, Event (d) Float, slack
76. A construction equipment costs Rs10000 and has an expected life of 5 years, and has no salvage value. Its book value according to double declining balance method after 2 years will be
(a) Rs 3000 (b) Rs 3600
(c) Rs 6000 (d) Rs 6800
77. Site order book is used for recording
(a) instructions by the executive engineers (b) construction measurements
(c) issue of store equipments (d) names of the casual labour
78. Various activities of a project, are shown on bar charts by
(a) vertical lines (b) horizontal lines
(c) dots (d) crosses
79. Trenching machines cannot be used for
(a) Hard clay (b) Loose material
(c) Muddy clay (d) Rocks
80. Concrete mixers are specified by
(a) Nominal volume of concrete that can be mixed in a batch
(b) Number of cement bags used in a batch
(c) Volume of grit used
(d) None of these
81. Concrete can be pumped up to a distance of _____ without any loss of its properties
(a) 30 m (b) 50 m
(c) 100 m (d) 350 m
82. The thickness used for the design of masonry walls should be the
(a) Actual thickness (b) Nominal thickness
(c) Average dimensions of the masonry units (d) None of these
83. The mode of failure of a very short masonry member having h/t ratio of less than 4 is by
(a) Buckling (b) Shear
(c) Vertical tensile splitting (d) All of these

- 84.** Water retentively for brick masonry should not be less than
- (a) 50 % (b) 60 %
(c) 70 % (d) 80%
- 85.** Rich cement mortars are more liable to cracking as compared to lean mortars because rich mortars have
- (a) High shrinkage (b) Less strength
(c) Both (a) & (b) (d) None of these
- 86.** For strengthening of 50 m long and 5 m high straight compound wall built in brick work, which one of the following would be most suitable
- (a) Providing buttresses at certain intervals (b) Providing a deeper foundation
(c) Using richer mortar (d) Using stronger bricks
- 87.** For masonry work, with solid bricks, consistency of mortar should be
- (a) 5 – 8 cm (b) 9 – 13 cm
(c) 14 – 18 cm (d) 19 – 23 cm
- 88.** Bitumen is derived from
- (a) destructive distillation of coal tar (b) destructive distillation of petroleum
(c) fractional distillation of petroleum (d) naturally occurring ores
- 89.** Awarding a contract to lowest bidder ensuring efficient utilization of public money is called
- (a) bid contract (b) negotiated contract
(c) target contract (d) none of these
- 90.** Estimate of a residential building estimated using plinth area rate comes under
- (a) Preliminary estimate (b) Engineer's estimate
(c) Bid estimate (d) All of these
- 91.** Reduction in volume of soil primarily due to squeezing out of water from the void is called
- (a) Creep (b) Plastic flow
(c) Primary consolidation (d) Secondary consolidation
- 92.** Shear strength parameters of soil includes
- (a) Cohesion and friction angle of soil (b) Cohesion and void ratio of soil
(c) Friction angle and void ratio of soil (d) None of these
- 93.** Dolphin is a type of
- (a) Caisson (b) Isolated footing
(c) Pile foundation (d) Raft foundation
- 94.** Camber on highway pavement is provided to take care of
- (a) Centrifugal force (b) Drainage
(c) Sight Distance (d) Off-tracking
- 95.** Bituminous concrete is a mix comprising of
- (a) fine aggregate, filler and bitumen
(b) fine aggregate and bitumen
(c) coarse aggregate, fine aggregate, filler and bitumen
(d) coarse aggregate, filler and bitumen

96. In the context of flexible pavement design, the ratio of contact pressure tyre pressure is called the Rigidity Factor. This factor is less than unity when the tyre pressure is
- (a) less than 0.56 N/mm^2
 - (b) equal to 0.56 N/mm^2
 - (c) equal to 0.7 N/mm^2
 - (d) more than 0.7 N/mm^2
97. The star and Grid pattern of road network was adopted in
- (a) Nagpur Road Plan
 - (b) Lucknow Road Plan
 - (c) Bombay Road Plan
 - (d) Delhi Road Plan
98. The minimum number of satellites needed for a GPS to determine its position precisely is
- (a) 2
 - (b) 3
 - (c) 4
 - (d) 24
99. Engineer's estimate is prepared using
- (a) lumpsum price
 - (b) contractor's rate
 - (c) wholesale price
 - (d) unit price
100. Ratio of labour cost to total construction cost of the building lies in the range of
- (a) 10 – 20%
 - (b) 15 – 25%
 - (c) 20 – 25%
 - (d) 20 – 35%

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