

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF ASSISTANT CONTROLLER OF MINES UNDER COMMERCE & INDUSTRIES DEPARTMENT GOVERNMENT OF MIZORAM, OCTOBER, 2022

PAPER - II (TECHNICAL)

Time Allowed : 3 hours

Full Marks : 200

All questions carry equal marks of 2 each.

Attempt all questions.

- In proximate analysis of coal, percentage of fixed carbon is:
(a) $100 - \% (\text{ash} + \text{volatile matter} + \text{moisture})$ (b) $100 - \% (\text{ash} + \text{moisture})$
(c) $100 - \% (\text{ash} + \text{moisture}) + \text{volatile matter}$ (d) $100 - \% (\text{volatile matter} + \text{moisture})$
- Which of the coal have the best heating values in terms of volatile matter?
(a) Containing 20% volatile matter (b) Containing 30% volatile matter
(c) Containing 40% volatile matter (d) Containing 50% volatile matter
- On what factors does the specific gravity of coal depend?
(a) Its calorific value and ash content (b) Its ignition temperature and calorific value
(c) Type of coal and ash content (d) Type of coal and calorific value
- Protodyakonov Index test is an indirect method for determination of:
(a) Shear strength of coal/rocks (b) Young Modulus of coal/rocks
(c) Compressive strength of coal/rocks (d) Tensile strength of coal/rocks
- The incubation period in underground coal mine is used for deciding:
(a) Size of coal pillar
(b) Number of pillars in depillaring panel/size of depillaring panel
(c) Width of the gallery
(d) Diagonal line of extraction
- When an open-pit mine reaches to its ultimate pit limit, the locked-up coal is extracted by:
(a) Punch longwall mining (b) Highwall mining
(c) Augur mining (d) Hydraulic mining
- Goaf edge support is used to prevent:
(a) Stress development from goaf (b) Goaf encroachment
(c) Spontaneous heating (d) Roof fall at goaf
- With the increase in depth of cover, surface subsidence value:
(a) Increases (b) decreases
(c) is constant (d) does not show any trend
- With the increase in height, the strength of pillar:
(a) increases (b) decreases
(c) is constant (d) does not show any trend

10. Tributary area method for stress estimation is valid for:
- (a) Caving with Longwall,
 - (b) Depillaring
 - (c) Development
 - (d) All cases
11. Cut and Fill stoping is generally operated:
- (a) Overhand
 - (b) Underhand
 - (c) Both (a) & (b)
 - (d) None of the above
12. In case of tick ore body, the preferable stoping method is:
- (a) Longitudinal
 - (b) Transverse
 - (c) Both (a) & (b)
 - (d) None
13. Mining method to protect the surface structure-
- (a) Wide stall method
 - (b) Non effective width (NEW) of extraction method
 - (c) Both (a) & (b)
 - (d) None
14. A coal pillar of 36 m x 36 m (centre to centre) is situated at a depth of 150 m. The width of gallery is 6.0 m. Considering the unit weight of rock 0.025 MPa/m, the load on the pillar, calculated by tributary area method would be:
- (a) 5.4 MPa
 - (b) 5.9 MPa
 - (c) 5.8 MPa
 - (d) 5.1 MPa
15. Development works are going on with 35% recovery from a coal seam. The pillars developed during development stage are having strength of 13.27 MPa with factor of safety 2.3. Considering the unit weight of rock 0.025 MPa/m, the depth of cover of the coal seam is:
- (a) ~200 m
 - (b) ~250 m
 - (c) ~150 m
 - (d) ~100 m
16. If the full/maximum subsidence is occurred more than one point, then the subsidence is called:
- (a) Critical subsidence
 - (b) Subcritical subsidence
 - (c) Supercritical subsidence
 - (d) Trough subsidence
17. The fall which takes place soon after withdrawal of supports is called:
- (a) Local fall
 - (b) Main fall
 - (c) Air blast
 - (d) Rock burst
18. Dump failure mode is:
- (a) Circular failure
 - (b) Wedge failure
 - (c) Plane failure
 - (d) Toppling failure
19. The pore water pressure the slope stability:
- (a) Increases
 - (b) Decreases
 - (c) Does not have any effect
 - (d) May increase or decrease
20. In longwall caving, the caving height is calculated from:
- (a) Bulking factor and width of the longwall face
 - (b) Height of extraction and width of the longwall face
 - (c) Height of extraction and bulking factor
 - (d) Seam thickness and length of the panel

21. Purpose of slot raise is:
- (a) For transportation of man and machinery
 - (b) For laying of pipe line
 - (c) Establish the ventilation circuit
 - (d) To create free face
22. In which method of mining, slot raise are not required:
- (a) VCR method
 - (b) Sublevel method
 - (c) Room and pillar method
 - (d) Cut and fill method
23. In which open stoping method, the stoping operation at lower level is in advance to the upper level?
- (a) VCR method
 - (b) Sublevel method
 - (c) Room and pillar method
 - (d) Shrinkage method
24. The factor of safety of a slope will be less than one, when (consider that the cohesion is zero):
- (a) Slope angle is less than the friction angle
 - (b) Slope angle is greater than friction angle
 - (c) Slope angle is equal to the friction angle
 - (d) None of the above
25. The factor of safety of a slope is 1.74 for the slope angle of 45° . For which slope angle, the factor of safety will be equal to 1.0 (consider that the cohesion is zero):
- (a) $\sim 50^\circ$
 - (b) $\sim 55^\circ$
 - (c) $\sim 60^\circ$
 - (d) $\sim 65^\circ$
26. In transverse stoping methods, stoping operation advances:
- (a) Along strike direction
 - (b) Along oblique direction
 - (c) From hangwall to footwall
 - (d) Any of the above
27. The pillar left between draw level and next drill level is called:
- (a) Post pillar
 - (b) Crown pillar
 - (c) Sill pillar
 - (d) Rib pillar
28. Which is associated only with longwall mining?
- (a) Hydraulic prop
 - (b) Powered support
 - (c) Shuttle car
 - (d) Roadheader
29. The opening cut in opencast mining is called:
- (a) Berm
 - (b) Trench
 - (c) Drift
 - (d) Box cut
30. Distance of working from any water body should be at least:
- (a) 35 m
 - (b) 16.4 m
 - (c) 60 m
 - (d) 48 m
31. Which of the following factor is considered for calculation of cycle time of excavating machine such as shovel, drag line etc.?
- (a) Swell factor
 - (b) Bucket factor
 - (c) Swing factor
 - (d) Drill factor
32. Filling up of mined area in Opencast mines is known as:
- (a) OB removal
 - (b) Trenching
 - (c) Reclamation
 - (d) Salvaging

33. The point beyond which the mineral/coal cannot be economically extracted is called
- (a) Stripping ratio
 - (b) Cost of stripping ratio
 - (c) Break-even ratio
 - (d) Limit of extraction
34. What is the relationship between break-even stripping ratio (BESR) and ordinary stripping ratio (OSR)?
- (a) $BESR < OSR$
 - (b) $BESR = OSR$
 - (c) $BESR > OSR$
 - (d) No relation
35. Which of the following excavator is preferred to be used for a bench height of 30 m or more?
- (a) Bucket wheel Excavator
 - (b) Shovel
 - (c) Front and end loader
 - (d) Dragline
36. The concept suggested by Deere to quantify discontinuity spacing in rock masses:
- (a) RMR
 - (b) Q-system
 - (c) RQD
 - (d) CMRR
37. Mohr's circle is drawn between-
- (a) Normal and shear stress
 - (b) Shear and normal stress
 - (c) Major principal stress and Minor principal stresses
 - (d) Young modulus and Poison's ratio
38. Compressive strength of the rock can be expressed as:
- (a) $\sigma_c = \frac{F_c}{A}$, where F_c is the failure load, and A is cross sectional area
 - (b) $\sigma_c = \frac{A}{F_c}$, where F_c is the failure load, and A is cross sectional area
 - (c) $\sigma_c = \frac{F_c}{V}$, where F_c is the failure load, and A is the Volume in m^3
 - (d) $\sigma_c = \frac{V}{F_c}$, where F_c is the failure load, and A is the Volume in m^3
39. In Slake durability index, the approximate weights of the broken rock samples are:
- (a) 400 gram
 - (b) 300 gram
 - (c) 200 gram
 - (d) 500 gram
40. Dry density is defined as:
- (a) Mass per unit volume when the sample is dry
 - (b) Mass per unit volume when the sample is wet
 - (c) Mass per unit area when the sample is dry
 - (d) Mass per unit area when the sample is wet
41. In a Brazilian test, the diameter of the sample was 50 mm and the thickness is 25 mm. If the failure load occurs is of 1964.28 kg, than the tensile strength of the specimen will be:
- (a) 9.99 kg/cm^2
 - (b) 99.9 kg/cm^2
 - (c) 999 kg/cm^2
 - (d) 0.999 kg/cm^2

42. The linear relationship between stress and strain can be represented by:

- (a) $\varepsilon = \frac{\sigma}{E}$, where, ε is strain, σ is applied stress and E is modulus of elasticity
- (b) $\varepsilon = \frac{E}{\sigma}$, where, ε is strain, σ is applied stress and E is modulus of elasticity
- (c) $\sigma = \frac{E}{\varepsilon}$, where, ε is strain, σ is applied stress and E is modulus of elasticity
- (d) $\sigma = \frac{\varepsilon}{E}$, where, ε is strain, σ is applied stress and E is modulus of elasticity

43. Anisotropy is defined as:

- (a) Rock mass does not have same properties in all the directions
- (b) Rock mass have same properties in all the directions
- (c) Rock mass does not have same properties in one direction
- (d) Rock mass have same properties in one direction

44. As per Mohr's scale of hardness, which rock can be stretched from knife only?

- (a) Ortho class
- (b) Quartz
- (c) Apatite
- (d) Diamond

45. Punch shear test is used to determine:

- (a) Tri-axial compressive strength
- (b) Tensile strength
- (c) Shear strength
- (d) None of the above

46. Coal mines roof rating (CMRR) was given by:

- (a) Z T Bieniawski
- (b) Mark and Molinda
- (c) Marinos and Hoek
- (d) Laubscher and Taylor

47. The correct formula for determination of RQD is:

- (a) $RQD = \frac{\sum(\text{core length} \geq 10 \text{ cm})}{\text{total length of core}} \times 100$
- (b) $RQD = \frac{\sum(\text{core length} \geq 100 \text{ cm})}{\text{total length of core}} \times 10$
- (c) $RQD = \frac{\sum(\text{core length} \geq 10 \text{ mm})}{\text{total length of core}} \times 100$
- (d) $RQD = \frac{\sum(\text{core length} \geq 100 \text{ mm})}{\text{total length of core}} \times 10$

48. Rock mass classification is needed:

- (a) For the assessment of stability of the mines
- (b) For division of rock mass into group of similar behaviour
- (c) For design of optimum support system in mines and tunnels
- (d) All of the above

49. If the porosity in rock mass is higher-

- (a) Density will be also higher
- (b) Modulus of elasticity will be lower
- (c) Transmission of the sound waves will be higher
- (d) Internal friction and rock stability will be higher

50. Which of the following diagram can represent one aspect of bi-axial stress acting on a point with respect to a set of reference axes?
- (a) Mohr's circle diagram (b) Rose diagram
(c) Intraformational shear diagram (d) Goodman diagram
51. Which of the following is known as point load index?
- (a) $(14+0.175 D)I_s$ (b) P/D^2
(c) $\sigma_t = \frac{2F}{\tau DL}$ (d) $S = C + s \tan \Phi$
52. The plane on which the value of shear stress becomes zero, such planes are called?
- (a) Vertical plane (b) Horizontal plane
(c) Principal plane (d) Normal plane
53. Poisson's ratio can be expressed as:
- (a) Lateral strain/ Longitudinal strain (b) Longitudinal strain / Lateral strain
(c) Major principal stress/ Minor principal stress (d) Normal stress/ Shear stress
54. Which of the method is applicable for geophysical prospecting?
- (a) Seismic method (b) Electrical method
(c) Gravity method (d) All of the above
55. While determining the tri-axial compressive strength in the laboratory the lateral pressure acting of the rock sample known as:
- (a) Atmospheric pressure (b) Hydrostatic pressure
(c) Deviatoric pressure (d) None of these
56. For circular slope failure the factor of safety can be expressed as
- (a) $\frac{\text{Tensile strength available to resist sliding}}{\text{Tensile strength induces sliding}}$ (b) $\frac{\text{Shear strength available to resist sliding}}{\text{Shear strength induces sliding}}$
(c) $\frac{\text{Shear strength induces sliding}}{\text{Shear strength available to resist sliding}}$ (d) None of these
57. For a circular opening of radius a, where the far-field stress value is P. The radial and tangential stresses at a distance r from the centre of the opening are
- (a) $\sigma_r = 0, \sigma_t = P(1 + \frac{a^2}{r^2})$ (b) $\sigma_r = P(1 - \frac{a^2}{r^2}), \sigma_t = P(1 + \frac{a^2}{r^2})$
(c) $\sigma_r = 2P(1 - \frac{a^2}{r^2}), \sigma_t = P(1 + \frac{a^2}{r^2})$ (d) $\sigma_r = 3P, \sigma_t = 0$
58. As per Unal, suggested bolt length should be:
- (a) $L = \frac{B}{2} (\frac{100 - RMR}{100})$ (b) $L = \frac{B}{2}$
(c) $L = \frac{B}{3}$ (d) $L = B^{2/3}$

68. In an underground coal mine, the percentage of inflammable gas should not exceed ____ in the general body of the return air of any ventilating district and ____ in any place in the mine:
- (a) 0.50 and 1.25 (b) 0.65 and 1.25
(c) 0.75 and 1.25 (d) 0.85 and 1.25
69. If sum of the powers developed by the fans is to be the same when running in series as when running separately, the quantity will increase the quantity produced by one of them.
- (a) $p^{2/3}$ times (b) $3p^2$ times
(c) $p^{1.5}$ times (d) p^3 times
70. In ventilation survey for underground mine, the quantity of air flowing in the gallery is measured by using:
- (a) Anemometer (b) Barometer
(c) Vernier Caliper (d) None of the above
71. Find the combined resistance of four parallel airways having individual resistances 64, 4, 64 and 16 Ns^2m^8 respectively.
- (a) $2.9 \text{Ns}^2\text{m}^8$ (b) $1.0 \text{Ns}^2\text{m}^8$
(c) $128 \text{Ns}^2\text{m}^8$ (d) $4 \text{Ns}^2\text{m}^8$
72. Match the following with respect to Graham's ratio:
- | <u>Status of fire</u> | <u>Graham's Ratio</u> |
|---|-----------------------|
| A. Active fire | 1. 2.0 |
| B. Necessity for checkup | 2. 1.0 |
| C. Existence for fire | 3. 0.4 |
| D. Spontaneous heating approaches active fire | 4. 0.5 |
| E. Normal | 5. 3.0 |
- (a) A-1, B-4, C-5, D-2, E-3 (b) A-4, B-5, C-2, D-1, E-3
(c) A-5, B-4, C-2, D-1, E-3 (d) A-5, B-4, C-2, D-3, E-1
73. According to recommendations of 12th National Conference on Safety in Mines, the permissible respirable dust levels be brought down to mg/m^3 (In case percentage of free silica content up to 5) or divided by percentage of free silica content in dust, from the present level, in line of prescribed limits of NIOSH, USA.
- (a) 2, 10 (b) 1.5, 5
(c) 3, 15 (d) 1, 5
74. If rate of emission of methane is less than $1 \text{ m}^3/\text{t}$ of coal production with less than 0.1% of inflammable gas in general body air, the degree of gassiness of the mine is:
- (a) Degree - I (b) Degree -II
(c) Degree - III (d) Degree - IV
75. The total pressure and the static pressure measured at a point in a ventilation duct are 20 mm and 10 mm of water gauge respectively. If density of air is $1.2 \text{ kg}/\text{m}^3$, the velocity of the air in m/s is:
- (a) 12.78 (b) 14.08
(c) 9.63 (d) 8.53
76. Psychometric chart shows the of air along Y-axis against along X-axis.
- (a) Dry bulb temperature, vapour pressure (b) Vapour pressure, dry bulb temperature
(c) Vapour pressure, wet bulb temperature (d) Wet bulb temperature, vapour pressure

77. An underground coal mine district produces 520 tons of coal per day deploying 220, 200 and 192 persons in first, second and third shift respectively. Find the minimum quantity of air in m^3/min to be provided in the ventilating district.
- (a) 1300 (b) 1430
(c) 1224 (d) 1320
78. The Chemical used in self-contained self-rescuer to absorb exhaled CO_2 is:
- (a) None of the above (b) CaCO_3
(c) KMnO_3 (d) LiOH
79. An auxiliary fan ventilating a heading through a duct of 600 mm diameter, circulates $5 \text{ m}^3/\text{sec}$ of air at the face. What will be the velocity of air in the duct ?
- (a) 17.67 (b) 16.67
(c) 15.67 (d) 14.67
80. When Q is in m^3 / sec and P in Pa and R is in Gaul, equivalent orifice in m^2 can be defined as:
- (a) $1.29Q/\rho P$ (b) $1.29/\rho R$
(c) $1.29\rho P/Q$ (d) $2.29\rho P/Q$
81. The softest mineral known as per the Mohs scale is:
- (a) Quartz (b) Orthoclase
(c) Talc (d) Calcite
82. Galena is an ore mineral of:
- (a) Manganese (b) Copper
(c) Iron (d) Lead
83. Crystal can be grouped into 'n' classes, 'n' is:
- (a) 42 (b) 32
(c) 24 (d) 12
84. The direction along which a mineral tends to break is called:
- (a) Fracture (b) Form
(c) Cleavage (d) All of these
85. A sandstone with less than 15% matrix content is known as:
- (a) Silts Stone (b) Mud Stone
(c) GreyWacke (d) Arenite
86. Which of the following is in decreasing order of particle size?
- (a) Sandstone, siltstone, conglomerate (b) Sandstone, conglomerate, siltstone
(c) Conglomerate, sandstone, siltstone (d) Siltstone, sandstone, conglomerate
87. Which is the largest Geological Time unit?
- (a) Eon (b) Era
(c) Epoch (d) Period
88. As compared with metamorphism, diagenesis is
- (a) Means exactly the same thing
(b) Takes place at lower temperature and pressures
(c) Takes place at higher temperatures and pressures
(d) Takes place at greater depth that are well within the mantle

89. If on a geological map, contour lines run parallel to contact lines, the beds are:
(a) Horizontal (b) Vertical
(c) Inclined (d) All of the above
90. A thrust fault is:
(a) A normal fault with fault plane at < 45 degree (b) A normal fault with fault plane at > 45 degree
(c) A reverse fault with fault plane at < 45 degree (d) A reverse fault with fault plane at > 45 degree
91. Bedding fault is a special type of:
(a) Strike fault (b) Strike-slip fault
(c) Oblique slip fault (d) Dip-slip fault
92. If the strike of the inclined bed is $N15^\circ E$, the dip direction can be:
(a) $S75^\circ W$ (b) $N75^\circ E$
(c) $S75^\circ E$ (d) $S15^\circ W$
93. The study of fossils within rock beds and their proper utilization in elucidating the past history of the earth is called:
(a) Mineralogy (b) Palaeontology
(c) Petrology (d) Structural geology
94. In palaeontology the conversion of remains of plants and animals into rock is known as:
(a) Fossils (b) Petrification
(c) Moulds (d) Carbonization
95. Which of the following is the oldest oil field in India?
(a) Bombay high (b) Combay Basin
(c) Digboi (d) Krishna-Godavari Basin
96. Which of the following is the highest rank of coal?
(a) Peat (b) Lignite
(c) Bituminous (d) Anthracite
97. In India, coking coal are mainly found in:
(a) Odisha (b) Tamil Nadu
(c) Jharkhand State (d) Madhya Pradesh
98. Major Al-deposits in India are associated with:
(a) Gondwana rocks (b) Archean rocks in Singhbhum
(c) Vindhyan rocks (d) Khondalites along east coast of India
99. Placer deposits are formed by:
(a) Gravitational separation (b) Magma segregation
(c) Fluid boiling (d) Wall-rock alteration
100. Which of these rocks could be an important source of diamonds?
(a) Komatiite (b) Gabbro
(c) Gabbro (d) Kimberlite