

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC HEALTH DEPARTMENT, GOVERNMENT OF MIZORAM, MARCH, 2019.

CIVIL ENGINEERING PAPER - I

Time Allowed : 3 hours

FM : 200

SECTION - A (Multiple Choice questions)

(100 Marks)

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

This Section should be answered only on the OMR Response Sheet provided.

- Which of the following is not an assumption in Euler's beam theory?
 - Column is initially straight and loaded axially.
 - Beam material is homogeneous, isotropic and elastic.
 - Plane section before bending remains plane after bending.
 - Beam axis bends but does not stretch.
- For an element subjected to pure shear stress τ N/mm², the maximum principal stress will be
 - 2τ
 - $\tau/2$
 - τ
 - 4τ
- The value of Poisson's ratio ranges between
 - 0 and 0.5
 - 0.5 and 0.5
 - 0 and 1
 - 1 and 0.5
- For a material to be considered incompressible, its Poisson's ratio should approach
 - 0.25
 - 0
 - 0.5
 - 1
- A column is defined as short, when the slenderness ratio for the column (L_{eff}/r) is less than
 - 100
 - 50
 - 200
 - None of these
- A material is referred to as perfectly rigid if modulus of elasticity of the material is
 - Unity
 - Zero
 - Equal to carbon
 - Infinity
- A column is restrained against rotation at one end and the other end is left free. Euler buckling load for column would be
 - $\frac{\pi^2 EI}{4L^2}$
 - $\frac{4\pi^2 EI}{L^2}$
 - $\frac{2\pi^2 EI}{L^2}$
 - $\frac{\pi^2 EI}{L^2}$

8. Strain energy density at rupture is defined as
- (a) Modulus of resilience (b) Modulus of toughness
(c) Modulus of elasticity (d) Sheen Modulus
9. Match List-I with List-II and select the correct answer from the codes given below
- | <u>List-I</u> | <u>List-II</u> |
|------------------------|--|
| 1. Poisson's ratio | i. Measure of compressibility |
| 2. Bulk modulus | ii. Ratio of shear stress to shear strain |
| 3. Modulus of rigidity | iii. Ratio of lateral strain to axial strain |
| 4. Young's modulus | iv. Ratio of axial stress to axial strain |
- (a) 1-iii, 2-i, 3-ii, 4-iv (b) 1-ii, 2-iv, 3-iii, 4-ii
(c) 1-iii, 2-ii, 3-i, 4-iv (d) 1-iii, 2-i, 3-iv, 4-ii
10. Corrosion resisting ability of structural steel can be enhanced by applying a finishing coat of
- (a) zinc and chromium (b) zinc and aluminium
(c) Aluminium and nickel (d) Nickel and chromium
11. The Mix proportion M-10 is
- (a) 1:5:10 (b) 1:4:8
(c) 1:3:6 (d) 1:2:4
12. Fineness modulus for coarse sand ranges between
- (a) 2.2 and 2.6 (b) 2.6 and 2.9
(c) 2.9 and 3.2 (d) 2.2 and 3.2
13. Estimate of a residential building estimated using plinth area rate comes under
- (a) Preliminary estimate (b) Engineer's estimate
(c) Bid estimate (d) All of these
14. Engineer's estimate is prepared using
- (a) Lumpsum price (b) contractor's rate
(c) wholesale price (d) unit price
15. In limit state, factor of safety for steel and concrete shall be based on
- (a) Yield strength of steel and ultimate strength of concrete
(b) Ultimate strength of steel and concrete
(c) Both (a) & (b)
(d) None of these
16. The minimum reinforcement for axially loaded columns is
- (a) 4 % of cross sectional area (b) 1.8 % of cross sectional area
(c) 0.8 % of cross sectional area (d) 6 % of cross sectional area
17. In reinforced concrete columns, lateral reinforcement is designed to resist
- (a) Compression (b) Shear
(c) Buckling of longitudinal bars (d) Bending moment and shear force
18. Which of the following sections shall be preferred to ensure ductile failure of RC beams?
- (a) Under reinforced section (b) Balanced section
(c) Over reinforced section (d) Non prismatic section

19. If the area of tensile reinforcement is doubled, the moment of resistance for the beam increases by
(a) 100% (b) 22%
(c) 50% (d) 200%
20. Distance between centres of two consecutive rivets measured along row of rivets is defined as
(a) gauge distance (b) pitch
(c) edge distance (d) staggered pitch
21. The slenderness ratio of lacing bar shall not exceed
(a) 120 (b) 145
(c) 160 (d) 165
22. Permissible bending stress in compression for laterally supported beams shall not exceed
(a) $0.6 f_y$ (b) $0.66 f_y$
(c) $0.75 f_y$ (d) $0.4 f_y$
23. Maximum deflection permissible as per IS : 800-1984 is restricted to
(a) $\frac{span}{160}$ (b) $\frac{span}{320}$
(c) $\frac{span}{325}$ (d) $\frac{span}{384}$
24. For a given depth, which of the following I-section represents the heaviest section?
(a) ISMB (b) ISLB
(c) ISHB (d) ISWB
25. Lateral buckling of web is prevented by
(a) intermediate vertical stiffener (b) bearing stiffener
(c) web splice (d) flange plate
26. Shape factor is a property that depends on
(a) ultimate stress of material (b) geometry of cross section
(c) yield stress of material (d) both (a) & (c)
27. Column-I give a list of test methods for evaluating properties of concrete and Column-II gives the list of properties.
- | Column-I | Column-II |
|----------------------------|----------------------------------|
| P. Resonant frequency test | 1. Tensile strength |
| Q. Rebound Hammer test | 2. Dynamic modulus of elasticity |
| R. Split cylinder test | 3. Workability |
| S. Compacting factor test | 4. Compressive Strength |
- The correct match of the test with the property is
(a) P-2, Q-4, R-1, S-3 (b) P-2, Q-1, R-4, S-3
(c) P-2, Q-4, R-3, S-1 (d) P-4, Q-3, R-1, S-2
28. 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
29. The term EI is called as
(a) moment of resistance (b) flexural rigidity
(c) compressive strength (d) tensile strength

30. A body will be in equilibrium condition when external effect on a body is:
- (a) Minimum
 - (b) Maximum
 - (c) Zero
 - (d) None
31. Stresses are occurred due to
- (a) shear force and compressive force
 - (b) Bending moment and wind force
 - (c) shear force and tensile force
 - (d) Bending moment and shear force
32. Clay and silt content in a good brick earth must be at least
- (a) 30%
 - (b) 25%
 - (c) 45%
 - (d) 50%
33. Strength of cement concrete primarily depends upon
- (a) quality of water
 - (b) quantity of concrete
 - (c) quantity of cement
 - (d) water cement ratio
34. Soundness of cement is tested using
- (a) vicat's apparatus
 - (b) compressive strength test
 - (c) slump cone test
 - (d) le-chatelier apparatus
35. 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 the above
36. Seasoning of timber is done
- (a) to remove water
 - (b) to clean the timber
 - (c) to paint its surface
 - (d) all of these
37. The condition when concrete and steel reinforcement reach its maximum permissible limit at the same time is
- (a) balanced section
 - (b) under reinforced
 - (c) over reinforced
 - (d) deformed section
38. Strength gaining of Ordinary Portland Cement after 7 days curing
- (a) 75% of design strength
 - (b) 70% of design strength
 - (c) 65% of design strength
 - (d) 50% of design strength
39. 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
40. Hooke's law is obeyed by a material with its
- (a) Plastic Limit
 - (b) Yield Limit
 - (c) Limit of Proportionality
 - (d) Elastic limit
41. The neutral axis is a section
- (a) at the centroid axis
 - (b) at the middle axis
 - (c) where strain change its sign
 - (d) where the principal stress is zero
42. The weakest section in a fillet is
- (a) Side perpendicular to force
 - (b) throat of the fillet
 - (c) smaller side
 - (d) none of these

43. Sand particles are made up of
(a) clay (b) rock minerals
(c) chemical (d) fly ash
44. The relation between modulus of rupture f_{cr} and characteristic strength of concrete f_{ck} is given by
(a) $f_{cr} = 0.4\sqrt{f_{ck}}$ (b) $f_{cr} = 0.5\sqrt{f_{ck}}$
(c) $f_{cr} = 0.7\sqrt{f_{ck}}$ (d) $f_{cr} = 1.2\sqrt{f_{ck}}$
45. Timber as a material is not suitable for the construction of
(a) Fender piles (b) Friction piles
(c) Tension pile (d) None of these
46. In limit state approach, spacing of main reinforcement controls primarily
(a) Collapse (b) Durability
(c) Cracking (d) Deflection
47. In RCC beam, side face reinforcement is provided, if its depth exceeds
(a) 300 mm (b) 500 mm
(c) 800 mm (d) 750 mm
48. Shear span is defined as the zone where
(a) Bending moment is zero (b) Shear force is zero
(c) Shear force is constant (d) Bending moment is constant
49. 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%
50. Which of the following is generally not designed for shear
(a) A cantilever beam (b) A slab
(c) A footing (d) None of these

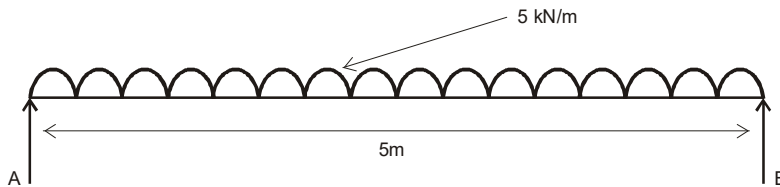
SECTION - B (Short answer type question)
(100 Marks)

All questions carry equal marks of 5 each.

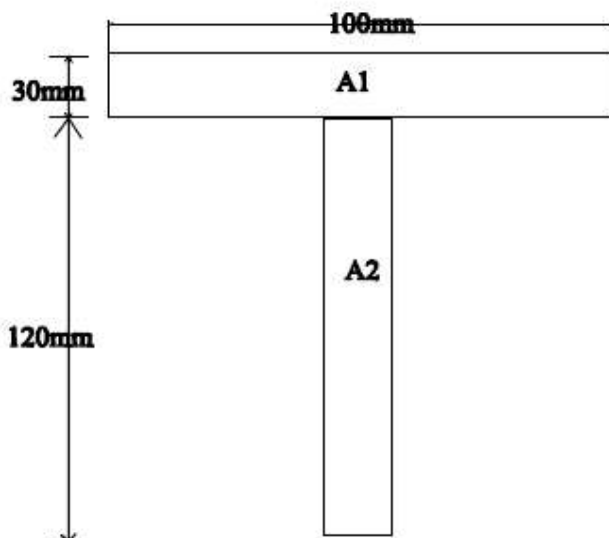
*This Section should be answered only on the **Answer Sheet** provided.*

1. What are the constituents of good brick earth and their functions?
2. What are the qualities required for good bricks? Mention the factors which affect the strength of bricks?
3. Describe Field test for cement.
4. Why the river sand is widely used for all purposes? State the functions of sand in mortar.
5. What are the natural sources of sand? Write the classification of sands.
6. Define and explain workability of concrete.
7. What is meant by curing of concrete? What are its purposes?

8. Discuss the methods adopted for the preservation of timber.
9. State the advantages and disadvantages of timber construction.
10. What are different zones of sand as per IS code? What zone is recommended for good concrete? What do you mean standard sand?
11. List the various types of loss of prestress in pretension and post-tensioned members.
12. Define water/cement ratio and water/binder ratio. Why and how does water/cement ratio affects compressive strength of concrete?
13. State the difference between a design mix and nominal mix.
14. Calculate the strength of ISA 40 × 25, 6 mm thick when used as a tension member with its longer leg connected by (i) 14 mm diameter rivets and (ii) fillet weld.
15. Write down the difference between statically determinate and statically indeterminate structure?
16. Draw bending moment diagram (BMD) and shear force diagram (SFD) for udl (uniformly distributed load).



17. Design a one way simply supported slab with the following data span = 4.5 m; live load = 4 kN/m² floor finish = 1 kN/m², partitions = 1 kN/m² ; concrete M15 and steel Fe 415. Design constants: concrete M15 and steel Fe 415, $f_{ck} = 15 \text{ N/mm}^2$; $f_y = 415 \text{ N/mm}^2$; $x_{u_{max}} = 0.479d$, $p_{t_{lim}} = 0.72$, $M_{u_{lim}} = 0.138bd^2f_{ck}$.
18. What are the assumptions made in the theory of bending as applied to reinforced concrete?
19. Locate the centroid of the I –section



20. Determine the buckling load for a strut of tee section, the flange width being 100 mm, overall depth 80 mm and both flange and stem 10 mm thick. The strut is 3 m long and is hinged at both ends. Take $E = 200 \text{ G N/mm}^2$.