MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF ASSISTANT ENGINEER (CIVIL) UNDER TOURISM DEPARTMENT, GOVERNMENT OF MIZORAM, FEBRUARY - 2020.

TECHNICAL PAPER - I

Time Allowed : 2 hours FM : 200

All questions carry equal marks of 2 each.
Attempt all questions.

1. The rocks which are formed due to cooling of magma at a considerable depth from earth's surface are called
(a) Plutonic rocks (b) Hypabyssal rocks
(c) Volcanic rocks (d) Igneous rocks

2. The constituent of cement which is responsible for all the undesirable properties of cement is
(a) Di-calcium silicate (b) Tri-calcium silicate
(c) Tri-calcium aluminate (d) Tetra calcium alumino ferrite

3. Inner part of a timber log surrounding the pitch, is called
(a) Sapwood (b) Cambium layer
(c) Heart wood (d) None to these

4. For testing compressive and tensile strength of cement, the cement mortar is made by mixing cement and standard sand in the proportions of
(a) 1 : 2 (b) 1 : 3
(c) 1 : 4 (d) 1 : 6

5. Clay and silt content in a good brick earth must be at least
(a) 50 % (b) 40 %
(c) 30 % (d) 25 %

6. Which of the following is the purest form of iron?
(a) Cast iron (b) Wrought iron
(c) Mild steel (d) High carbon steel

7. Which of the following stresses is used for identifying the quality of structural steel?
(a) Ultimate stress (b) Yield stress
(c) Proof stress (d) None of the above

8. A volatile substance added to a paint to make its application easy and smooth, is known as
(a) Base (b) Solvent
(c) Vehicle (d) None to these

9. Strength of cement concrete primarily depends upon
(a) Quality of water (b) Quantity of aggregate
(c) Quantity of cement (d) Water-cement ratio

10. Bitumen may be dissolved in
(a) Carbondioxide (b) Water
(c) Sodium chloride (d) Carbon disulphide

11. The most common admixture which is used to accelerate the initial set of concrete is
(a) Gypsum (b) Calcium chloride
(c) Calcium carbonate (d) None of these

12. For the manufacture of Portland cement, the proportions of raw materials used, are
(a) Lime 63% ; silica 22% ; other ingredients 15%
(b) Lime 22% ; silica 63% ; other ingredients 15%
(c) Silica 40% ; lime 40% ; other ingredients 20%
(d) Silica 70% ; lime 20% ; other ingredients 10%

13. Cast iron piles
(a) Are suitable for works under sea water
(b) Resist shocks or vibrations
(c) Are suitable for use as batter piles
(d) Are useful for heavy vertical loads

14. The form work from the slabs excluding props, can be removed only after
(a) 1 day (b) 4 days
(c) 7 days (d) 14 days

15. The pile which supports the load due to friction between pile face and surrounding soil, is generally known as
(a) Bearing pile (b) Friction pile
(c) Sheet pile (d) Battered pile

16. The inclined surface of an abutment to receive the arch, is known as
(a) Skew back (b) Soffit
(c) Spandril (d) Haunch

17. As compared to stretcher course, the thickness of joints in header course should be
(a) Less (b) More
(c) Equal (d) Equal or more

18. Pick up the correct statement from the following:
(a) Plain cement concrete is equally strong in compression as well as in tension
(b) Slump test is performed to check concrete strength
(c) Curing of concrete is done for proper compaction of cement
(d) Fineness modulus is the index number expressing the relative sizes of both coarse and fine aggregates

19. The bearing capacity of a water logged soil can be improved by
(a) Compacting the soil (b) Draining the soil
(c) Increasing the depth of foundation (d) Grouting

20. A stair should not have pitch more than
(a) 25° (b) 30°
(c) 40° (d) 50°

21. According to National Building Code, the hydrants in water mains is provided at minimum interval of
(a) 50 m (b) 60 m
(c) 75 m (d) 90 m

22. The predominant constituent which is responsible for strength in granite is
(a) Quartz (b) Felspar
(c) Mica (d) None of these

23. The arrangement made to support an unsafe structure temporarily, is known as
(a) Shoring (b) Scaffolding
(c) Underpinning (d) Jacking

24. The window which projects outside a room of a building for admitting more light and air, is known
(a) Bay window (b) Casement window
(c) Lantern window (d) Dormer window

25. The differential settlement in case of foundations on sandy soils should not exceed
(a) 25 mm (b) 40 mm
(c) 65 mm (d) 100 mm

26. An R.C.C. beam of 6 m span is 30 cm wide and has a lever arm of 55 cm. If it carries a U.D.L. of 12 t per m and allowable shear stress is 5 kg/cm^2, the beam
(a) Is safe in shear (b) Is safe with stirrups
(c) Is safe with stirrups and inclined bars (d) Needs revision of section

27. The floor slab of a building is supported on reinforced cement floor beams. The ratio of the end and intermediate spans is kept
(a) 0.7 (b) 0.8
(c) 0.9 (d) 0.6

28. Minimum spacing between horizontal parallel reinforcement of the same size should not be less than
(a) One diameter (b) 2.5 diameters
(c) 3 diameters (d) 3.5 diameters

29. Columns may be made of plain concrete if their unsupported lengths do not exceed their least lateral dimension
(a) Two times (b) Three times
(c) Four times (d) Five times

30. 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) 10 mm (b) 15 mm
(c) 20 mm (d) 25 mm

31. An R.C.C. lintel is spanning an opening of 2 m span in a brick wall. The height of the roof is 2.9 m above the floor level and that of the opening is 2.1 m above the floor level. The lintel is to be designed for self weight plus
(a) Triangular load of the wall (b) UDL of wall
(c) UDL of wall + load from the roof (d) Triangular load + load from the roof

32. The phenomenon of collision of two elastic bodies takes place because bodies
(a) Immediately after collision come momentarily to rest
(b) Tend to compress each other till they are compressed maximum possible
(c) Attempt to regain its original shape due to their elasticity
(d) All of these

33. Side face reinforcement shall be provided in the beam when depth of the web in a beam exceeds
(a) 50 cm (b) 75 cm
(c) 100 cm (d) 120 cm

34. The advantage of reinforced concrete, is due to
(a) Monolithic character
(b) Fire-resisting and durability
(c) Economy because of less maintenance cost
(d) All of these

35. A column is regarded as long column if the ratio of its effective length and lateral dimension, exceeds
(a) 10 (b) 15
(c) 20 (d) 25

36. A singly reinforced concrete beam of 25 cm width and 70 cm effective depth is provided with 18.75 cm^2 steel. If the modular ratio (m) is 15, the depth of the neutral axis, is
(a) 20 cm (b) 25 cm
(c) 30 cm (d) 35 cm

37. The effective span of a simply supported slab, is
(a) Distance between the centres of the bearings
(b) Clear distance between the inner faces of the walls plus twice the thickness of the wall
(c) Clear span plus effective depth of the slab
(d) None of these

38. An under-reinforced section means
(a) Steel is provided at the underside only (b) Steel provided is insufficient
(c) Steel provided on one face only (d) Steel will yield first

39. Principle of superposition is applicable when
(a) Deflections are linear functions of applied forces
(b) Material obeys Hooke's law
(c) The action of applied forces will be affected by small deformations of the structure
(d) None of these

40. The Castigliano's second theorem can be used to compute deflections
(a) In statically determinate structures only (b) For any type of structure
(c) At the point under the load only (d) For beams and frames only

41. Which of the following methods of structural analysis is a force method?
(a) Slope deflection method (b) Column analogy method
(c) Moment distribution method (d) None of these

42. Which of the following is not the displacement method?

(a) Equilibrium method
(b) Column analogy method
(c) Moment distribution method
(d) Kani's method

43. If in a rigid-jointed space frame, $(6m + r) < 6j$, then the frame is

(a) Unstable
(b) Stable and statically determinate
(c) Stable and statically indeterminate
(d) None of these

44. A rigid-jointed plane frame is stable and statically determinate if

(a) $(m + r) = 2j$
(b) $(m + r) = 3j$
(c) $(3m + r) = 3j$
(d) $(m + 3r) = 3j$

Where m is number of members, r is reaction components and j is number of joints.

45. 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

46. 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) 15kN-m
(c) 30 kN-m
(d) 60 kN-m

47. Consider the following statements:

Sinking of an intermediate support of a continuous beam

1. Reduces the negative moment at support.
2. Increases the negative moment at support.
3. Reduces the positive moment at support.
4. Increases the positive moment at the centre of span.

Of these statements

(a) 1 and 4 are correct
(b) 1 and 3 are correct
(c) 2 and 3 are correct
(d) 2 and 4 are correct

48. According to Lami's theorem

(a) Three forces acting at a point will be in equilibrium
(b) Three forces acting at a point can be represented by a triangle, each side being proportional to force
(c) If three forces acting upon a particle are represented in magnitude and direction by the sides of a triangle, taken in order, they will be in equilibrium
(d) If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two

49. According to principle of transmissibility of forces, the effect of a force upon a body is

(a) Maximum when it acts at the center of gravity of a body
(b) Different at different points in its line of action
(c) The same at every point in its line of action
(d) Minimum when it acts at the C.G. of the body

50. The tensile force required to cause an elongation of 0.045 mm in a steel rod of 1000 mm length and 12 mm diameter, is (where $E = 2 \times 10^6 kg/cm^2$)

(a) 166 kg (b) 102 kg

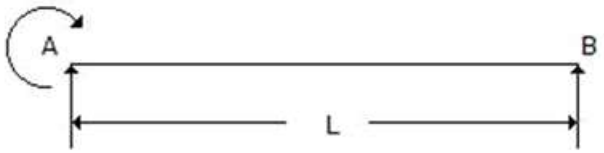
(c) 204 kg (d) 74 kg

51. If a rectangular beam measuring 10 × 18 × 400 cm carries a uniformly distributed load such that the bending stress developed is 100 kg/cm**2.** The intensity of the load per metre length, is

(a) 240 kg (b) 250 kg

(c) 260 kg (d) 270 kg

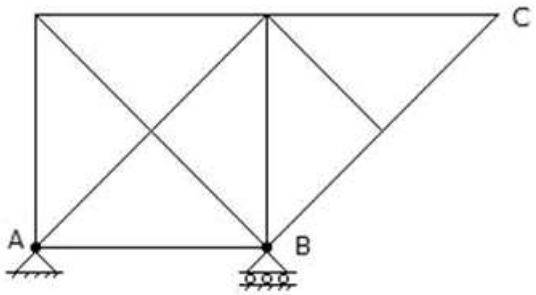
52. The B.M. diagram of the beam shown in below figure, is



(a) A rectangle (b) A triangle

(c) A trapezium (d) A parabola

53. The degree of indeterminacy of the frame in the given figure, is



(a) 1 (b) 2

(c) 3 (d) Zero

54. The assumption in the theory of bending of beams is:

(a) Material is homogeneous

(b) Material is isotropic

(c) Young's modulus is same in tension as well as in compression

(d) All of these

55. The ratio of lateral strain to axial strain of a homogeneous material, is known

(a) Yield ratio (b) Hooke's ratio

(c) Poisson's ratio (d) Plastic ratio

56. In plastic analysis, the shape factor for rectangular section, is

(a) 1.4 (b) 1.5

(c) 1.6 (d) 1.7

57. If Q is load factor, S is shape factor and F is factor of safety in elastic design, the following:

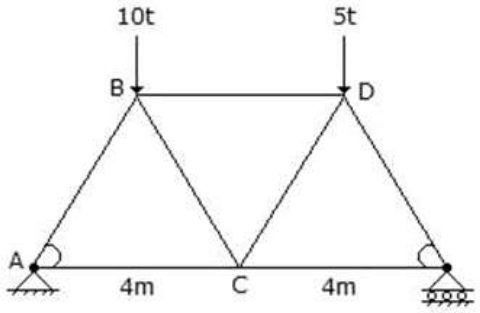
(a) Q = S + F (b) Q = S - F

(c) Q = F - S (d) Q = S × F

58. By applying the static equations i. e $\sum H = 0, \sum V = 0$ *and* $\sum M = 0$, to a determinate structure, we may determine

(a) Supporting reactions only
(b) Shear forces only
(c) Bending moments only
(d) All of these

59. In the truss, the force in the member AC is



(a) 6.25 t compressive
(b) 8.75 t tensile
(c) (8.75/Ö3) t tensile
(d) (8.75/Ö3) t compressive

60. A composite beam is composed of two equal strips one of brass and other of steel. If the temperature is raised

(a) Steel experiences tensile force
(b) Brass experiences compressive force
(c) Composite beam gets subjected to a couple
(d) All of these

61. The yield moment of a cross section is defined as the moment that will just produce the yield stress in

(a) The outer most fibre of the section
(b) The inner most fibre of the section
(c) The neutral fibre of the section
(d) The fibre everywhere

62. The moment of inertia of a triangular section (height h, base b) about its base, is

(a) $bh^2/12$
(b) $b^2h/12$
(c) $bh^3/12$
(d) $b^3h/12$

63. The strain energy stored in a spring when subjected to greatest load without being permanently distorted, is called

(a) Stiffness
(b) Proof resilience
(c) Proof stress
(d) Proof load

64. Bending moment at any section in a conjugate beam gives in the actual beam

(a) Slope
(b) Curvature
(c) Deflection
(d) Bending moment

65. Castigliano's first theorem is applicable

(a) For statically determinate structures only
(b) When the system behaves elastically
(c) Only when principle of superposition is valid
(d) None of these

66. Generally the purlins are placed at the panel points so as to avoid

(a) Axial force in rafter
(b) Shear force in rafter
(c) Deflection of rafter
(d) Bending moment in rafter

67. Select the correct statement
(a) Material cost of a rivet is higher than that of a bolt
(b) Tensile strength of a bolt is lesser than that of a rivet
(c) Bolts are used as a temporary fastening whereas rivets are used as permanent fastenings
(d) Riveting is less noisy than bolting

68. The effective length of a fillet weld should not be less than
(a) Two times the weld size
(b) Four times the weld size
(c) Six times the weld size
(d) Weld size

69. In moment resistant connections, the moment resistance of riveted connection depends upon
(a) Shear in rivets
(b) Compression in rivets
(c) Tension in rivets
(d) Strength of rivets in bearing

70. Lacing bars in a steel column should be designed to resist
(a) Bending moment due to 2.5% of the column load
(b) Shear force due to 2.5% of the column load
(c) 2.5% of the column load
(d) Both (a) & (b)

71. A column splice is used to increase
(a) Length of the column
(b) Strength of the column
(c) Cross-sectional area of the column
(d) None of these

72. Stiffeners are used in a plate girder
(a) To reduce the compressive stress
(b) To reduce the shear stress
(c) To take the bearing stress
(d) To avoid bulking of web plate

73. A fillet weld whose axis is parallel to the direction of the applied load, is known as
(a) Diagonal filler weld
(b) End fillet weld
(c) Side fillet weld
(d) All of these

74. A cable loaded with 0.5 tonne per horizontal metre span is stretched between supports in the same horizontal line 400 m apart. If central dip is 20 m, the minimum tension in the cable, will be
(a) 200 tonnes at the centre
(b) 500 tonnes at the centre
(c) 200 tonnes at the right support
(d) 200 tonnes at the left support

75. Factor of safety is the ratio of
(a) Yield stress to working stress
(b) Tensile stress to working stress
(c) Compressive stress to working stress
(d) Bearing stress to working stress

76. The effective length of a compression member of length L held in position at both ends but not restrained in direction, is
(a) L
(b) 0.67L
(c) 0.85L
(d) 1.5 L

77. Design of a riveted joint is based on the assumption:
(a) Bending stress in rivets is accounted for
(b) Riveted hole is assumed to be completely filled by the rivet
(c) Stress in the plate in not uniform
(d) Friction between plates is taken into account

78. The safe working pressure for a spherical vessel 1.5 m diameter and having 1.5 cm thick wall not to exceed tensile stress 50kg/cm^2, is

(a) 16 kg/cm^2 (b) 18 kg/cm^2

(c) 20 kg/cm^2 (d) 22 kg/cm^2

79. Bending compressive and tensile stresses respectively are calculated based on

(a) Net area and gross area (b) Gross area and net area

(c) Net area in both cases (d) Gross area in both cases

80. The following is in unstable equilibrium

(a) A uniform solid cone resting on a generator on a smooth horizontal plane

(b) A uniform solid cone resting on its base on a horizontal plane

(c) A solid cube resting on one edge

(d) A satellite encircling the earth

81. In a lifting machine with efficiency 60%, an effort of 200 N is required to raise a load of 6 kN. The velocity ratio of the machine is

(a) 30 (b) 50

(c) 60 (d) 80

82. The member forces in a statically in determinate truss

(a) Can be obtained by graphic statics

(b) Cannot be obtained by graphic statics

(c) May be obtained by graphic statics

(d) Can be obtained by graphic statics by trial and error

83. A heavy ladder resting on floor and against a vertical wall may not be in equilibrium if

(a) Floor is smooth and wall is rough (b) Floor is rough and wall is smooth

(c) Both floor and wall are rough (d) Both floor and wall are smooth

84. A sphere and a cylinder having the same mass and radii start from rest and roll down the same inclined plane. Which body gets to the bottom first?

(a) Sphere with greater rotational energy at bottom than cylinder

(b) Sphere with lesser rotational energy at bottom than cylinder

(c) Cylinder with greater rotational energy at bottom than sphere

(d) Both reach the bottom simultaneously with equal rotational energy at bottom

85. A light rope is loaded with many equal weights at equal horizontal intervals. The points of suspension on the rope lie on a

(a) Parabola (b) Catenary

(c) Cycloid (d) Ellipse

86. Free body diagram is an

(a) Isolated joint with only body forces acting on it

(b) Isolated joint with internal forces acting on it

(c) Isolated joint with all the forces, internal as well as external, acting on it

(d) None of these

87. The graphical method of determining the forces in the members of a truss is based on

(a) Method of joint (b) Method of section

(c) Either method (d) None of the two methods

88. If the direction of projection bisects the angle between the vertical and the inclined plane, then the range of projectile on the inclined plane is

(a) Zero
(b) Maximum
(c) Minimum
(d) None of these

89. The tension in a cable supporting a lift

(a) Is more when the lift is moving downwards
(b) Is less when the lift is moving upwards
(c) Remains constant whether its moves downwards or upwards
(d) Is less when the lift is moving downwards

90. The inherent property of a body which offers reluctance to change its state of rest or uniform motion, is

(a) Weight
(b) Mass
(c) Inertia
(d) Momentum

91. Pick up the correct statement from the following. The kinetic energy of a body

(a) Before impact is equal to that after impact
(b) Before impact is less than that after impact
(c) Before impact is more than that after impact
(d) Remain constant

92. Three forces which act on a rigid body to keep it in equilibrium. The forces must be coplanar and

(a) Concurrent
(b) Parallel
(c) Concurrent parallel
(d) None of these

93. The maximum pull in a cable, carrying a uniformly distributed load and supported at two ends which are at the same level, is at

(a) Supports
(b) Quarter span
(c) Mid span
(d) None of these

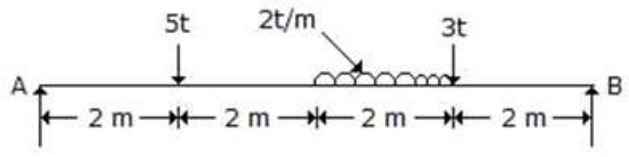
94. The centre of gravity of a homogenous body is the point at which the whole

(a) Volume of the body is assumed to be concentrated
(b) Area of the surface of the body is assumed to be concentrated
(c) Weight of the body is assumed to be concentrated
(d) All the above

95. A force P of 50 N and another force Q of unknown magnitude act at 90° to each other. They are balanced by a force of 130 N. The magnitude of Q is

(a) 60 N
(b) 80 N
(c) 100 N
(d) 120 N

96. The ratio of the reactions RA and RB of a simply supported beam shown in below figure is



(a) 0.50
(b) 0.40
(c) 0.67
(d) 1.00

97. One Joule is equivalent to

(a) 9.81 Newton metre
(b) 1 Newton metre
(c) 1 kg wt metre
(d) 1 dyne metre

98. For perfectly elastic bodies, the value of coefficient of restitution is

(a) Zero
(b) 0.5
(c) 1.0
(d) Between 0 and 1

99. A stone was thrown vertically upwards from the ground with a velocity of 50 m/sec. After 5 seconds another stone was thrown vertically upwards from the same place. If both the stones strike the ground at the same time, then the velocity with which the second stone was thrown should be (Assume $g = 10$ m/sec^2)

(a) 15 m/sec
(b) 25 m/sec
(c) 40 m/sec
(d) 50 m/sec

100. To double the period of oscillation of a simple pendulum

(a) The mass of its bob should be doubled
(b) The mass of its bob should be quadrupled
(c) Its length should be quadrupled
(d) Its length should be doubled

* * * * * * *