MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (COMBINED)
UNDER VARIOUS DEPARTMENT,
GOVERNMENT OF MIZORAM, JULY-2024

CIVIL ENGINEERING
PAPER-III

Time Allowed : 3 hours FM : 200

SECTION - A *(Multiple Choice questions) (100 Marks)*

All questions carry equal mark of 2 each. Attempt all questions.

*This Section should be answered only on the **OMR Response Sheet** provided.*

1. The minimum size of grains of silt soil is about:
(a) 0.002 mm (b) 1.5 mm
(c) 3 mm (d) 2 mm

2. Non-cohesive soil is:
(a) sand (b) silt
(c) clay (d) clay and silt

3. The ratio of weight of water to the weight of solids in a given mass of soil is known as:
(a) void ratio (b) porosity
(c) specific gravity (d) water content

4. A normally consolidated clay layer settles by 25 mm when the effective stress is increased from 15 kPa to 30 kPa. If the effective stress is later increased further from 30 kPa to 60 kPa then the additional settlement would be:
(a) 25 mm (b) 50 mm
(c) 75 mm (d) 100 mm

5. A soil sample has a shrinkage limit of 10% and specific gravity of soil solids as 2.7. The porosity of the soil at shrinkage limit is:
(a) 21.2% (b) 27%
(c) 73% (d) 78.8%

6. The magnetic bearing of a line is 58°30′ and the magnetic declination at that place is 4°30′ east. The true bearing will be:
(a) 54° (b) 13°
(c) 63° (d) 93°

7. If the fore bearing of a line is observed to be 12°24′ the back bearing of the line should be:
(a) 92°24′ (b) 102°24′
(c) 152°25′ (d) 192°24′

8. The plinth area of a building does not include:
   (a) area of stair cover
   (b) area of the walls at the floor level
   (c) area of cantilevered porch
   (d) lift and wall including landing

9. The excavation exceeding 1.5 m in width and 10 sq.m in plan area with a depth not exceeding 30 cm, is termed as:
   (a) Surface excavation
   (b) Surface dressing
   (c) Cutting
   (d) Excavation

10. The lift off distance is the distance along the centre of the runway between the starting point and:
   (a) end of stopway
   (b) point where air craft becomes air borne
   (c) point where air craft attains a height of 10.7 m
   (d) end of the runway

11. Airport elevation is the reduced level above M.S.L. of:
   (a) control tower
   (b) lowest point of the landing area
   (c) highest point of the landing area
   (d) lowest point of the stopway area

12. Minimum depth of ballast prescribed of B.G. trunk lines of Indian Railways, is:
   (a) 25 cm
   (b) 15 cm
   (c) 10 cm
   (d) 40 cm

13. Distance between the inner rail and check rail provided on sharp curve, is:
   (a) 35 mm
   (b) 76 mm
   (c) 44 mm
   (d) 110 mm

14. A district road with a bituminous pavement has a horizontal curve of 1000 m for a design speed of 75 kmph. The super-elevation is:
   (a) 1 in 40
   (b) 1 in 30
   (c) 1 in 20
   (d) 1 in 50

15. The minimum value of camber provided for thin bituminous surface hill roads, is:
   (a) 1.5 %
   (b) 2.5 %
   (c) 3.5%
   (d) 4.5%

16. The free float is equal to:
   (a) latest allowable event occurrence time + Early finish time
   (b) latest allowable event occurrence time - Early finish time
   (c) earliest event occurrence time - Early finish time
   (d) earliest event occurrence time + Early finish time

17. Float or slack represents the difference between the:
   (a) latest allowable time and earliest completion time
   (b) latest allowable time and normal allowable time
   (c) earliest completion time and latest allowable time
   (d) earliest completion time and normal expected time

18. A critical activity has:
   (a) zero float
   (b) minimum float
   (c) maximum float
   (d) average float

19. The artificial activity which indicates that an activity following it, cannot be started unless the preceding activity is complete, is known as
   (a) free float
   (b) dummy
   (c) constant
   (d) event

20. _____ types of equipments are characteristics of both, intermittent as well as continuous flow type equipments.

(a) Combined (b) Mixed

(c) Flow (d) Advanced

21. A _____ is very useful equipment and it can be used for construction work like to clear the site of work, to make the land level, etc.

(a) Scraper (b) Grader

(c) Excavator (d) Bulldozer

22. Sand is produced by crushing in

(a) hammer mill (b) ball mill

(c) gyrator (d) jaw crusher

23. The bending stress in a wall or column subjected to effective vertical load need not be considered, if the eccentricity ratio is:

(a) less than or equal to 1/14 (b) less than or equal to 1/34

(c) less than or equal to 1/4 (d) less than or equal to 1/24

24. The plastic limit of a soil is defined as the:

(a) moisture content where the soil starts to behave as a liquid.

(b) moisture content at which a fine-grained soil can no longer be remolded without cracking.

(c) moisture content at which a fine-grained soil no longer changes volume upon drying

(d) moisture content at which the soil is fully saturated.

25. If the distance between well-1 and well-2 is 100m, and the elevation of water surface in well-2 is 3m below that in well-1. Assuming porosity equal to 15%, the coefficient of permeability (expressed in m/day) is:

(a) 3 (b) 0.3

(c) 5 (d) 0.45

26. Which of the following is an assumption of Rankine's theory?

(a) The most critical shear surface is a sphere.

(b) The soil mass is infinite.

(c) The ground surface is a plane that may be horizontal or inclined.

(d) The soil mass is cohesive.

27. Lime stabilization is the most effective technique for treating:

(a) Sandy soils (b) Silty soils

(c) Plastic clayey soils (d) Non-plastic soils

28. In a rigid footing on a cohesive soil, the contact pressure distribution is:

(a) linear

(b) non-uniform with maximum at the center and minimum at the ends

(c) non-uniform with minimum at the center and maximum at the ends

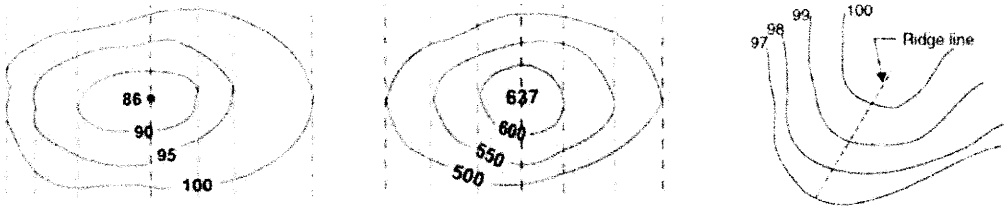
(d) uniform

29. The load-carrying capacity of a bored cast in situ pile develops due to:

(a) end bearing and hydrostatic uplift pressure (b) skin friction and end-bearing

(c) skin friction and hydrostatic uplift pressure (d) end bearing and overturning forces

30. Select the proper geological feature for the following contour lines.



A B C

(a) A: Ridge; B: Hill; C: Pond
(b) A: Hill; B: Ridge; C: Pond
(c) A: Pond; B: Ridge; C: Hill
(d) A: Pond; B: Hill; C: Ridge

31. What does 1 cm on a map drawn at a scale of 1 : 50,000 represent on the ground?

(a) 0.05 km
(b) 0.5 km
(c) 5.0 km
(d) 50 km

32. Company A purchases a machine for Rs.100,000 with an estimated salvage value of Rs.20,000 and a useful life of 5 years. Determine the annual depreciation for the machine using straight line method.

(a) Rs. 120,000
(b) Rs. 80,000
(c) Rs. 16,000
(d) Rs. 24,000

33. If detailed drawings are not available, the steel reinforcement in concrete construction may be calculated approximately on the percentage basis of:

(a) the concrete volume
(b) the height of the building
(c) the brickwork volume
(d) the size of bending

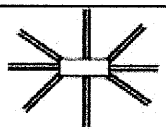
34. A protective barrier made up of concrete or Course Rubble Masonry, constructed from shore towards the sea to enclose harbor is known as:

(a) Pier
(b) Breakwater
(c) Dock
(d) Wharf

35. The clear minimum distance between the running faces of the two rails is known as:

(a) Sleeper
(b) Gauge
(c) Ballast
(d) Track

36. Match the following diagrams to correct road network patterns.

Diagram	Name of the road network
1. 	A. Hexagonal pattern
2. 	B. Star and block pattern
3. 	C. Star and grid pattern
4. 	D. Star and circular pattern

(a) 1-B; 2-C; 3-D; 4-A
(b) 1-C; 2-A; 3-D; 4-B
(c) 1-D; 2-C; 3-B; 4-A
(d) 1-C; 2-D; 3-B; 4-A

37. The following table contains information on various physical properties and their acceptable limits for aggregates used in flexible pavement construction. Match the tests with correct acceptable limits.

Test	Requirement (acceptable limit)
1. Los Angeles abrasion value	A. 25% maximum
2. Aggregate impact value	B. 40% maximum
3. Aggregate stripping value	C. 2% maximum
4. Water absorption	D. 30% maximum

(a) 1-B; 2-D; 3-A; 4-C
(b) 1-C; 2-A; 3-D; 4-B
(c) 1-C; 2-D; 3-B; 4-A
(d) 1-D; 2-A; 3-B; 4-C

38. IRC 82 classifies defects/distress on flexible pavement in to four types. Which among the following is NOT a type of flexible pavement distress?

(a) Cracks
(b) Deformation
(c) Disintegration
(d) Displacement

39. Consider the following three statements.

Statement 1: PERT is a probabilistic model while CPM is a deterministic model.

Statement 2: PERT networks are used for repetitive works like construction while CPM network is used for non-repetitive works like research projects.

Statement 3: PERT is activity oriented while CPM is event oriented.

(a) Statement 1 is false, Statement 2 is false, and Statement 3 is false.
(b) Statement 1 is true, Statement 2 is false, and Statement 3 is true.
(c) Statement 1 is true, Statement 2 is false, and Statement 3 is false.
(d) Statement 1 is false, Statement 2 is true, and Statement 3 is false.

40. Critical path of a PERT network has:

(a) Slack > 1 (b) Slack < 1

(c) Slack = 1 (d) Slack = 0

41. A project consists of 8 activities. The following table shows their respective duration and it can be utilized to draw the Bar Chart for this project. For this project, A and B can be done parallelly, C and D cannot start until A is completed, E cannot start until half the work of C is completed, F can start only after D is completed, G succeeds C, H is the last activity which succeed E. If the project is scheduled to start in June 2024, the project will complete at the earliest by:

(a) December 2024 (b) January 2025

(c) July 2025 (d) December 2025

Activity	Duration (months)
A	2
B	4
C	2
D	4
E	7
F	4
G	6
H	3

42. Identify the parameter that is not a part of the triple constraint theory for a construction project.

(a) Money (b) Plan

(c) Scope (d) Time

43. Which type of contract requires the contractor to quote a fixed amount for completing the work in all aspects?

(a) Labor contract (b) Material supply contract

(c) Lump-sum contract (d) Cost-plus fix fee Contract

44. Which of the following statements are correct?

A. Masonry in rich cement mortar, though having good strength with high shrinkage, is much liable for surface cracks.

B. Masonry in lime mortar has better resistance against rain penetration and is less liable to crack when compared to masonry in cement mortar.

C. Lime mortar has poor workability and water retentivity and suffers high shrinkage.

(a) A, B, and C (b) A, C

(c) A, B (d) B, C

45. The function of weep holes in retaining and breast walls is:

(a) to increase the compaction of the earth retained

(b) for architectural beauty

(c) to ventilate the stone masonry

(d) to drain off the water from the filling

46. A wall built around the top of flat roof which acts as a protection walls for the users is called:

(a) Buttress wall (b) Parapet wall

(c) Blast wall (d) Protection wall

47. Which of the following is true about English bond in bricky masonry?

(a) It is the strongest bond that is designed to carry the heaviest loads

(b) All bricks are arranged in header course

(c) All bricks are arranged in stretcher course

(d) Continuous vertical joints are formed except at the stopped ends.

48. Which of the following statement is correct?

(a) A queen closer is a piece of brick made and defined with respect to the length of the brick.

(b) A queen closer is obtained by cutting a triangular portion of the brick.

(c) A queen closer is obtained by cutting the brick longitudinally in equal parts.

(d) A queen closer is a horizontal projection provided at the base of the wall of the building.

49. In stone masonry, the stones are placed in position such that the natural bedding plane is:

(a) normal to the direction of pressure they carry

(b) parallel to the direction of pressure they carry

(c) at 45° to the direction of pressure they carry

(d) at 60° to the direction of pressure they carry

50. Which of the following tools is used to check the structure's verticality?

(a) Trowel

(b) Mason's square

(c) Plumb bob

(d) Spirit Level

SECTION - B *(Short answer type question) (100 Marks)*

All questions carry equal marks of 5 each.

*This Section should be answered only on the **Answer Sheet** provided.*

1. Write short note on:
   (a) Saturated Soil
   (b) Partially Saturated Soil
2. In a consolidated drained triaxial test a specimen of clay fails at a cell pressure of 60 kN/m^2. The effective shear strength parameters are C' = 15 kN/m^2 and φ ' = 20°. Determine the compressive strength.
3. How Bearing Capacity of the soil can be determined? Explain.
4. Explain the fundamentals of Theodolite Survey.
5. Write short note on Compass Survey and Plane Table Survey.
6. Define Refuge Harbour and Commercial Harbour.
7. Write short note on CPM and PERT.
8. What is the difference between Free Float and Independent Float?
9. Explain the role of employer, engineer and contractor in the project.
10. Mention 5 commonly used equipments for the earthworks and its functions.
11. What is a retaining wall? Mention its types with suitable diagram and what is the purpose of a retaining wall?
12. Write short note on Creep of Rails and Welding of Rails.
13. Explain the importance of Widening of Pavements on Curves.
14. Briefly explain the different types of soil stabilization techniques along with their applications.
15. If a soil sample has a dry unit weight of 19.5 kN/m^3, moisture content of 8%, and a specific gravity of solids particles is 2.67. Calculate the following: a) void ratio. b) saturated unit weight. c) mass of water to be added to cubic meter of soil to reach 80% saturation. d) volume of solids particles when the mass of water required for saturation is 25 grams.
16. If the reduced level of a Benchmark is 100.00m, the backsight is 1.215m, and the foresight is 1.870m, determine the reduced level of the forward station.
17. Calculate the quantity of earthwork for the construction of an approach road with the following details: Length = 1km; Width of formation = 10 m; Height of embankment = 60 cm; Side slope = 1:2.
18. The speed of overtaking and overtaken vehicles on a highway are 90 kmph and 70 kmph, respectively. Assume the acceleration of the overtaking vehicle as 2.5 kmph per second and the speed of the vehicle in the opposite direction as 90 kmph. Take perception reaction time t = 2.5s. Calculate the overtaking sight-distance needed for two-way traffic.
19. Briefly explain the functions of (i) Return wall, (ii) Retaining wall, and (iii) Breast wall masonry structures.
20. Explain in detail the different factors that affect the strength of masonry structures.

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