

# MIZORAM PUBLIC SERVICE COMMISSION

## COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO) (CIVIL) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, MARCH, 2017.

### 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.*

- The coefficient of compressibility of soil is the ratio of
  - Stress to strain
  - Strain to stress
  - Stress to settlement
  - Rate of loading to that of settlement
- The ratio of the volume of voids to the volume of soil solids in a given soil mass, is known as
  - Porosity
  - Specific gravity
  - Void ratio
  - Water content
- The Terzaghi's general bearing capacity equation for a continuous footing is given by
  - $qf = cNc + \gamma DNq + 0.5\gamma BN\gamma$
  - $qf = cNc - \gamma DNq + 0.5\gamma BN\gamma$
  - $qf = cNc + \gamma DNq - 0.5\gamma BN\gamma$
  - None of the above
- The maximum water content at which a reduction in water content does not cause a decrease in volume of a soil mass, is known as
  - Liquid limit
  - Plastic limit
  - Shrinkage limit
  - Permeability limit
- Uniformity coefficient of a soil is
  - Always less than 1
  - Always equal to 1
  - Equal to or less than 1
  - Equal to or greater than 1
- When the plastic limit of a soil is greater than the liquid limit, then the plasticity index is reported as
  - Negative
  - Zero
  - Non-Plastic
  - 1
- Toughness index is defined as the ratio of
  - Plasticity index to consistency index
  - Plasticity index to flow index
  - Liquidity index to flow index
  - Consistency index to liquidity index

8. Which of the following soil has more plasticity index
  - (a) Sand
  - (b) Silt
  - (c) Clay
  - (d) Gravel
9. A soil having particles of nearly the same size is known as
  - (a) Uniformly graded
  - (b) Well graded
  - (c) Poorly graded
  - (d) Gap graded
10. The soils most susceptible to liquefaction are
  - (a) Saturated dense sands
  - (b) Saturated fine and medium sands of uniform particle
  - (c) Saturated clays of uniform size
  - (d) Saturated gravels and cobbles
11. During the seepage through earth mass, the direction of seepage is
  - (a) Parallel to the equilibrium lines
  - (b) Perpendicular to the stream lines
  - (c) Perpendicular to the equipotential lines
  - (d) Along the gravity
12. The correct increasing order of the surface areas of the given soils is
  - (a) Silt, sand, colloid, clay
  - (b) Sand, silt, clay, colloids
  - (c) Clay, silt, sand, colloids
  - (d) Colloids, clay, silt, sand
13. Surveys which are carried out to provide a national grid of control for preparation of accurate maps of large areas, are known as
  - (a) Cadastral surveying
  - (b) Geodetic surveying
  - (c) Topographical surveying
  - (d) Plane survey
14. The boundary of water of a still lake represents
  - (a) Level surface
  - (b) Horizontal surface
  - (c) Contour line
  - (d) Concave surface
15. The vertical angle between longitudinal axis of a freely suspended magnetic needle and a horizontal line at its pivot is known as
  - (a) Declination
  - (b) Azimuth
  - (c) Dip
  - (d) Bearing
16. If the whole circle bearing (WCB) of a line is  $103^\circ$ , its reduced bearing is
  - (a) N  $103^\circ$  E
  - (b) S  $77^\circ$  E
  - (c) S  $77^\circ$  W
  - (d) N  $77^\circ$  W
17. Planimeter is used for measuring
  - (a) Volume
  - (b) Area
  - (c) Contour gradient
  - (d) Slope angle
18. Remote sensing techniques are being usefully employed for the purpose of
  - (a) Improving natural resource management
  - (b) Land use
  - (c) Protection of environment
  - (d) All of these
19. Which of the following is an obstacle to chaining but not to ranging?
  - (a) River
  - (b) Hillock
  - (c) Building
  - (d) None of these

20. The correction of sag is
- (a) Always additive
  - (b) Always subtractive
  - (c) Always zero
  - (d) Sometimes additive or subtractive
21. The rise and fall method of surveying using theodolite is
- (a) Less accurate than height of instrument method
  - (b) Is not suitable for levelling with tilting levels
  - (c) Provides a check on the reduction of intermediate point levels
  - (d) Quicker and less tedious for large number of intermediate sights
22. The projection of a traverse line on a line perpendicular to the meridian is known as
- (a) Latitude of the line
  - (b) Departure of the line
  - (c) Bearing of the line
  - (d) Co-ordinate of the line
23. A 'level line' is a
- (a) Horizontal line
  - (b) Line parallel to the mean spheroidal surface of earth
  - (c) Line passing through the centre of the cross hairs and the centre of the eye piece
  - (d) Line passing through the objective lens and eyepiece of a dumpy or tilting level
24. In water bound macadam roads, binding material, is
- (a) Sand
  - (b) Stone dust
  - (c) Cement
  - (d) Brick dust
25. The minimum width of the pavement of a National Highway should be
- (a) 4.7
  - (b) 5.7
  - (c) 6.7
  - (d) 7.7
26. The advantage of providing super-elevation on road is
- (a) Higher speed of vehicle
  - (b) Reduced maintenance cost of the roads
  - (c) Draining off rainwater quickly
  - (d) All of these
27. The distance travelled by a moving vehicle during perception and brake reaction times, is known as
- (a) Sight distance
  - (b) Stopping distance
  - (c) Lag distance
  - (d) None of these
28. Stability of hill slope depends on
- (a) Angle of slope
  - (b) Geological condition
  - (c) Groundwater conditions
  - (d) All of these
29. Horizontal curves on highways are provided
- (a) To break the monotony of driving
  - (b) To discourage the tendency to increase speed
  - (c) To decrease the mental strain on drivers
  - (d) All of these

30. The safe stopping distance may be calculated from the equation

(a)  $D = 0.278Vt + \frac{V^2}{254f}$

(b)  $D = 0.254Vt + \frac{V^2}{278f}$

(c)  $D = 0.254Vt + \frac{V^2}{225f}$

(d)  $D = 0.225Vt + \frac{V^2}{254f}$

31. PERT technique of network analysis is mainly useful for

(a) Small project

(b) Large and complex project

(c) Research and Development project

(d) Deterministic activity

32. Free float for any activity is defined as the difference between

(a) Its earliest finish time and earliest start time for its successive activity

(b) Its latest start time and earliest start time

(c) Its latest finish time and earliest start time for its successive activity

(d) Its earliest finish time and latest start time for its successive activity

33. The independent float affects only

(a) Preceding activity

(b) Succeeding activity

(c) The particular activity involved

(d) None of these

34. The time corresponding to minimum total project cost is

(a) Crash time

(b) Normal time

(c) Optimistic time

(d) Between normal time and crash time

35. Site order book is used for recording

(a) Instruction of the executive engineer

(b) Construction measurements

(c) Requisition of plants and equipment

(d) Indents for materials to be ordered.

36. Which one of the following is not excavating and moving type equipment?

(a) Bulldozer

(b) Clam shell

(c) Scraper

(d) Dump truck

37. Batching refers to

(a) Controlling the total quantity at each batch

(b) Weighing accurately, the quantity of each material for a job before mixing

(c) Controlling the quantity of each material into each batch

(d) Adjusting the water to be added in each batch according to the moisture content of materials being mixed in the batch.

38. Cost –benefit studies are essential to

(a) Assess the total cost of the work

(b) Monitor the expenditure

(c) Ascertain the relevant escalation in prices

(d) Evaluate the viability and worthwhileness of taking up the project

39. A Gantt chart indicates
- (a) Comparison of actual process with the scheduled progress
  - (b) Cost of the project
  - (c) Balance of work to be done
  - (d) Efficiency of project work
40. Which of the following is dummy activity?
- (a) Excavation of foundations
  - (b) Laying of foundation concrete
  - (c) Awaiting the arrival of concrete material
  - (d) Curing the foundation concrete
41. Which of the following R.C. retaining walls is suitable for heights beyond 6 m?
- (a) L shaped wall
  - (b) T shaped wall
  - (c) Counterfort type
  - (d) All of these
42. A T shaped retaining wall mainly consists of
- (a) One cantilever
  - (b) Two cantilever
  - (c) Three cantilever
  - (d) Four cantilever
43. For the design of retaining walls, the minimum factor of safety against overturning is
- (a) 1.5
  - (b) 2.0
  - (c) 2.5
  - (d) 3.0
44. The failure of foundation of a building is due to
- (a) Withdrawal of subsoil moisture
  - (b) Unequal settlement
  - (c) Lateral escape of the supporting materials
  - (d) All of these
45. The type of foundation which is most suitable for bridge
- (a) Pier foundation
  - (b) Raft foundation
  - (c) Pile foundation
  - (d) Strap foundation
46. The piles which are driven in the type of soil whose strength does not increase with depth or where the increase in strength with depth is very slow, are known as
- (a) Friction piles
  - (b) Bearing piles
  - (c) Batter piles
  - (d) Compaction piles
47. The most commonly used material for damp proofing is
- (a) Bitumen
  - (b) Paraffin wax
  - (c) Cement solution
  - (d) Cement concrete
48. The horizontal upper part of a step on which foot is placed in ascending or descending in a staircase, is called
- (a) Riser
  - (b) Tread
  - (c) Flight
  - (d) Nosing
49. For ordinary Portland cement, the initial setting time should not be more than
- (a) 30 mins
  - (b) 3 hours
  - (c) 6 hours
  - (d) 10 hours

50. The higher water cement ratio in concrete results in
- (a) Weak mixed
  - (b) Strong mix
  - (c) Better workable mix
  - (d) Less bleeding

**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.*

51. A sampler with a volume of  $45 \text{ cm}^3$  is filled with a soil sample. When the soil is poured into a graduated cylinder, it displaces  $25 \text{ cm}^3$  of water. What is the porosity and void ratio of the soil?
52. A soil sample has porosity of 40%. The specific gravity of solids is 2.7. Calculate (i) void ratio (ii) dry density (iii) unit weight of soil if the soil is 50% saturated (iv) unit weight of soil if the soil is completely saturated.
53. Explain any two of the following:
- (i) Liquidity Index
  - (ii) Activity Number
  - (iii) Thixotropy and
  - (iv) Sensitivity of soil.
54. What is negative skin friction?
55. Explain any two terms:
- (i) Dip
  - (ii) Magnetic Declination
  - (iii) Tacheometric Surveying
  - (iv) Electronic distance measurement (EDM).
56. Differentiate between plane surveying and geodetic surveying.
57. A flag post of height 2 m was erected on top of the building. Find the reduced level (RL) of the top of the flag post, if the vertical angles to the bottom and top of it were measured using theodolite as  $7^\circ$  and  $10^\circ$  respectively. A staffs reading 1.245 m was taken as benchmark of 100.00 m with a vertical angle of  $0^\circ$ .
58. The offsets( in meters) taken from a survey line to a curved boundary are given below:

Chainage	0	5	10	15	20	25	35	45	55	65
Offset	2.5	3.8	8.4	7.6	10.5	9.3	5.8	7.8	6.9	8.4

Find the area between the survey line, first and last offsets, and the boundary by Simpson's rule

59. An embankment has side slopes 1.5:1 and is level in the transverse direction. The formation width is 8.8m. The depths at the centre at 20m intervals are 1.8m, 2.4m, 3.0m and 3.6m. Find the volume by the trapezoidal formula.
60. Determine the minimum non-passing sight distance that should be provided for a vehicle coming down a 6% gradient, using the following data:  
Design speed,  $V = 56 \text{ kmph}$ , Reaction time of the driver = 2 seconds, coefficient of friction between tyre and road surface = 0.5.
61. Differentiate between flexible pavements and rigid pavements.
62. Define cant and cant deficiency.

63. Write a note on track ballast. How the ballast depth is recommended.
64. Explain the need for air traffic control.
65. Compare PERT and CPM.
66. Define 'slack'. What does negative slack indicate in PERT network analysis?
67. Define optimistic, pessimistic and most likely time estimate.
68. Explain the difference between 33 grade, 43 grade and 53 grade of ordinary Portland cement.
69. What is ferrocement? List its properties.
70. Describe rapid hardening cement.

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