

MIZORAM PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF
INSPECTOR OF LEGAL METROLOGY UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS
DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2018

CIVIL ENGINEERING
PAPER - I

Time Allowed : 2 hours

Full Marks : 200

All questions carry equal marks of two (2) each.
Attempt all questions.

1. A material with identical properties in all directions is known as
 - (a) Elastic
 - (b) Homogeneous
 - (c) Isotropic
 - (d) None of these
2. The modulus of rupture of concrete in terms of its characteristic cube compressive strength (f_{ck}) is MPa according to IS 456: 2000 is
 - (a) $5000 f_{ck}$
 - (b) $5000\sqrt{f_{ck}}$
 - (c) $0.7\sqrt{f_{ck}}$
 - (d) $0.7 f_{ck}$
3. As per Indian standard code of practice for prestressed concrete (IS : 1343-1980) the minimum grades of concrete to be used for post-tensioned and pre-tensioned structural elements are respectively.
 - (a) m20 for both
 - (b) m40 and m30
 - (c) m15 and m20
 - (d) m30 and m40
4. The resistance to deformation of a body per unit area is known as
 - (a) Modulus of elasticity
 - (b) Modulus of rigidity
 - (c) Stress
 - (d) Strain
5. A good building stone should not absorb water more than
 - (a) 5 %
 - (b) 10%
 - (c) 20%
 - (d) 25%
6. The bricks capable of withstanding high temperature and low coefficient of expansion and contraction:
 - (a) Chrome bricks
 - (b) Fire bricks
 - (c) Refractory Bricks
 - (d) Silica bricks
7. The specific gravity of Granite is
 - (a) 2.20
 - (b) 2.40
 - (c) 2.64
 - (d) 2.80
8. The moisture content of a well-seasoned timber is
 - (a) 4% - 8%
 - (b) 10% - 12%
 - (c) 16% - 20%
 - (d) 30% - 40%
9. A second class brick should have a minimum crushing strength of:
 - (a) 5.5 MN per Meter Square
 - (b) 7.0 MN per Meter Square
 - (c) 7.5 MN per Meter Square
 - (d) 10.5 MN per Meter Square

10. Single Flemish bond consists of
 - (a) Double Flemish bond facing and English bond backing in each course
 - (b) Double flemish bond facing and header bond backing in each course
 - (c) English bond facing and double Flemish bond backing in each course
 - (d) Sketcher bond facing and double Flemish bond backing in each course
11. The sum of tread and rise must lie between
 - (a) 300 to 350 mm
 - (b) 400 to 450 mm
 - (c) 500 to 550 mm
 - (d) 600 to 650 mm
12. Minimum width of landing should be
 - (a) Equal to the width of stairs
 - (b) Half the width of stairs
 - (c) Twice the width of stairs
 - (d) One fourth the width of stairs
13. Which one is not a harmful ingredient in brick earth?
 - (a) lime
 - (b) alkalies
 - (c) iron pyrites
 - (d) silica
14. For the manufacture of Portland cement, the proportions of raw materials used are
 - (a) lime 63%, silica 22%, other ingredients 15%
 - (b) lime 50%, silica 35%, other ingredients 15%
 - (c) lime 40%, silica 40%, other ingredients 20%
 - (d) all of these
15. Strength of cement concrete primarily depends upon
 - (a) quality of water
 - (b) quantity of concrete
 - (c) quantity of cement
 - (d) water cement ratio
16. The compacting factor test of cement concrete determines its
 - (a) Degree of compacting under loads
 - (b) Porosity
 - (c) Strength
 - (d) Workability
17. Segregation means
 - (a) Separation of water from aggregates and cement
 - (b) Separation of fine aggregate from coarse aggregate
 - (c) Separation of cement paste from coarse aggregate
 - (d) All of these
18. Slump value for mass concrete should range between
 - (a) 0–25 mm
 - (b) 25–50 mm
 - (c) 50–100 mm
 - (d) 100–175 mm
19. In a spherical dome subjected to concentrated load at crown or uniformly distributed load, the meridional force is always
 - (a) zero
 - (b) tensile
 - (c) compressive
 - (d) shear
20. Maximum possible value of compaction factor for fresh (green) concrete is
 - (a) 0.5
 - (b) 1.0
 - (c) 1.5
 - (d) 2.0
21. Wobble effect is related with
 - (a) creep of concrete
 - (b) Frictional loss
 - (c) creep of steel
 - (d) shrinkage of concrete

22. The minimum area of tension reinforcement in a beam expressed as percentage of cross sectional area is
(a) $0.85/f_y$ (b) $0.75/f_y$
(c) $85/f_y$ (d) 4%
23. In RCC column, if ties are not provided, the column is likely to
(a) Fail by buckling (b) Fail by crushing
(c) behave like a beam (d) none of these
24. To design a column, one should normally start by assuming the area of steel as
(a) 0.15% (b) zero
(c) 0.18% (d) 1%
25. A surface water tank will be economical if its shape is
(a) square (b) circular
(c) rectangle (d) all of these
26. Workability is independent of
(a) Mix proportions (b) Water content
(c) Shape, size and texture of aggregate (d) None of these
27. The quality of concrete is appropriately defined as the
(a) Assurance that all aspects of materials, equipment and workmanship are well looked after
(b) Assurance for the safety and serviceability of structure
(c) Conformity to the specifications, no more no less
(d) Quality of overall workmanship and supervision at the site
28. The nominal size of particles of graded aggregate is said to be 12.5mm when most of it passes through a _____ mm IS sieve and is retained in a _____ mm IS sieve
(a) 12.5, 4.75 (b) 12.5, 10
(c) 16, 4.75 (d) 16, 12.5
29. In a trail concrete mix, if the desired slump is not obtained, the adjustment in the water content for each 10 mm difference in slump (in per cent) is
(a) 0.5 (b) 1.0
(c) 2.0 (d) 10.0
30. For ferrocement structures exposed to corrosive environments
(a) Apply asphaltic and bituminous coatings on the exposed surface
(b) Apply rust proof paint on the wire mesh
(c) Apply vinyl and epoxy coatings on the wire mesh
(d) Any of these
31. The following compounds may be used as inhibitors of iron corrosion
(a) Calcium and sodium chlorides
(b) Calcium sulfate
(c) Potassium dichromate, zinc and lead chromates
(d) Fly ash
32. Hooke's law is obeyed by a material with its
(a) Plastic Limit (b) Yield Limit
(c) Limit of Proportionality (d) Elastic limit

33. Modulus of Rigidity is defined as
- (a) Stress to strain
 - (b) Stress to volumetric strain
 - (c) Longitudinal stress to strain
 - (d) Shear stress to shear strain
34. When the strain in a material increases with time under sustained constant stress, the phenomenon is known as
- (a) Strain hardening
 - (b) Creep
 - (c) Hysteresis
 - (d) Visco-elasticity
35. The loss of pre-stress due to shrinkage of concrete is the product of
- (a) Modular ratio and percentage of steel
 - (b) Modulus of elasticity of concrete and shrinkage of concrete
 - (c) Modulus of elasticity of steel and shrinkage of concrete
 - (d) Modular ratio and modulus of elasticity of steel
36. A T-beam roof section has the following particulars:
- | | |
|---|----------|
| Thickness of slab | = 100 mm |
| Width of rib | = 300 mm |
| Depth of beam | = 500 mm |
| Centre to centre distance of beams | = 3.0 m |
| Effective span of beams | = 6.0 m |
| Distance between points of contraflexure is | = 3.60 m |
- The effective width of flange of the beam is
- (a) 1.50 m
 - (b) 1.60 m
 - (c) 2.10 m
 - (d) 2.40 m
37. The reduction co-efficient of a reinforced concrete column with an effective length of 4.8 m and size 250×300 mm is
- (a) 0.80
 - (b) 0.85
 - (c) 0.90
 - (d) 0.95
38. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is
- (a) 6 mm diameter
 - (b) 8 mm diameter
 - (c) 12 mm diameter
 - (d) 16 mm diameter
39. The reinforcement for positive moments in a continuous one way slab can be curtailed from the continuous edge at a distance of
- (a) $0.25l$
 - (b) $0.35l$
 - (c) $0.15l$
 - (d) $0.5l$
40. Neutral axis for a beam is defined as a fibre for which
- (a) longitudinal strain is zero
 - (b) longitudinal stress is zero
 - (c) poisson's ratio is zero
 - (d) both (a) & (b)
41. Strength gaining of Ordinary Portland Cement after 7 days curing
- (a) 65% of design strength
 - (b) 70% of design strength
 - (c) 75% of design strength
 - (d) 50% of design strength
42. The design shear strength of concrete depends on
- (a) area of longitudinal steel provided
 - (b) area of shear stirrups provided
 - (c) spacing of shear reinforcement
 - (d) none of these

43. In limit state approach, spacing of main reinforcement controls primarily,
- (a) Collapse
 - (b) Cracking
 - (c) Deflection
 - (d) Durability
44. Deflection can be controlled by using the appropriate
- (a) Aspect ratio
 - (b) Modular ratio
 - (c) Span/depth ratio
 - (d) Water/cement ratio
45. The load carrying capacity of a column designed by working stress method is 500 kN. The collapse load of the column is
- (a) 500.0 kN
 - (b) 750.0 kN
 - (c) 1100.0 kN
 - (d) 1400.0 kN
46. For ultimate load design of prestressed concrete girders used for bridges, combination of load factors used is (here D.L. = dead load, L.L. = live load)
- (a) 1.5D.L. + 2.5 L.L.
 - (b) 1.0D.L. + 2.5 L.L.
 - (c) 1.0D.L. + 2.0 L.L.
 - (d) 2.0D.L. + 2.0 L.L.
47. The co-efficient of expansion for steel may be taken as
- (a) $1.2 \times 10^{-5} / ^\circ\text{C}$
 - (b) $2.2 \times 10^{-5} / ^\circ\text{C}$
 - (c) $1.5 \times 10^{-5} / ^\circ\text{C}$
 - (d) $2 \times 10^{-5} / ^\circ\text{C}$
48. In a steel plate with bolted connection, the rupture of the net section is a mode of failure under
- (a) tension
 - (b) compression
 - (c) flexure
 - (d) shear
49. In the theory of plastic bending of beams, the ratio of plastic moment to yield moment is called
- (a) shape factor
 - (b) plastic section modulus
 - (c) modulus of resilience
 - (d) rigidity modulus
50. The square root of the ratio of moment of inertia of the cross-section to its cross-sectional area is called
- (a) second moment of area
 - (b) slenderness ratio
 - (c) section modulus
 - (d) radius of gyration
51. In a plate girder, the web plate is connected to the flange plates by fillet welding. The size of the fillet welds is designed to safely resist
- (a) the bending stresses in the flanges
 - (b) the vertical shear force at the section
 - (c) the horizontal shear force between the flanges and the web plate
 - (d) the forces causing buckling in the web
52. Rivet value is defined as
- (a) lesser of the bearing strength of rivet and the shearing strength of the rivet
 - (b) lesser of the bearing strength of rivet and the tearing strength of thinner plate
 - (c) greater of the bearing strength of rivet and the shearing of the rivet
 - (d) lesser of the shearing strength of the rivet and the tearing strength of thinner plate
53. In double riveted double covered butt joint, the strength of the joint per pitch length in shearing the rivets 'n' times the shear strength of one rivet in single shear, where n is equal to
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4

54. Most efficient and economical section used as a beam is
(a) I section (b) Circular section
(c) H section (d) Angles
55. A 6mm thick mild steel plate is connected to a 8mm thick plate by 16 mm diameter shop rivets. What is the number of rivets required to carry 80 kN load?
(a) 2 (b) 3
(c) 4 (d) 5
56. List-I contains some elements in design of a simply supported plate girder and List II give some qualitative locations on the girder. Match the items of two lists as per good design practice and relevant codal provisions.

List I		List II	
A	Flange splice	1	At supports (minimum)
B	Web splice	2	Away from centre of span
C	Bearing Stiffeners	3	Away from support
D	Horizontal stiffener	4	In the middle of span
		5	Longitudinally somewhere in the compression flange

Codes :

	A	B	C	D
(a)	2	3	1	5
(b)	4	2	1	3
(c)	3	4	2	1
(d)	1	5	2	3

57. When designing steel structures, one must ensure that local buckling in webs does not take place. This check may not be very critical when using rolled steel sections because
(a) quality control at the time of manufacture of rolled sections is very good
(b) web depths available are small
(c) web stiffeners are built in rolled sections
(d) depth to thickness ratio (of the web) are appropriately adjusted
58. An ISMB 500 is used as a beam in a multi-storey construction. From the viewpoint of structural design, it can be considered to be 'laterally restrained' when
(a) the tension flange is 'laterally restrained'
(b) the compression flange is 'laterally restrained'
(c) the web is adequately stiffened
(d) the conditions in a and c are met
59. The centre of gravity of a triangle is at the point where three
(a) medians of the triangle meet
(b) perpendicular bisectors of the sides of the triangle meet
(c) bisectors of the angle of the triangle meet
(d) none of these

60. The forces which meet at one point and have their lines of action in different planes are called
(a) coplaner non-concurrent forces (b) non-coplaner concurrent forces
(c) non-coplaner non-current forces (d) intersecting forces
61. At a given instant ship A is travelling at 6 km/h due east and ship B is travelling at 8 km/h due north. The velocity of B relative to A is
(a) 7 km/hrs (b) 2 km/hrs
(c) 1 km/hrs (d) 10 km/hrs
62. Principal planes are subjected to
(a) normal stresses only (b) tangential stresses only
(c) normal stresses as well as tangential stresses (d) none of these
63. Which of the following material has the highest value of Poisson's ratio?
(a) Wood (b) Steel
(c) Rubber (d) Aluminium
64. Area under the stress-strain curve represents
(a) Strain energy density of the material (b) Limiting value of failure stress
(c) Limiting value of failure strain (d) Work done on body
65. A material is referred to as perfectly rigid if modulus of elasticity of the material is
(a) Unity (b) Zero
(c) Equal to carbon (d) Infinity
66. The column with highest effective length has
(a) One end fixed and the other end free (b) Both ends fixed
(c) Both ends hinged (d) One end fixed and the other end hinged
67. Maximum principal stress theory is also known as
(a) Guest's and Tresca's theory (b) Mises' and Henkey's theory
(c) Rankine's theory (d) St. Venant's theory
68. In a solid rotating disc, the hoop stress is maximum at the
(a) Centre (b) Mean radial section
(c) Outer surface (d) None of these
69. For a beam having a point load at the mid-span, the ratio of deflection when the two ends are simply supported to when they are fixed is
(a) 2 (b) 3
(c) 4 (d) 5
70. A beam is said to be loaded in pure bending if
(a) Shear force and bending moment are uniform throughout
(b) Shear force is zero and bending moment is uniform throughout
(c) Shear force can vary and bending moment is uniform throughout
(d) None of these
71. At the point of application of a point load on a beam, there is
(a) Maximum bending moment
(b) Maximum deflection
(c) Point of contraflexure
(d) Sudden change of shape of bending moment diagram

72. Modulus of toughness is the area of the stress-strain diagram up to
(a) Limit of proportionality (b) Rupture point
(c) Yield point (d) None of these
73. Strain energy for a given system of loads is
(a) Depends on member properties (b) Always negative
(c) Depends on nature of loads (d) Always positive
74. Primary unknown in case of flexibility method is
(a) Forces (b) Displacement
(c) Both (a) & (b) (d) None of these
75. 1 MPa is equal to
(a) 1 N/m² (b) 1N/mm²
(c) 1kN/m² (d) 1kN/mm²
76. In a thin spherical shell, the hoop stress is given by
(a) $pd/4t$ (b) $pd/2t$
(c) pd/t (d) $2pd/t$
77. Maximum normal stress theory is used for
(a) Brittle materials (b) Ductile materials
(c) None of these (d) Both of these
78. The point within the cross-sectional plane of a beam through which the resultant of the external loading on the beam has to pass through to ensure pure bending without twisting of the cross-section of the beam is called
(a) Centroid (b) Elastic center
(c) Moment centre (d) Shear centre
79. Hinged joints are used in frames to ensure _____ forces in the members.
(a) Axial (b) Horizontal and vertical
(c) Inclined (d) Transverse
80. The relationship between the number of members and the number of joints of a perfect frame can be expressed as
(a) $m = 2j - 3$ (b) $j = 2m - 3$
(c) $m = 3j - 2$ (d) $m = 3j - 3$
81. The point where bending moment changes its sign from positive to negative is known as
(a) moment (b) flexural rigidity
(c) point of contraflexure (d) compression
82. The term EI is called as
(a) moment of resistance (b) flexural rigidity
(c) compressive strength (d) tensile strength
83. Unequal settlements at the support of a statically indeterminate structure develop
(a) No reactions (b) Reactions from supports
(c) Strains in member only (d) Member force
84. Soundness of cement is tested using
(a) vicat's apparatus (b) compressive strength test
(c) slump cone test (d) le-chatelier apparatus

85. The method of moment distribution in structural analysis is
(a) Approximate method (b) An exact method
(c) An Iterative method (d) None of these
86. Which of the following method is not a displacement method
(a) Kani's Method (b) Equilibrium Method
(c) Column Analogy Method (d) Moment distribution Method
87. Euler critical load of column restrained or fixed at both ends is
(a) $\frac{4\pi^2 EI}{L^2}$ (b) $\frac{2\pi^2 EI}{L^2}$
(c) $\frac{\pi^2 EI}{L^2}$ (d) $\frac{\pi^2 EI}{4L^2}$
88. In truss analysis, the number of unknown forces that can be determined using the method of joints is
(a) Zero (b) Three
(c) Two (d) One
89. The ratio of strain energy for a bar subjected to axial and lateral loads acting at centre is
(a) (L/d) (b) (d/L)
(c) $(L/d)^2$ (d) $(d/L)^2$
90. In a structural steel of grade Fe415, the number 415 is used to represent strength of steel
(a) ultimate strength (b) yield strength
(c) proof strength (d) design strength
91. Effective length of a column is defined as
(a) Minimum distance between points of inflection
(b) Distance between the adjacent supports
(c) Both (a) & (b)
(d) None of these
92. The partial factor of safety for concrete as per IS:456-2000 is
(a) 1.50 (b) 1.15
(c) 0.87 (d) 0.446
93. The flexural strength of M30 concrete as per IS:456-2000 is
(a) 3.83 MPa (b) 5.47 MPa
(c) 21.23 MPa (d) 30.0 MPa
94. The codal provisions for Standard sand for testing cement specification is
(a) IS 320 (b) IS 386
(c) IS 578 (d) IS 650
95. Imposed loads on the roof of a building in case of earthquake resistant design of building is taken as
(a) Zero
(b) 50% of imposed load if imposed load is greater than 3kN/m^2
(c) 50% of imposed load if imposed load is lesser than 3kN/m^2
(d) None of these

96. A simply supported beam is overhanging equally on both sides and carries a uniformly distributed load of 'w' per unit length over the whole length. The length between the supports is 'l' and length of overhang to one side is 'a'. If $l > 2a$ then the number of points of contra-flexure will be
- (a) Zero (b) One
(c) Two (d) Three
97. In a fixed beam, temperature variation produces
- (a) Large stresses (b) Small stresses
(c) Zero stress (d) None of these
98. The buckling load will be maximum for a column if
- (a) One end of the column is clamped and other end is free
(b) Both ends of the column are clamped
(c) Both ends of the column are hinged
(d) One end of the column is hinged and other end is free
99. A T-beam behaves as a rectangular beam of a width equal to its flange if its neutral axis
- (a) remains within the flange (b) remains below the slab
(c) coincides the geometrical centre of the beam (d) none of these
100. Which of the following elements of a pitched roof industrial steel building primarily resists lateral load parallel to the ridge ?
- (a) bracings (b) purlins
(c) truss (d) columns

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