

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC WORKS DEPARTMENT, GOVERNMENT OF MIZORAM, MARCH, 2020

CIVIL ENGINEERING PAPER - III

Time Allowed : 3 hours

Full Marks : 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. A plane, which is perpendicular to the plumb line through a point and is tangential to the level surface at that point is called a
 - (a) tangential plane
 - (b) vertical plane
 - (c) level plane
 - (d) horizontal plane
2. Which of the following sights denote shifting of levelling instrument?
 - (a) back sight and fore sight
 - (b) back sight
 - (c) intermediate sight and fore sight
 - (d) fore sight
3. The rise and fall method for obtaining the reduced level of points provides a check on
 1. Fore sight
 2. Back sight
 3. Intermediate sightWhich of the above statements are correct?
 - (a) 1 and 2 only
 - (b) 1 and 3 only
 - (c) 2 and 3 only
 - (d) 1, 2 and 3
4. The method of plane tabling commonly used for establishing the instrument station is a method of
 - (a) radiation
 - (b) intersection
 - (c) resection
 - (d) traversing
5. Which one of the following types of transition curves is mostly used in Indian railways?
 - (a) Euler's spiral
 - (b) cubic spiral
 - (c) Lemniscate
 - (d) cubic parabola
6. Wind-rose diagram is useful in deciding on the orientation of
 - (a) Taxiway
 - (b) Hanger
 - (c) Apron
 - (d) Runway
7. The runway length after correcting for elevation and temperature is 2845 m. If the effective gradient on runway is 0.5 per cent, then the revised runway length will be
 - (a) 2845 m
 - (b) 2910 m
 - (c) 3030.5 m
 - (d) 3129.5 m

8. A ship is berthed in a chamber and lifted by principles of buoyancy. Such a chamber is called
- (a) Dry dock (b) Wet dock
(c) Floating dock (d) Refuge dock
9. A clayey soil has liquid limit = w_L ; plastic limit = w_P and natural moisture content = w . The consistency index of the soil is given by
- (a) $\frac{w_L - w}{w_L - w_P}$ (b) $\frac{w_L - w_P}{w_L - w}$
(c) $\frac{w_P - w}{w_L - w_P}$ (d) $\frac{w_L - w_P}{w_P - w}$
10. A soil sample has a void ratio of 0.5; its porosity will be
- (a) 50% (b) 100%
(c) 66% (d) 33%
11. The configuration of flow nets depends upon
- (a) permeability of soil
(b) difference in the head between upstream and downstream sides
(c) boundary conditions of flow
(d) amount of seepage that takes place
12. For determination of shear strength parameters, cohesion (c) and friction angle ($\tilde{\phi}$), of soil in the laboratory, the test to be conducted will be
- (a) Triaxial compression test (b) sieve analysis
(c) Compaction test (d) Relative density test
13. The contact pressure distribution under a rigid footing on a cohesionless soil would be
- (a) uniform throughout (b) zero at centre and maximum at edges
(c) zero at edges and maximum at centre (d) none of these
14. A static cone penetration test is usually conducted when the structure is likely to be founded on which of the following?
- (a) shallow foundations (b) pile foundations
(c) drier foundations (d) improved ground
15. Total reaction time of a driver does not depend upon
- (a) perception time (b) brake reaction time
(c) condition of mind of the driver (d) speed of vehicle
16. Which one of the following methods of tunnelling is used in hard rock?
- (a) Forepoling method (b) Needle beam method
(c) Heading and benching method (d) Shield tunnelling method
17. Tunnel alignment is carried out by
- (a) Surface theodolite traverse (b) Triangulation
(c) Compass traverse (d) Aerial photography
18. In PERT analysis, the time estimates of activities and probability of their occurrence follow
- (a) Normal distribution curve (b) $\hat{\alpha}$ -distribution curve
(c) Poisson's distribution curve (d) Binomial distribution curve

19. In CPM analysis, critical path moves along the activities having total float as
- (a) Positive (b) Negative
(c) Zero (d) Unity
20. Taylor's stability number curves are used for the analysis of stability of slopes. The angle of shearing resistance used in the chart is
- (a) mobilised angle (b) weighted angle
(c) effective angle (d) apparent angle
21. Plate load test is useful to estimate
- (a) bearing capacity of foundation (b) settlement of foundation
(c) both (a) & (b) (d) none of these
22. The function of an expansion joint in rigid pavements is to
- (a) relieve warping stresses (b) relieve shrinkage stresses
(c) resist stresses due to expansion (d) allow free expansion
23. The walls which are necessary on the hill side of a roadway where earth has to be retained from slipping is called
- (a) retaining wall (b) breast wall
(c) parapet wall (d) none of these
24. The original cost of a property minus the depreciation till the previous year is called
- (a) book value (b) rentable value
(c) sinking value (d) market value
25. A masonry wall has height 'h', length 'L' and thickness 't'. The allowable stress based on slenderness is calculated on the basis of
- (a) h/t only (b) L/t only
(c) Lesser of L/t and h/t (d) Greater of L/t and h/t
26. Which type of brick masonry bond is provided for heavy loads on masonry?
- (a) English bond (b) Zig-zag bond
(c) Single Flemish bond (d) Double Flemish bond
27. Cohesionless soils are
- (a) Sand (b) Clay
(c) Silt (d) Silt and clay
28. Consolidation and compressibility of soil
- (a) is a measure of the ability of soil to allow the water to pass through its pores
(b) is a measure of the ability of soil to bear stresses without failure
(c) deals with changes in volume of pores in a soil under load
(d) none of these
29. Consider the following statements:
1. Organic matter decreases the permeability of a soil
 2. Entrapped air decreases the permeability of a soil
- Which of these statements are correct?
- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

30. Plasticity index is equal to
- (a) liquid limit + plastic limit
 - (b) liquid limit - plastic limit
 - (c) shrinkage limit + liquid limit
 - (d) shrinkage limit - liquid limit
31. A 30 m metric chain is found to be 0.1 m too short throughout the measurement. If the distance measured is recorded as 300 m, then the actual distance measured will be
- (a) 300.1 m
 - (b) 301.0 m
 - (c) 299.0 m
 - (d) 310.0 m
32. The true bearing of a line is $34^{\circ}20'40''$ and the magnetic declination at the place of observation is $2^{\circ}00'20''$ W on the date of observation
- (a) $36^{\circ}21'00''$
 - (b) $34^{\circ}20'20''$
 - (c) $32^{\circ}20'20''$
 - (d) $32^{\circ}00'20''$
33. The whole circle bearings of lines AB and BC are $30^{\circ}15'$ and $120^{\circ}30'$. What is the included angle ABC between the lines AB and BC?
- (a) $229^{\circ}45'$
 - (b) $89^{\circ}45'$
 - (c) $269^{\circ}45'$
 - (d) $90^{\circ}15'$
34. 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
35. The height of instrument is equal to
- (a) reduced level of bench mark + back sight
 - (b) reduced level of bench mark + fore sight
 - (c) reduced level of bench mark + intermediate sight
 - (d) back sight + fore sight
36. The contour lines can cross one another on map only in the case of
- (a) vertical cliff
 - (b) valley
 - (c) ridge
 - (d) overhanging cliff
37. Given that the scope of the construction work is well defined with all its drawings, specifications, quantities and estimates, which one of the following types of contract would be most preferred?
- (a) EPC contract
 - (b) Percentage rate contract
 - (c) Item rate contract
 - (d) Lump sum contract
38. The process of calculating the resource requirement of a project is known as
- (a) Scheduling
 - (b) co-ordinating
 - (c) resource aggregation
 - (d) all of these
39. The occurrence of the completion of an activity is called its
- (a) head event
 - (b) tail event
 - (c) dual role event
 - (d) none of these
40. CPM is
- (a) activity oriented
 - (b) event oriented
 - (c) time oriented
 - (d) resource oriented
41. The size of hangar in airport is guided by which of the following?
- (a) speed and direction of wind and visibility
 - (b) weight of aircraft and turning needs
 - (c) fuelling capacity and storage space
 - (d) length, wingspan and height of aircraft

42. The function of sleepers is to
- support the rails
 - keep the two rails at correct gauge
 - distribute the load coming on rails to the ballast
 - all of the above
43. Fish plates are used in rail joints to:
- Maintain continuity of rails
 - Provide for any expansion or contraction
 - Transfer the load to the ballast
 - Maintain correct alignment
- Choose the correct option
- | | |
|---------------------|---------------------|
| (a) 1, 2, 3 and 4 | (b) 1, 2 and 3 only |
| (c) 2, 3 and 4 only | (d) 1, 2 and 4 only |
44. A rail which is tapered to a toe at one end and has a heel at the other end is called as
- | | |
|----------------|-----------------|
| (a) stock rail | (b) tongue rail |
| (c) wing rail | (d) lead rail |
45. Base course is used in rigid pavements for
- | | |
|---------------------------------------|-------------------------------------|
| (a) prevention of subgrade settlement | (b) prevention of slab cracking |
| (c) prevention of pumping | (d) prevention of thermal expansion |
46. Consistency and flow resistance of bitumen can be determined from which of the following?
- | | |
|--------------------------|----------------------|
| (a) Ductility test | (b) Penetration test |
| (c) Softening point test | (d) Viscosity test |
47. Bituminous concrete is a mix comprising of
- fine aggregate, filler and bitumen
 - fine aggregate and bitumen
 - coarse aggregate, fine aggregate, filler and bitumen
 - coarse aggregate, filler and bitumen
48. The penetration test for bitumen is conducted at a temperature of
- | | |
|----------|----------|
| (a) 60°C | (b) 37°C |
| (c) 25°C | (d) 50°C |
49. Stopping sight distance is the minimum distance available on a highway which is the
- distance of sufficient length to stop the vehicle without collision
 - distance visible to a driver during night driving
 - height of the object above road surface
 - distance equal to the height of the driver's eye above the road surface
50. The main objective of providing a camber is
- to make the road surface impervious
 - to make the road surface durable
 - to drain off rain water from road surface, as quickly as possible
 - all of the above

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. Calculate the safe stopping sight distance for design speed of 50 kmph two way traffic on a two lane road assuming coefficient of friction as 0.37 and reaction time as 2.5 second?
2. A bench mark has been established at the soffit of an ornamental arch at the known elevation of 100.0 m above mean sea level. The back sight used to establish height of instrument is an inverted staff reading of 2.105. A forward sight reading with normally held staff of 1.105 m is taken on a recently constructed plinth. Calculate the elevation of plinth?
3. List out any five assumptions in Boussinesq's Theory to calculate stresses and deformation due to point load applied at the surface of semi-infinite soil mass.
4. What is pile foundation? Explain any four classification of pile foundations based on its use.
5. Explain the concept of 'equivalent single wheel load'.
6. The optimistic, the most likely duration and the pessimistic time estimates in a network are 4, 5 and 8 months respectively. Calculate the expected time.
7. Activity 'C' follows activity 'A' and activity 'D' follows activities 'A' and 'B'. Give correct network diagram for this project.
8. What are rails in railway track? Explain the functions of rails.
9. In a three-layered soil system, the thicknesses of the top and bottom layers each are half the thickness of the middle layer. The coefficients of permeability of the top and bottom layers each are double the coefficient of permeability 'k' of the middle layer. When horizontal flow occurs, find out the equivalent coefficient of permeability of the system in terms of 'k'.
10. Based on the type of occurrence and function, explain any five classifications of harbours.
11. How does water content of soil affect compaction?
12. Describe Terzaghi's effective stress principle.
13. Define quick sand condition. Why does it occur?
14. What is a flow net? What is its significance?
15. Write any five characteristics of a contour.
16. What are the applications of plane table surveying? Discuss its advantages and disadvantages.
17. What is superelevation? Design the rate of superelevation for a horizontal highway curve of radius 500 m and speed 100 kmph.
18. Differentiate between rigid and flexible pavements.
19. What is the importance of highway drainage?
20. What are the components of a flexible pavement? Show the components in a diagrammatic representation.