

**MIZORAM PUBLIC SERVICE COMMISSION**  
**TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO**  
**JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE**  
**UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, 2014**

**CIVIL ENGINEERING**  
**PAPER - I**

Time Allowed : 3 hours

Full Marks : 200

*Attempt all questions.*

**Part A - Objective Type Questions (100 Marks)**

*All questions carry equal marks of 2 each.*

1. The initial setting time of ordinary portland cement should not be less than
  - (a) 15 minutes
  - (b) 30 minutes
  - (c) 45 minutes
  - (d) 60 minutes
2. The increase in volume of dry sand when water is added is called
  - (a) honey combing
  - (b) bulking
  - (c) segregation
  - (d) curing
3. In a well-seasoned timber, the moisture content will be in the range of
  - (a) 20-25%
  - (b) 15-20%
  - (c) 10-12%
  - (d) 5-7%
4. The maximum permissible eccentricity of load on a rectangular foundation of width B is equal to
  - (a) B/3
  - (b) B/6
  - (c) B/2
  - (d) B/4
5. The suitable remedy for the acoustic defect of sound foci in the new design
  - (a) add sound absorbers
  - (b) introduce suitable diffusers
  - (c) avoid curvilinear interiors
  - (d) none of these
6. Separation of water or water sand cement from a freshly mixed concrete is known as
  - (a) bleeding
  - (b) creeping
  - (c) segregation
  - (d) flooding
7. The top diameter, bottom diameter and the height of a slump mould are
  - (a) 10 cm, 20 cm, 30 cm
  - (b) 20 cm, 30 cm, 10 cm
  - (c) 30 cm, 20 cm, 10 cm
  - (d) 20 cm, 40 cm, 60 cm
8. The maximum area of longitudinal steel reinforcement in a column is
  - (a) 3%
  - (b) 4%
  - (c) 5%
  - (d) 6%

9. When HYSD bars are used the minimum quantity of reinforcement in a slab in each principal direction is
- (a) 0.12% (b) 0.13%  
(c) 0.16% (d) 0.60%
10. The thickness at the edge of a reinforced concrete footing resting on soil shall not be less than
- (a) 25 cm (b) 20 cm  
(c) 15 cm (d) 10 cm
11. In limit state method of design it is assumed that the maximum strain in concrete for the outermost compression fiber is
- (a) 0.0065 (b) 0.0055  
(c) 0.0045 (d) 0.0035
12. The strength of a riveted joint is equal to
- (a) shearing strength of the rivets (b) bearing strength of the rivets  
(c) tearing strength of the plate (d) least of (a), (b) and (c)
13. The slenderness ratio of lacing bars is limited to
- (a) 200 (b) 145  
(c) 350 (d) 400
14. Horizontal stiffeners are provided in plate girders if the thickness of the web is
- (a) 8 mm (b) less than  $\frac{d}{200}$   
(c) less than  $\frac{L}{200}$  (d) equal to that of flange
15. A body will be in equilibrium when
- (a) the algebraic sum of vertical components of all forces is zero  
(b) the algebraic sum of horizontal components of all forces is zero  
(c) the algebraic sum of moments components of all forces is zero  
(d) all of these
16. One newton is equal to
- (a)  $10^3$  dyne (b)  $10^4$  dyne  
(c)  $10^5$  dyne (d)  $10^6$  dyne
17. Moment of Inertia of a circular section of diameter 'd' about an axis passing through its C.G. and lying in the plane of the section is given by
- (a)  $I_x = \frac{\pi d^4}{32}$  (b)  $I_x = \frac{\pi d^4}{64}$   
(c)  $I_x = \frac{\pi d^4}{16}$  (d) none of these
18. The Poisson's Ratio is the ratio of
- (a) lateral elongation to linear elongation (b) lateral stress to linear stress  
(c) lateral strain to longitudinal strain (d) Young's Modulus to Modulus of Rigidity

19. Point of contra flexure is defined as the point

- (a) Where Shear force is maximum
- (b) Where Shear force changes its sign
- (c) Where Bending moment is maximum
- (d) Where Bending moment changes sign

20. Simple bending equation is

- (a)  $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$
- (b)  $\frac{I}{M} = \frac{E}{R} = \frac{F}{Y}$
- (c)  $\frac{M}{I} = \frac{E}{R} = \frac{F}{Y}$
- (d)  $\frac{M}{I} = \frac{R}{E} = \frac{Y}{F}$

21. When an end of a continuous beam is fixed, in Kani's method, the rotation contribution will be

- (a) zero
- (b)  $\frac{EI}{l}$
- (c)  $\frac{2EI}{l}$
- (d)  $\frac{4EI}{l}$

22. Numbers of bricks required in one cubic meter of brick masonry is

- (a) 400
- (b) 450
- (c) 500
- (d) 550

23. Distemper is used to coat

- (a) External concrete surface
- (b) Interior surfaces not exposed to weather
- (c) Wood work
- (d) Compound walls

24. 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

25. The Young's Modulus of elasticity of steel is

- (a) 150 kN/mm<sup>2</sup>
- (b) 200 kN/mm<sup>2</sup>
- (c) 250 kN/mm<sup>2</sup>
- (d) 300 kN/mm<sup>2</sup>

26. Steel beam theory is used for

- (a) design of simple steel beams
- (b) steel beams encased in concrete
- (c) doubly reinforced beams ignoring compressive stress in concrete
- (d) beams if shear exceeds 4 times of allowable shear stress

27. Poisson's ratio for steel within elastic limit ranges from

- (a) 0.15 to 0.20
- (b) 0.25 to 0.24
- (c) 0.25 to 0.33
- (d) 0.45 to 0.50

28. The path traced by a projectile in the sky is

- (a) circular
- (b) parabolic
- (c) elliptical
- (d) catenary

29. The equation of motion of a particle starting from rest along straight line  $x=t^3-3t^2+5$ . The ratios of velocities after 3 second and 5 second will be

- (a) 2
- (b) 3
- (c) 4
- (d) 5

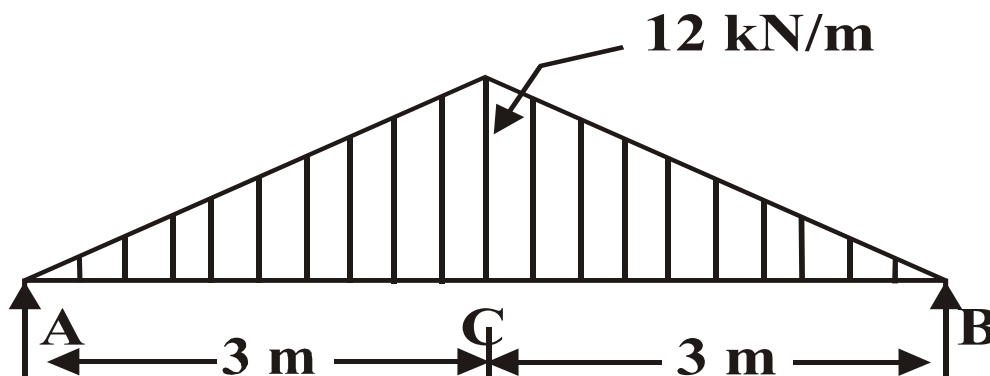
30. Shear stress on principal planes is  
(a) Zero (b) Maximum  
(c) Minimum (d) None of these
31. A rectangular block of size 200mm x 100 mm x 50 mm is subjected to a shear stress of 100 N/mm<sup>2</sup>. If modulus of rigidity of material is  $1 \times 10^5$  N/mm<sup>2</sup>, strain energy stored will be  
(a) 10 N.m (b) 25 N.m  
(c) 50 N.m (d) 100 N.m
32. The ratio of intensity of stress in case of a suddenly applied load to that of in case of a gradually applied load is  
(a)  $\frac{1}{2}$  (b) 1  
(c) 2 (d) more than 2
33. A truss containing  $j$  joints and  $m$  member will be a simple truss if  
(a)  $m=2j-3$  (b)  $j=2m-3$   
(c)  $m=3j-2$  (d)  $j=3m-2$
34. The forces in the members of simple trusses may be analyzed by  
(a) graphical method (b) method of joints  
(c) method of sections (d) all of these
35. A steel rod 1 m long having square cross section is pulled under a tensile load of 8 tones. The extension in the rod was 1 mm only. If  $E_{\text{steel}}=2 \times 10^6$  kg/cm<sup>2</sup>, the side of the rod is  
(a) 4 cm (b) 2 cm  
(c) 1 cm (d) 1.5 cm
36. The bond in a brick work when headers and stretchers are placed in alternate layers is called  
(a) Header Bond (b) English Bond  
(c) Flemish Bond (d) Herring Bone Bond
37. To increase the setting time of cement the following is added  
(a) Calcium Hydroxide (b) Sodium  
(c) Red Oxide of Mercury (d) Gypsum
38. Fire resistant mortars are made by using clay  
(a) Free from lime (b) Containing Iron oxide  
(c) Containing Dissolved Air (d) Of low compaction
39. The factor mainly contributing to the strength of cement concrete is  
(a) Aggregate Quantity (b) Cement Quantity  
(c) Water Quantity (d) Water Cement Ratio
40. The type of window provided on the sloping side of a pitched roof is called  
(a) Gable window (b) Dormer window  
(c) Lantern (d) None of these
41. The height between two floors is 3.0 m and riser is 150 mm. Assuming two flights between the floors, the number of the treads will be  
(a) 18 (b) 19  
(c) 20 (d) 21

42. Floor Area Ratio (FAR) is calculated as
- (a) Ratio of total covered area of all floors to the plot area
  - (b) Ratio of plot area to the total covered area of all floors
  - (c) Ratio of covered area of ground floor to the plot area
  - (d) Ratio of plot area to the covered area of ground floor
43. As per the National Building Code, the height of all rooms for human habitation shall not be less than from the surface of the floor to the lowest point of the ceiling (bottom of slab).
- (a) 2.5 m
  - (b) 2.75 m
  - (c) 3.0 m
  - (d) 3.25 m
44. Coefficient of friction depends on
- (a) Nature of surfaces only
  - (b) Area of contact only
  - (c) Both (a) and (b)
  - (d) None of these
45. If one end of a prismatic beam AB with fixed ends is given a transverse displacements  $\Delta$  without any rotation, then the transverse reactions at A or B due to displacement is
- (a)  $6EI\Delta/L^2$
  - (b)  $6EI\Delta/L^3$
  - (c)  $12EI\Delta/L^2$
  - (d)  $12EI\Delta/L^3$
46. In a thin cylinder, the ratio of hoop stress to longitudinal stress is
- (a)  $\frac{1}{2}$
  - (b) 2
  - (c)  $\frac{1}{4}$
  - (d) 4
47. Euler's buckling load for both end fixed
- (a)  $\frac{\pi^2 EI}{l^2}$
  - (b)  $\frac{2\pi^2 EI}{l^2}$
  - (c)  $\frac{4\pi^2 EI}{l^2}$
  - (d)  $\frac{\pi^2 EI}{4l^2}$
48. In case of simply supported I-section beam of span  $L$  and loaded with central load  $W$ , the length of elasto-plastic zone of the plastic hinge is
- (a)  $L/4$
  - (b)  $L/5$
  - (c)  $L/6$
  - (d)  $L/8$
49. Maximum distance between expansion joints in structure as per IS 456 is
- (a) 20 m
  - (b) 30 m
  - (c) 45 m
  - (d) 60 m
50. The depth of footing for an isolated column is governed by
- 1) Maximum bending moment,
  - 2) Shear Force,
  - 3) Punching Shear;
- The Correct answer is :
- (a) Only (1)
  - (b) Both (1) and (2)
  - (c) Both (1) and (3)
  - (d) All (1), (2) and (3)

**Part B - Short Answer Questions (100 Marks)**

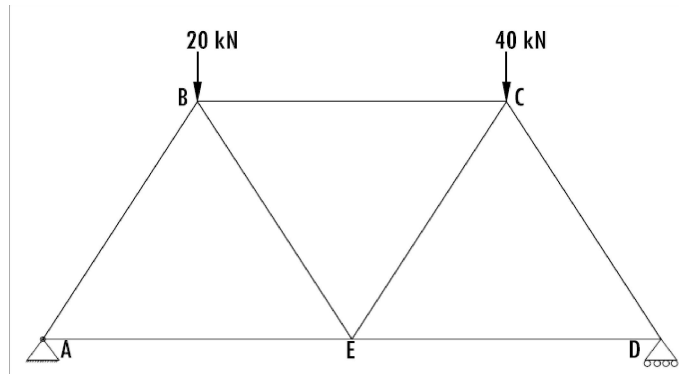
*All questions carry equal marks of 5 each.*

51. Describe about balanced section, under reinforced section and over reinforced sections.
52. State various types of losses of pre stressed concrete.
53. A bar 40 mm in diameter is subjected to a tensile force of 40000kg. The extension of the bar measured over a gauge length of 200 mm was 0.318 mm. the decrease in diameter was found to be 0.02 mm. Calculate values of Young's modulus of elasticity and modulus of rigidity of the materials.
54. The boundary walls of a bungalow are 25 cm thick and 2 m high above the base. Calculate the wind pressure which will cause tension at the base. The unit weight of masonry is  $1920 \text{ kg/m}^3$ .
55. A steel shaft is subjected to torque of 2000 kgm and a bending moment 1000 kgm. Diameter of the shaft = 10 cm. Calculate maximum, minimum principle stresses and maximum shear stress in the shaft at its surface.
56. Discuss about the various conditions of stability of Dams and Retaining walls.
57. Define Plastic moment, plastic hinge, shape factor and load factor.
58. State ten requirements of good stairs.
59. Write briefly the causes of failure of foundations.
60. Explain the general principles of planning of a residential building.
61. Calculate limiting moment of resistance of RCC beam of size  $250 \text{ mm} \times 400 \text{ mm}$ . Use M 25 grade of concrete and Fe 415 grade of steel.
62. Determine the different dimensions of a square isolated footing for a column of  $450 \text{ mm} \times 450 \text{ mm}$  carrying an axial load of 600 kN; Use safe bearing capacity of soil  $120 \text{ kN/m}^2$ , Use M 20 grade of concrete and Fe 415 grade of steel.
63. Design a suitable fillet weld to connect a tie bar  $60 \times 8 \text{ mm}$  to a 12 mm thick gusset plate. The permissible stresses in the tie bar and fillet weld are 150 Mpa and 108 Mpa respectively.
64. A steel wire 6 mm in diameter is used for hoisting purposes in building construction. If 150 m of the wire is hanging vertically and Load of 1 kN is being lifted at the lower end of the wire, determine the total elongation considering the both external load and the self-weight. Take the weight density of the steel as  $7.7 \times 10^4 \text{ N/mm}^3$  and  $E = 200 \text{ GN/m}^2$ .
65. Derive the expression of Crippling load for long column for both end hinged.
66. A simply supported beam of 6 m long carrying uniformly varying load from zero at each end to 12 kN per unit length at the center as shown in figure 1. Draw SFD and BMD.



**Figure 1**

67. Determine the member forces of the truss shown in figure 2. The sectional area of each member is  $1500 \text{ mm}^2$ . Take  $AB=BC=CD=DE=EA=BE=EC=3 \text{ meter}$  and  $E=2 \times 10^5 \text{ N/mm}^2$ .



**Figure 2**

68. Classify doors according to their movements.  
69. Differentiate between Ashlar masonry and Rubble masonry.  
70. Compare English bond and Flemish bond of brick masonry.

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