

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF **ASSISTANT SOIL CONSERVATION ENGINEER (ASCE)** UNDER LAND RESOURCES, SOIL & WATER CONSERVATION DEPARTMENT GOVERNMENT OF MIZORAM. APRIL, 2021

CIVIL ENGINEERING PAPER - I

Time Allowed : 2 hours

Full Marks : 200

All questions carry equal marks of 2 each.

Attempt all questions.

- The rocks formed due to cooling of magma at considerable depth of earth's surface are called
 - Plutonic rocks
 - Metamorphic rocks
 - Igneous rocks
 - Sedimentary rock
- The stone suitable for rubble masonry should be
 - Soft
 - Light
 - Heavy
 - Hard
- The standard size of masonry bricks, is
 - 18 cm x 8 cm x 8 cm
 - 19 cm x 9 cm x 9 cm
 - 20 cm x 10 cm x 10 cm
 - 21 cm x 11 cm x 11 cm
- For compressive and tensile strength test, the cement mortar is made by mixing cement and sand in proportion of
 - 1:2
 - 1:3
 - 1:4
 - 1:6
- A 1st class brick immersed in water for 24 hours, should not absorb water (by weight) more than
 - 10 %
 - 15 %
 - 20 %
 - 25 %
- The number of bricks required for one cubic meter of brick masonry is
 - 400
 - 450
 - 500
 - 550
- Crushing strength of good building stone should be more than
 - 50 MPa
 - 100 MPa
 - 150 MPa
 - 200 MPa
- The types of bond in a brick masonry for carrying heavy loads is
 - English bond
 - Flemish bond
 - Russian bond
 - Mixed bond
- A wall constructed to resist the pressure of an earth filling is called
 - Retaining wall
 - Breast wall
 - Buttress wall
 - Parapet wall
- In ordinary residential and public buildings, the damp proof course is generally provided at
 - Ground level
 - Plinth level
 - Water table level
 - Midway between ground level and water table

11. A well seasoned timber may contain moisture upto
 - (a) 4 to 6 %
 - (b) 8 to 10 %
 - (c) 10 to 12 %
 - (d) 12 to 15%
12. The strength of concrete primarily depends on
 - (a) Quantity of cement
 - (b) Quantity of aggregate
 - (c) Strength of the aggregate
 - (d) Water-cement ratio
13. The initial setting time of concrete for OPC cement as per IS specification should not be less than
 - (a) 10 minutes
 - (b) 30 minutes
 - (c) 60 minutes
 - (d) 600 minutes
14. The bearing capacity of soil in water logged soil can be improved by
 - (a) Grouting
 - (b) Compaction
 - (c) Increasing the foundation depth
 - (d) Draining the soil
15. To minimize the effect of differential settlement, the area of a footing should be design for
 - (a) Dead load only
 - (b) Dead load + live load
 - (c) Dead load + fraction of live load
 - (d) Live load + fraction of dead load
16. The window which projects outside a room of a building for admitting more light and air is known as
 - (a) Bay window
 - (b) Dormer window
 - (c) Lantern window
 - (d) Casement window
17. The sum of tread and rise must lie between
 - (a) 300 – 350 mm
 - (b) 400 – 450 mm
 - (c) 500 – 550 mm
 - (d) 600 – 650 mm
18. The maximum permissible differential settlement for foundation in sandy soil is
 - (a) 5 mm
 - (b) 15 mm
 - (c) 25 mm
 - (d) 35 mm
19. The construction joints in buildings are provided after
 - (a) 30 m
 - (b) 40 m
 - (c) 50 m
 - (d) 60 m
20. The sound which continues even after its source is cut off is called
 - (a) Reverberation
 - (b) Hertz
 - (c) Interference
 - (d) Echo
21. The maximum number of steps in a flight should generally be restricted to
 - (a) 10
 - (b) 12
 - (c) 15
 - (d) 18
22. The pile which supports the load partly by friction and partly by resting on hard stratum, is called
 - (a) Friction pile
 - (b) Bearing pile
 - (c) Load bearing pile
 - (d) Friction bearing pile
23. According to IS 456 the maximum reinforcement in column is
 - (a) 2 %
 - (b) 4 %
 - (c) 6 %
 - (d) 8 %
24. Modulus of rupture of concrete is a measure of
 - (a) Flexural tensile strength
 - (b) direct tensile strength
 - (c) compressive strength
 - (d) split tensile strength

25. An R.C.C column is treated as short column if its slenderness ratio is less than
- (a) 30 (b) 35
(c) 40 (d) 50
26. The minimum thickness of the cover at the end of a reinforcing bar should not be less than twice the diameter of the bar subject to a minimum of
- (a) 15 mm (b) 20 mm
(c) 25 mm (d) 30 mm
27. Finer grinding of cement
- (a) Affects the early development strength (b) Affects the ultimate strength
(c) Both (a) and (b) (d) Does not affect the strength
28. Spacing of stirrup in rectangular beam is
- (a) Kept constant throughout the length (b) Decreased towards the centre of the beam
(c) Increased at the ends (d) Increased at the centre of the beam
29. The maximum ratio of span to depth of a slab simply supported and spanning in two directions, is
- (a) 25 (b) 30
(c) 35 (d) 40
30. The aspect ratio is defined as the ratio of
- (a) Length to breadth of a state
(b) Effective width of flange and effective depth of the beam
(c) Width of well and depth of flange
(d) None of these
31. The compression stress in concrete at the level of centroid of compression steel is equal to
- (a) $0.416 F_{ck}$ (b) $0.446 F_{ck}$
(c) $0.36 F_{ck}$ (d) $0.57 F_{ck}$
32. The flexural strength of M30 concrete as per IS 456-2000
- (a) 3.83 MPa (b) 5.47 MPa
(c) 21.23 MPa (d) 30.0 MPa
33. The maximum strain in the tension reinforcement in the section of flexural member shall not be less than
- (a) $\frac{f_y}{E_s} + 0.002$ (b) $\frac{f_y}{1.15 E_s} + 0.002$
(c) $1.15 \frac{f_y}{E_s} + 0.002$ (d) $\frac{f_y}{2.15 E_s} + 0.002$
- Where f_y is the characteristic strength of steel and E_s is the modulus of elasticity.
34. For M15 concrete (1:2:4) the moment of resistance factor is
- (a) 0.87 (b) 8.5
(c) 7.5 (d) 4.46
35. As per IS : 800, the maximum deflection in a beam of span L should not exceed
- (a) $L/180$ (b) $L/250$
(c) $L/325$ (d) $L/360$
36. If the permissible compressive and tensile stresses in a singly reinforce beam are 50 kg/cm^2 and 1400 kg/cm^2 respectively and modular ratio is 18, the percentage of area (A_{st}) of steel required for economic section is
- (a) 0.596 % (b) 0.696 %
(c) 0.796 % (d) 0.596 %

37. The most critical consideration in the design of rolled steel columns carrying axial loads is the
- (a) percent elongation at yield and the net cross-sectional areas
 - (b) critical bending strength and axial yield strength of the material
 - (c) buckling strength based on the net area of the section and percent elongation at ultimate load
 - (d) compressive strength based on the slenderness ratio and cross-sectional area of the member
38. The modulus of elasticity, $E = 5000f_{ck}$ where f_{ck} is the characteristic compressive strength of concrete, specified in IS 456:2000 is based on
- (a) Tangent modulus
 - (b) Initial tangent modulus
 - (c) Secant modulus
 - (d) Chord modulus
39. The target mean strength f_{cm} for concrete mix design obtained from the characteristic strength f_{ck} and standard deviation s , as defined in IS456:2000 is
- (a) $f_{ck} + 1.35 s$
 - (b) $f_{ck} + 1.45 s$
 - (c) $f_{ck} + 1.55 s$
 - (d) $f_{ck} + 1.65 s$
40. The modular ratio m in terms of permissible compressive stress due to bending in concrete σ_{cbc} (N/mm²) is given by
- (a) $\frac{280}{\sigma_{cbc}}$
 - (b) $\frac{2800}{\sigma_{cbc}}$
 - (c) $\frac{280}{3\sigma_{cbc}}$
 - (d) $\frac{2800}{3\sigma_{cbc}}$
41. Which one of the following is categorized as a long term loss of prestress in a prestressed concrete member
- (a) Loss due to elastic shortening
 - (b) Loss due to friction
 - (c) Loss due to relaxation of strand
 - (d) Loss due to anchorage slip
42. Shear buckling of web in plate girder is provided to safeguard against
- (a) Vertical intermediate stiffener
 - (b) Horizontal stiffener at neutral axis
 - (c) Bearing stiffener
 - (d) None of the above
43. The heaviest I-section for same depth is
- (a) ISMB
 - (b) ISLB
 - (c) ISHB
 - (d) ISWB
44. Minimum pitch of the rivets shall not be less than
- (a) 1.5 d
 - (b) 2.0 d
 - (c) 2.5 d
 - (d) 3.0 d
45. In a steel plate with bolted connections, the rupture of the net section is mode of failure under
- (a) Shear
 - (b) Bending
 - (c) Flexure
 - (d) Tension
46. As per IS 800:2007, the cross section in which extreme fibre can reach the yield stress, but cannot develop the plastic moment of resistance due to failure by local buckling is classified as
- (a) Plastic section
 - (b) Compact section
 - (c) Semi compact section
 - (d) Slender section
47. An ISMB 500 is used as a beam in multi-storey construction. From the view point of structural design, it can be considered 'laterally restrained' when
- (a) Tension is laterally restrained
 - (b) Compression flange is laterally restrained
 - (c) The web is adequately stiffened
 - (d) The conditions in (a) and (c) are met

48. Which of the following elements of a pitched roof industrial steel building primarily resist lateral load parallel to the ridge
- (a) Bracings (b) Purlins
(c) Truss (d) Columns
49. A steel beam supporting loads from the floor slab as well as from wall is termed as
- (a) Stringer beam (b) Lintel beam
(c) Spandrel beam (d) Header beam
50. Moment of inertia of a circular section about an axis perpendicular to the section is
- (a) $\pi d^3/32$ (b) $\pi d^4/32$
(c) $\pi d^3/64$ (d) $\pi d^2/12$
51. If a number of forces are acting at a point, their resultant will be inclined at an angle θ with the horizontal, such that
- (a) $\tan \theta = \Sigma H / \Sigma V$ (b) $\tan \theta = \Sigma H \times \Sigma V$
(c) $\tan \theta = \Sigma V / \Sigma H$ (d) $\tan \theta = \sqrt{\Sigma H / \Sigma V}$
52. The moment of inertia of rectangular section having a 3 cm width (b) and 4 cm depth (d) about an axis passing through C.G and parallel to width (b) is
- (a) 8 cm^4 (b) 16 cm^4
(c) 32 cm^4 (d) 64 cm^4
53. The friction experienced by a body when in motion
- (a) Static friction (b) Dynamic friction
(c) Limiting friction (d) Coefficient of friction
54. Which of the following is a scalar quantity?
- (a) Force (b) Speed
(c) Velocity (d) Acceleration
55. For any system of coplanar forces, the condition of equilibrium is that
- (a) Algebraic sum of horizontal components of all forces should be zero
(b) Algebraic sum of vertical components of all forces should be zero
(c) Algebraic sum of moments of all forces should be zero
(d) All the above
56. The velocity of a body reaching the ground from a height of h, is
- (a) $2\sqrt{gh}$ (b) \sqrt{gh}
(c) $\sqrt{2gh}$ (d) $2g\sqrt{h}$
57. The centre of gravity of cone lies at
- (a) $1/3^{\text{rd}}$ of height above the base (b) $1/2$ of height above the base
(c) $3/8$ of height above the base (d) $2/3$ of the height above the base
58. The velocity of a particle (v) moving with simple harmonic motion, at any given instant is given by (where r = amplitude of motion, y = displacement of particle from mean position)
- (a) $\omega \ddot{(y^2-r^2)}$ (b) $\omega \ddot{(r^2-y^2)}$
(c) $\omega^2 \ddot{(y^2-r^2)}$ (d) $\omega^2 \ddot{(r^2-y^2)}$
59. The resultant of two forces P and Q acting at an angle θ , is
- (a) $P^2 + Q^2 + 2PQ \sin \theta$ (b) $P^2 + Q^2 + 2PQ \cos \theta$
(c) $\sqrt{P^2 + Q^2 + 2PQ \sin \theta}$ (d) $\sqrt{P^2 + Q^2 + 2PQ \cos \theta}$

60. Equation of motion of a point in a straight line, is
(a) $v = u + ft$ (b) $S = ut + (1/2) ft^2$
(c) $2fS = v^2 - u^2$ (d) All of the above
61. In simple harmonic motion, acceleration of a particle is proportional to
(a) Rate of change of velocity (b) Displacement
(c) Velocity (d) Direction
62. The product of mass and velocity of a moving body is called
(a) Moment (b) Momentum
(c) Power (d) Impulse
63. Work may be defined as
(a) Force x distance (b) Force x velocity
(c) Force x acceleration (d) None of these
64. A couple produces
(a) Translatory motion (b) Rotational
(c) Combined translator and rotational (d) Hogging
65. The “plane section remain plane” assumption in bending theory implies
(a) Strain profile is line (b) Stress profile is linear
(c) Both strain and stress are linear (d) Shear deformation are neglected
66. The law which states, “within elastic limits strain produced is proportional to the stress producing it” is known as
(a) Bernoulli’s law (b) Stress law
(c) Law of equilibrium (d) Hooke’s law
67. The Poisson’s ratio is defined as
(a) Axial stress/lateral stress (b) Lateral strain/axial strain
(c) Lateral stress/axial stress (d) axial strain/lateral strain
68. For an isotropic material, the relationship between the Young’s modulus (E), shear modulus (G) and Poisson’s ratio (μ) is given by
(a) $G = \frac{E}{2(1+\mu)}$ (b) $E = \frac{G}{2(1+\mu)}$
(c) $G = \frac{E}{(1+2\mu)}$ (d) $G = \frac{E}{2(1-\mu)}$
69. If the principal stresses at a point in a strained body are p_1 and p_2 ($p_1 > p_2$), then the resultant stress on a plane carrying the maximum shear stress is equal to
(a) $\sqrt{p_1^2 + p_2^2}$ (b) $\sqrt{\frac{p_1^2 + p_2^2}{2}}$
(c) $\sqrt{\frac{p_1^2 - p_2^2}{2}}$ (d) $\sqrt{p_1^2 - p_2^2}$
70. The shape of the bending moment diagram over the length of a beam carrying a uniformly distributed load is always
(a) Linear (b) Parabola
(c) Cubical (d) Circular

71. A mild steel specimen is under uni-axial tensile stress. Young's modulus and yield stress for mild steel are 2×10^5 MPa and 250 MPa, respectively. The maximum amount of strain energy per unit volume that can be stored in this specimen without permanent set is
- (a) 156 N/mm^3 (b) 15.6 N/mm^3
(c) 1.56 N/mm^3 (d) 0.156 N/mm^3
72. The specimen in a Charpy impact test is supported as
- (a) Cantilever beam (b) Simply supported beam
(c) Fixed beam (d) Continuous beam
73. Struts are load carrying member of a frame, which are subjected to
- (a) Transverse load (b) Axial tensile load
(c) Axial compressive load (d) Torsional load
74. The shear force diagram of cantilever beam which is subjected to carrying uniformly distributed load over its length, is
- (a) Triangle (b) Rectangle
(c) Parabola (d) Cubic parabola
75. Strain energy is the
- (a) Energy stored in a body when strained within elastic limits
(b) Energy stored in a body when strained upto the breaking point of a specimen
(c) Maximum strain energy which can be stored in a body
(d) Proof resilience per unit volume of a material
76. If the principal stresses in two dimensional case are -10 MPa and 20 MPa respectively, then maximum shear stress at the point is
- (a) 10 MPa (b) 15 MPa
(c) 20 MPa (d) 30 MPa
77. Maximum deflection of a cantilever due to pure bending moment at its free end, is
- (a) $\frac{ML^2}{3EI}$ (b) $\frac{ML^2}{4EI}$
(c) $\frac{ML^2}{6EI}$ (d) $\frac{ML^2}{2EI}$
78. The moment required to rotate the near end of a prismatic beam through a unit angle without transition, the far end being simply supported, is given by (EI – flexural rigidity and L is the span of beam)
- (a) $\frac{3EI}{L}$ (b) $\frac{4EI}{L}$
(c) $\frac{2EI}{L}$ (d) $\frac{EI}{L}$
79. For the design of a cast iron member, the most appropriate theory of failure is
- (a) Mohr's theory (b) Rankine's theory
(c) Maximum strain theory (d) Maximum shear energy theory
80. If the shear force at a section of beam under bending is equal to 0 then the bending moment at the section is
- (a) Zero (b) Maximum
(c) Minimum (d) Constant

81. For a given shear force across a symmetrical I section, the intensity of shear stress is maximum at the
- (a) Extreme fibres
 - (b) Centroid of section
 - (c) At the junction of flange and the web, but on the web
 - (d) At the junction of flange and the web, but on the flange
82. In an experiment it is found that the bulk modulus of a material is equal to its shear modulus. The Poisson's ratio is
- (a) 0.124
 - (b) 0.250
 - (c) 0.375
 - (d) 0.500
83. The kinematic indeterminacy of single bay portal frame fixed at the base is
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 0
84. Castigliano's first theorem is applicable when
- (a) For statically determinate structures only
 - (b) When the system behave elasticity
 - (c) Only when principal of superposition is valid
 - (d) None of the above
85. In moment distribution method, the sum of distribution factors of all the member meeting at any joint is always
- (a) Zero
 - (b) Less than 1
 - (c) 1
 - (d) Greater than 1
86. The number of simultaneous equations to be solved in slope deflection method is equal to
- (a) Degree of static indeterminacy
 - (b) Degree of kinematic indeterminacy
 - (c) The number of joints in the structure
 - (d) Number of equilibrium conditions
87. A single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be
- (a) 8 kN.m
 - (b) 15 kN.m
 - (c) 20 kN.m
 - (d) 30 kN.m
88. Which of the following is displacement method?
- (a) Kani's method
 - (b) Column analogy method
 - (c) Flexibility method
 - (d) Energy method
89. The strain energy of a structure due to bending is given by
- (a) $\int \frac{M^2 dx}{EI}$
 - (b) $\frac{1}{2} \int \frac{M^2 dx}{EI}$
 - (c) $\int \frac{2M^2 dx}{EI}$
 - (d) $\frac{1}{3} \int \frac{M^2 dx}{EI}$
90. The carryover factor in a prismatic member whose far end is fixed is
- (a) 0
 - (b) $\frac{1}{2}$
 - (c) $\frac{3}{4}$
 - (d) 1
91. The deformation of a spring produced by a unit load is called
- (a) Stiffness
 - (b) Flexibility
 - (c) Influence coefficient
 - (d) Unit strain
92. A fixed beam of uniform section is carrying a point load at its mid-span. If the moment of inertia of the middle half-length is now reduced to half its previous value, then the fixed end moment will
- (a) Remain constant
 - (b) Decrease
 - (c) Increase
 - (d) Change their direction

93. The principal of virtual work can be applied to elastic system considering the virtual work of
(a) Internal forces only (b) External forces only
(c) Internal and external forces (d) None
94. Muller Breslau principle in structural analysis is used for
(a) Drawing influence line diagram for any force function
(b) Writing virtual work equation
(c) Super-position of load effects
(d) None of these
95. Degree of static indeterminacy of a rigid jointed plane frame having 15 members, 3 reaction components and 14 joints is
(a) 2 (b) 3
(c) 6 (d) 8
96. A prismatic beam of length L and fixed at both ends carries a uniformly distributed load. The distance of points of contraflexure from either end is
(a) $0.207 * L$ (b) $0.403 * L$
(c) $0.586 * L$ (d) $0.25 * L$
97. A simply supported beam of length L carries a load varying uniformly from zero at left end to maximum at right end. The maximum bending moment occurs at a distance of
(a) $1/\sqrt{3}$ from left end (b) $1/3$ from left end
(c) $1/\sqrt{3}$ from right end (d) $1/3$ from right end
98. In the displacement method of structural analysis, the basic unknowns are
(a) Displacement (b) Force
(c) Displacement and forces (d) Stiffness
99. A simply supported beam deflects by 5 mm when subjected to a concentrated load of 10 KN at its centre. What will be the deflection in a 1/10 model of beam if the model is subjected to 1 KN load at its centre
(a) 50 mm (b) 5 mm
(c) 0.5 mm (d) 0.05 mm
100. If the sinking of a support of a fixed beam causes the beam to rotate in the clockwise direction, then the moments induced at both ends of the beam will be
(a) Anticlockwise direction and of equal magnitude
(b) Clockwise direction and of equal magnitude
(c) Opposite directions and of equal magnitude
(d) Opposite directions and of different magnitude

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