

**MIZORAM PUBLIC SERVICE COMMISSION**  
**COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S.**  
**UNDER POWER & ELECTRICITY DEPARTMENT, AUGUST, 2018.**

**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.*

1. The rocks which are formed due to cooling of magma at a considerable depth from the earth's surface are called
  - (a) Plutonic rocks
  - (b) Metamorphic rocks
  - (c) Volcanic rocks
  - (d) Sedimentary rocks
2. Stones used for retaining walls must be
  - (a) Hard
  - (b) Heavy
  - (c) Impermeable
  - (d) Smooth
3. Plywood has the advantage of
  - (a) Greater tensile strength in longer direction
  - (b) Greater tensile strength in shorter direction
  - (c) Same tensile strength in all directions
  - (d) None of these
4. A 1<sup>st</sup> class brick immersed in water for 24 hours, should not absorb water (by weight) more than
  - (a) 30 %
  - (b) 25 %
  - (c) 20 %
  - (d) 15 %
5. Due to the attack of dry rot, the timber
  - (a) Cracks
  - (b) Shrinks
  - (c) Discolour
  - (d) Reduces to powder
6. The minimum strength of the mortar used in load bearing brick masonry, is
  - (a) 50 N/cm<sup>2</sup>
  - (b) 100 N/cm<sup>2</sup>
  - (c) 150 N/cm<sup>2</sup>
  - (d) 200 N/cm<sup>2</sup>
7. The types of bond in a brick masonry containing alternate courses of stretchers and headers, is called
  - (a) English bond
  - (b) Russian bond
  - (c) Flemish bond
  - (d) Mixed bond
8. A wall constructed to resist the pressure of an earth filling is called
  - (a) Retaining wall
  - (b) Breast wall
  - (c) Buttress wall
  - (d) Parapet wall

9. According to Whitney's theory, depth of stress block for a balanced section of a concrete beam is limited to
- (a) 0.43 d (b) 0.537 d  
(c) 0.68 d (d) 0.85 d
10. In ordinary residential and public buildings, the damp proof course is generally provided at
- (a) Ground level  
(b) Plinth level  
(c) Water table level  
(d) Midway between ground level and water table
11. According to IS 456 the maximum reinforcement in column is
- (a) 2 % (b) 4 %  
(c) 5 % (d) 6 %
12. The number of bricks required for one cubic meter of brick masonry is
- (a) 400 (b) 450  
(c) 500 (d) 550
13. For M150 mix concrete, according to I.S specifications, local bond stress, is
- (a) 7 kg/cm<sup>2</sup> (b) 10 kg/cm<sup>2</sup>  
(c) 15 kg/cm<sup>2</sup> (d) 20 kg/cm<sup>2</sup>
14. Early attainment of strength in rapid hardening cement is mainly due to
- (a) Gypsum (b) Finer grinding  
(c) Tri-Calcium Silicate (d) Tri-Calcium Aluminate
15. 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
16. 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
17. 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
18. 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) None of these

Where  $f_y$  is the characteristic strength of steel and  $E_s$  is the modulus of elasticity.

19. 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)  $0.57 F_{ck}$
20. 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)  $L/360$
21. 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 these
22. 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 these
23. The heaviest I-section for same depth is  
(a) ISMB (b) ISLB  
(c) ISHB (d) ISWB
24. 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
25. 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 in rafter (d) Bending moment in rafter
26. If a number of forces are acting at a point, their resultant will be inclined at an angle  $\theta$  with the horizontal, such that  
(a)  $\tan \theta = \Sigma H / \Sigma V$  (b)  $\tan \theta = \Sigma V / \Sigma H$   
(c)  $\tan \theta = \Sigma H \times \Sigma V$  (d)  $\tan \theta = \sqrt{\Sigma H / \Sigma V}$
27. Three forces which acts on a rigid body to keep it in equilibrium. The forces must be coplanar and  
(a) Concurrent (b) Parallel  
(c) Concurrent and Parallel (d) None of these
28. The moment of inertia of a circular section about its diameter (d) is  
(a)  $\frac{\Pi d^3}{16}$  (b)  $\frac{\Pi d^3}{32}$   
(c)  $\frac{\Pi d^4}{32}$  (d)  $\frac{\Pi d^4}{64}$

29. The maximum frictional force which comes into play, when a body just begin to slide over the surface of the other body, is known as
- (a) Static friction (b) Dynamic friction  
(c) Limiting friction (d) Coefficient of friction
30. Which of the following is a scalar quantity?
- (a) Force (b) Speed  
(c) Velocity (d) Acceleration
31. 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)  $2g\sqrt{h}$
32. 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) Poisson’s law (d) Hooke’s law
33. 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)  $\sqrt{p_1^2 - p_2^2}$
34. 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
35. 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
36. 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
37. 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

38. A bending moment may be defined as,
- (a) Arithmetic sum of the moments of all the forces on either side of the section
  - (b) Arithmetic sum of the forces on either side of the section
  - (c) Algebraic sum of the moments of all the forces on either side of the section
  - (d) None of these
39. 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)  $\frac{ML^2}{2EI}$
40. Which of the following is not the displacement method:
- (a) Equilibrium Method
  - (b) Column Analogy Method
  - (c) Moment distribution Method
  - (d) Kani's Method
41. 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
42. 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
43. 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
44. In a portal frame of strong column and weak beam fixed at both ends
- (a) The beam does not deform and the column buckled in half-sine wave.
  - (b) The column does not buckle but the beam deformed in full-sine wave.
  - (c) The beam deforms in full-sine wave and column deforms in half-sine wave.
  - (d) Both the beam and column deform in full-sine wave.
45. 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)  $\frac{1}{3} \int \frac{M^2 dx}{EI}$

46. The carryover factor in a prismatic member whose far end is hinged is  
(a) 0 (b)  $\frac{1}{2}$   
(c)  $\frac{3}{4}$  (d) 1
47. The deformation of a spring produced by a unit load is called  
(a) Stiffness (b) Flexibility  
(c) Influence coefficient (d) Unit strain
48. 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) Increase (b) Decrease  
(c) Remain constant (d) Change their direction
49. 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
50. The shape of a suspended cable for a uniformly distributed load over it, is  
(a) Triangle (b) rectangle  
(c) Parabola (d) Cubic parabola

**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. Enumerate the situation in which doubly reinforced concrete beams become necessary. What is the role of compression steel?
2. Explain Varignon's theorem with examples.
3. How bricks are classified as per IS Code? What are the properties associated with this classification
4. What is decay in timber? How it is detected and lists out the various reasons for early decay of timber.
5. Write a short note on composition and properties of refractory bricks.
6. Briefly discuss the importance of determining the initial and final setting time of cement.
7. What is ferrocement, lists out various properties of ferrocement.
8. Explain the steps involve in the design of slab for residential building considering various loads acting on it, along with check required.
9. Draw the bending moment diagram of a beam from the shear force diagram of the beam shown in fig 1.

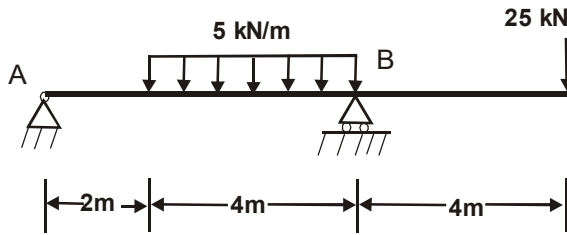


Figure 1

10. A horizontal steel cantilever is fixed at end A and it is free end B supports a vertical load 60 kN. The cross section of the cantilever is rectangular, 3 cm wide, 12 cm deep, AB is 30 cm length. Calculate magnitude and direction of principal stresses at end A at 2 cm above the neutral axis.
11. Distinguish between yield moment and plastic moment capacity of a section.
12. At a point in a elastic material, a direct tensile stress of 600 MPa and a direct compressive stress of 400 MPa are applied on a plane at right angles to each other. If the maximum principal stress in the material is to be limited to 650 MPa, find out the shear stress that may be allowed on the planes.
13. A flat steel plate is acted upon by various stresses. Along x axis  $\sigma_x = 10,000 N / mm^2$ , along y axis  $\sigma_y = 6,000 N / mm^2$  and  $\tau_{xy} = 8,000 N / mm^2$ . Find the magnitude and the orientation of the principal stress in the plane of the plate.
14. Explain the principle on which plastic design of steel structure is based? What are its essential properties?
15. What is the principle of design of splice in a steel member subjected to an axial tensile force?
16. State the assumptions made for riveted connection in steels. Name the various types of rivet failures.
17. Derive an expression for limiting percentage of tensile reinforcement of flexural reinforced cement concrete.
18. A propped cantilever beam of length 4 m is subjected to UDL of 30 KN/m over the entire length of span. If the flexural rigidity of the beam is  $2 \times 10^4 \text{ KNm}^2$ , what would be the rotation at the propped support of the beam?
19. Find the vertical deflection at C (Fig 2) if the temperature in the member BC is raised by  $30^\circ$ . Given  $\alpha = 6 \times 10^{-6} / ^\circ\text{C}$  and  $AE = 5 \times 10^7 \text{ Nmm}^2$ .

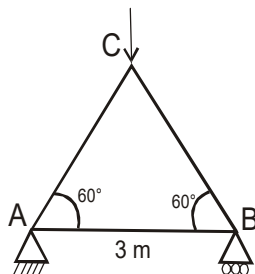


Figure 2

20. Explain with neat figure Mohr's circle of stress with its practical application.