MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, 2014

CIVIL ENGINEERING
PAPER - III

Time Allowed : 3 hours Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

1. The ratio of volume of voids to the total volume of a given soil mass is
(a) void ratio (b) porosity
(c) air content (d) air ratio

2. Relationship between void ratio '*e*' and porosity '*n*' is given by
(a) $e = n(1 + n)$ (b) $e = n(1 + e)$
(c) $e = n(1 - e)$ (d) $e = n(1 - n)$

3. Uniformity co-efficient is the ratio of
(a) D_{10} to D_{60} (b) D_{60} to D_{10}
(c) D_{30} to D_{60} (d) D_{10} to D_{80}

4. The numerical difference between liquid limit and plastic limit is the
(a) flow index (b) toughness index
(c) plasticity index (d) liquidity index

5. The quick sand condition occurs when
(a) pore water pressure exceeds the downward pressure
(b) pore water pressure is less than the downward pressure
(c) pore water pressure is equal to the downward pressure
(d) none of these

6. Liquefaction may occur
(a) when there are vibrations induced by earthquakes
(b) when there is cyclic loading in sand deposits
(c) in the presence of loose, poor sand with mostly uniform size particles
(d) all of these

7. The function of sand drains is to
(a) increase the rate of consolidation (b) decrease the rate of consolidation
(c) keep constant rate of consolidation (d) none of these

8. Proctor needle is used to determine
(a) water content
(b) dry density
(c) both water content and dry density
(d) permeability

9. The maximum pressure intensity which a soil can carry without shear failure is known as
(a) safe bearing capacity
(b) ultimate bearing capacity
(c) net safe bearing capacity
(d) net ultimate bearing capacity

10. Unconfined compression strength is
(a) undrained test
(b) drained test
(c) slow test
(d) consolidated drained test

11. If bearing of AB = 40^0; bearing of BC = 120^0, then $\angle ABC =$
(a) 80^0
(b) 100^0
(c) 180^0
(d) 260^0

12. A Bench mark is a
(a) reference point
(b) the very first station
(c) the point of known elevation
(d) last station of the survey work

13. A level line is a
(a) horizontal line
(b) line parallel to the mean spheroidal surface of earth
(c) line perpendicular to the mean spheroidal surface of earth
(d) line passing through the objective and centre of eye piece

14. The road connecting district head quarters of a state is
(a) National Highway
(b) State Highway
(c) Major district road
(d) Minor district road

15. The primary object of providing camber is
(a) easy drainage
(b) improved appearance
(c) easy separation of vehicle
(d) easy overtaking facilities

16. Maximum equivalent single wheel load as per IRC is
(a) 4080 kg
(b) 8610 kg
(c) 1020 kg
(d) 2040 kg

17. Grade separation had the advantage of
(a) easy right turn
(b) no speed restriction
(c) occupying the least space
(d) minimising the conflict at point

18. Maximum degree of curve on BG of Indian Railways is
(a) 10^0
(b) 16^0
(c) 20^0
(d) 40^0

19. Bar chart is drawn for
(a) time versus activity
(b) activity versus resources
(c) resources versus progress
(d) progress versus time

20. CPM stands for
(a) computer programming mode
(b) critical project management
(c) controlling, planning and maintenance
(d) critical path method

21. Total project cost
(a) increases with increase in time
(b) reduces with increase in time
(c) initially reduces and then increases with increase in time
(d) initially increases and then reduces with increase in time

22. Crashing to the project means
(a) reducing the time of completion by spending more resources
(b) reducing the cost of project by delaying the time of completion
(c) reducing the project size to save the resources
(d) all of these

23. The portion of the wall which supports an arch is termed as
(a) abutment (b) pier
(c) column (d) bearer

24. For masonry work with solid bricks, consistency of mortar should be
(a) 5 to 8 cm (b) 9 to 13 cm
(c) 14 to 18 cm (d) 19 to 23 cm

25. In random rubble masonry
(a) the stones are neatly dressed and laid in courses
(b) the stones are neatly dressed but not built to courses
(c) the stones are not dressed and are laid without mortar
(d) the stones are either not dressed or roughly dressed and may be coursed or uncoursed

26. The unit weight of a soil at zero air voids depends on
(a) Specific gravity (b) Water content
(c) Unit weight of water (d) All of these

27. A fully compensated raft foundation for a building is
(a) designed as a very rigid raft
(b) designed as a completely flexible raft
(c) such that the weight of the excavated soil is equal to the load due to the building
(d) supported by piles of short length

28. A metallic tape is made of
(a) Steel (b) Invar
(c) Linen (d) Cloth and Wires

29. Three point problem can be solved by
(a) Tracing paper method (b) Bessel's method
(c) Lehman's method (d) All of these

30. Which of the following methods estimates best the area of an irregular and curved boundary?
(a) Trapezoidal method b) Simpson's method
(c) Average ordinate method (d) Mid-ordinate method

31. ABCD is a regular parallelogram plot of land, whose angle BAD is 60^0. If the bearing of the line AB is 30^0, then the bearing of the line CD is
(a) 90^0 b) 120^0
(c) 210^0 d) 270^0

32. Pick up the item of work not included in the plinth area estimate

(a) Wall thickness (b) Room area

(c) W.C. area (d) Courtyard area

33. The damp proof course (D.P.C) is measured in

(a) Cub.m (b) Sqm

(c) Metres (d) None of these

34. The length of runway under standard atmospheric conditions is 1800 m. If the actual reduced level of the site is 1200 m, the design length of the runway is

(a) 2360 m (b) 2460 m

(c) 2560 m (d) 2660 m

35. The Runway orientation is made so that landing and takeoff are

(a) against the wind direction (b) along the wind direction

(c) perpendicular to wind direction (d) none of these

36. Maximum super-elevation on hill roads should not exceed

(a) 5% (b) 7%

(c) 8% (d) 10 %

37. Completion of CPM network diagram is generally known

(a) Event (b) Node

(c) Connector (d) All of these

38. A construction schedule is prepared after collecting

(a) Number of operations (b) Output of labour

(c) Output of machinery (d) All of these

39. Void ratio of soil mass can

(a) Never be greater than unity (b) Be zero

(c) Take any value greater than zero (d) Take values between 0 and 1 only

40. The liquefaction of loose sand deposits may be caused by

(a) Dilatancy (b) Sensitivity

(c) Thixotropy (d) None of these

41. If the plasticity index of a soil mass is zero, the soil is

(a) Sand (b) Silt

(c) Clay (d) Clayey Silt

42. Inorganic soils with low compressibility are represented by

(a) *MH* (b) *SL*

(c) *ML* (d) *CH*

43. If the voids of a soil mass are full of air only, the soil is termed as

(a) Air entrained soil (b) Partially saturated soil

(c) Dry soil (d) Dehydrated soil

44. The angle that Coulomb's failure envelope makes with the horizontal is called

(a) Cohesion (b) Angle of internal friction

(c) Angle of repose (d) None of the above

45. A soil has a bulk density of 22 kN/m^3 and water content 10%. The dry density of soil is

(a) 18.6 kN/m^3 (b) 20.0 kN/m^3

(c) 22.0 kN/m^3 (d) 23.2 kN/m^3

46. A soil has liquid limit of 60%, plastic limit of 35% and shrinkage limit of 20% and it has a natural moisture content of 50%. The liquidity index of soil is

(a) 1.5 (b) 1.25

(c) 0.6 (d) 0.4

47. Which of the following scales is largest?

(a) 1 cm = 50 m (b) 1: 42000

(c) R.F. = $\frac{1}{300000}$ (d) 1 cm = 50 km

48. If the quadrantal bearing of a line is $N\,25^0\,W$, then the whole circle bearing of the line is

(a) $S\,25^0\,E$ (b) 205^0

(c) 335^0 (d) 295^0

49. In the quadrantal bearing system, a whole circle bearing of 293°30' can be expressed as

(a) W 23° 30' N (b) N 66° 30' W

(c) S 113° 30' N (d) N 23° 30' W

50. Total angle of deflection of a transition curve is

(a) Spiral angle (b) Spiral angle/3

(c) Spiral angle/2 (d) Spiral angle/4

Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

51. If n is the porosity and e is the void ratio of a soil sample, prove that

$$n = \frac{e}{1+e} \text{ And } e = \frac{n}{1-n}$$

52. In conducting tri-axial test to determine shear strengths for soil samples, what consolidation pressures should be specified?

53. Determine the net ultimate bearing capacity of a mat foundation measuring 12 m × 8 m on a saturated clay with C_u = 80 kN/m^2 , Φ = 0 and D_f=2 m.

54. A concrete pile 400 mm × 400 mm in cross section is embedded in saturated clay. The length of embedment is 16 m. The un-drained cohesion C_u of clay is 60 kN/m^2 and the unit weight of clay is 18 kN/m^2. Use a factor of safety of 5 to determine the allowable load the pile can carry.

55. Describe the method of determining the bearing capacity of soil in the field.

56. The measured length of a survey line using 20 m chain was 652 m. Find the actual length of the survey line if the chain was 80 mm too long.

57. The fore bearings of the lines of a traverse are given below. Find the interior angles

Line	Fore Bearing
AB	36°20'
BC	100°36'
CD	138°25'
DE	198°40'
EA	317°10'

58. Prepare a detailed estimate for earthwork for a portion of a road from the following data:

Dist. in m	0	100	200	300	400	500	600	700	800	900	1000	1100	1200
RL of Ground	124	124.70	125.05	125.25	126.15	126.80	128.10	128.35	128.155	127.805	127.70	127.905	127.505
RL of Formation	125 Upward gradient 1 in 100 up to 600 m							Downward gradient 1 in 300					

Formation width of road is 10 m. Side slope 2.5:1 banking and 1.5:1 cutting. Adopt suitable rates.

59. Calculate the super-elevation or a horizontal curve on a highway with the following data
(a) Radius of the curve = 400 m and (b) Design speed = 100 KPH

60. For rigid pavement, what are the advantages of using lean concrete sub-base instead of traditional granular sub-base?

61. Explain what a bar chart is and state its limitations and advantages in the planning of construction projects.

62. A soil sample is partially saturated. Its natural moisture content was found to be 22% and bulk density 2 g/cc. If the specific gravity of the solid particles be 2.65 and the density of water be taken as 1 g/cc, find out the degree of saturation and the void ratio.

63. Determine the stresses at the top and bottom of a vertical cut, 4.5 m deep in soil with $\Phi^{\prime} = 16^{0} : C^{\prime} = 1.91$ tones / m^2 And $\gamma = 1.85$ t/m^3 . What would be the depth of the potential crack? What is the maximum depth of excavation that can be left unsupported?

64. A purely cohesive soil was tested by unconfined compression. The mean unconfined compression strength was obtained as 50 kN/m^2. Estimate the ultimate bearing capacity utilizing Terzaghi's concept. (Bearing capacity factor = 5.7)

65. Two tangents intersect at chainage 1200 m, the deflection angle being 40^0. Compute the data for setting out a 400 m radius curve by deflection angles and offsets. Take 30 m chord length in general reach.

66. An observer standing on the deck of a ship just sees a light house. The top of the light house is 49 m above the sea level and height of the observing eyes is 9 m on above the sea level. Find the distance of the observer from the light house.

67. Discuss the characteristics of contours.

68. Discuss about grade compensation on Horizontal curves on Roads.

69. Find the absolute minimum and desirable sight distance when the speed of the vehicle is 80 km/hr.

70. Discuss the criteria of choice of Railway Gauges.

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