MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (COMBINED)
UNDER VARIOUS DEPARTMENT,
GOVERNMENT OF MIZORAM, JULY-2024

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. In a mortar, the binding material is :
(a) Cement (b) Water
(c) Sand (d) Coarse Aggregate

2. The standard size of a masonry brick is
(a) 18cm × 18cm × 18cm (b) 19cm × 9cm × 9cm
(c) 20cm × 10cm × 10cm (d) 21cm × 11cm × 11cm

3. Excess of alumina in brick earth makes the brick
(a) To lose cohesion (b) Impermeable
(c) To crack and warp on drying (d) Brittle and weak

4. Vicat apparatus is used for
(a) Soundness test (b) Standard consistency test
(c) Fineness test (d) Compressive strength test

5. Inner part of a timber log surrounding the pitch, is called
(a) Sapwood (b) Cambium layer
(c) Heart wood (d) Mid wood

6. Clay and silt content in a good brick earth must be at least
(a) 20% (b) 30%
(c) 40% (d) 50%

7. The main constituent of cement responsible for initial setting properties of cement is
(a) Dicalcium silicate (b) Tricalcium silicate
(c) Tricalcium aluminate (d) Tetra calcium alumina ferrite

8. The liquid which is mixed in paint to make the paint thinner or of desired consistency so that it can be easily applied on the surface is called
(a) Pigment (b) Solvent
(c) Plasticizer (d) Extender

9. A three-hinged arch is said to be :
   (a) statically determinate structure
   (b) statically indeterminate structure
   (c) a bent beam
   (d) a 90^0 beam

10. The term 'SOFFIT' represents which part of the staircases.
   (a) Top surface of stairs
   (b) Outer projection of a tread
   (c) Side surface of stairs
   (d) Under surface of stairs

11. The strength of the concrete is indirectly proportional to
   (a) water cement ratio
   (b) water sand ratio
   (c) sand cement ratio
   (d) aggregate water ratio

12. Which criteria are considered in the Limit State Method?
   (a) Control of Deflection
   (b) Deflection and Flexure
   (c) Flexure and Serviceability
   (d) Serviceability and Collapse

13. The steel parts at right angles are welded with fillet weld of 10 mm size. The throat thickness of the fillet weld should be
   (a) 7mm
   (b) 10mm
   (c) 12mm
   (d) 5mm

14. At a given instant ship A is travelling at 6 km/h due east and ship B is travelling at 8 km/h due north. The velocity of B relative to A is
   (a) 5 km/hr
   (b) 10 km/h
   (c) 20 km/h
   (d) 15 km/h

15. What is the limiting moment of resistance in accordance with the limit state design of a singly reinforced rectangular beam whose width is 200 mm and effective depth is 400 mm. Consider that the grade of steel is Fe415 and that of concrete is M20.
   (a) 69.98 kN-m
   (b) 75.96 kN-m
   (c) 96.52 kN-m
   (d) 88.30 kN-m

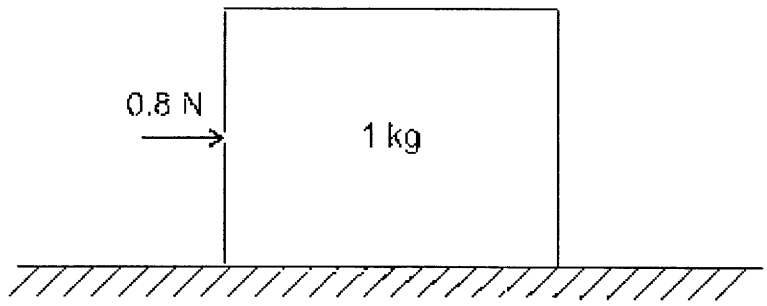
16. A reinforced concrete beam is subjected to the following bending moments:
Moment due to dead load = 50 kN-m; Moment due to live load = 50 kN-m; Moment due to seismic load = 20 kN-m. The design bending moment for limit state of collapse is
   (a) 150 kN-m
   (b) 144 kN-m
   (c) 105 kN-m
   (d) 100 kN-m

17. In a loaded beam, the point of Contraflexure occurs at a section where
   (a) bending moment is minimum
   (b) bending moment is zero or changes sign
   (c) bending moment is maximum
   (d) shearing force is maximum

18. The deformation per unit length is called
   (a) tensile stress
   (b) compressive stress
   (c) shear stress
   (d) strain

19. A simple pendulum of length 5m, having a bob of mass 1 kg, is in simple harmonic motion. The net force on the bob at the mean position is
   (a) 2.5 N
   (b) 9.8 N
   (c) 0 N
   (d) 5 N

20. A 1kg block is resting on a surface with a co-efficient of friction, $\mu = 0.1$. A force of 0.8N is applied to the block, as shown in the figure. The friction force in Newton is



(a) 0.06 (b) 0.04
(c) 0.08 (d) 0.98

21. A load of 200 kg has to be lifted at the end of steel wire. If the unit stress in the wire must not exceed 800 kg/cm^2, the diameter of wire required will be nearest to

(a) 10 mm (b) 0.01 mm
(c) 4 mm (d) 50 mm

22. A simply supported beam carries two equal concentrated loads W at distance L/3 from either support. The value of maximum bending moment anywhere in the section will be

(a) $\frac{WL}{3}$ (b) $\frac{WL}{8}$

(c) $\frac{3WL}{P}$ (d) $\frac{W3L}{5}$

23. If the shear force at a section of a beam is zero, the bending moment at that section is

(a) zero (b) constant
(c) maximum or minimum (d) none of these

24. What is the ratio of Young's modulus to the modulus of rigidity for a material if the Poisson's ratio for the material is 0.35?

(a) 0.60 (b) 1.35
(c) 2.70 (d) 0.37

25. The relationship between load intensity (W), shear force (S) and bending moment (M) is given by

(a) $W = \frac{dS}{dx} and\ S = \frac{dM}{dx}$ (b) $W = \frac{dM}{dx} and\ S = \frac{dW}{dx}$

(c) $S = \frac{dW}{dx} and\ M = \frac{dS}{dx}$ (d) None of these

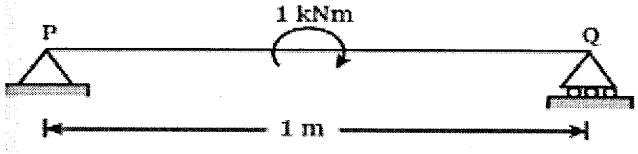
26. If the principal stresses in a plane stress problem are $\sigma_1 = 100$ MPa, $\sigma_2 = 40$ MPa, the magnitude of the maximum shear stress (in MPa) will be

(a) 30 (b) 50
(c) 60 (d) 20

27. The dimensional formula for strain energy density is

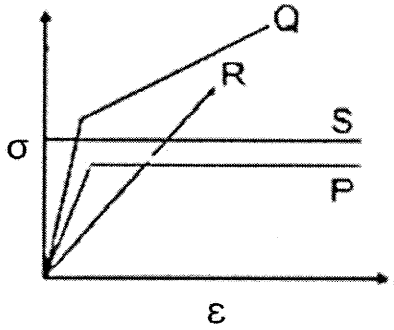
(a) ML^2T^{-3} (b) ML^2T^3
(c) $ML^{-1}T^{-2}$ (d) ML^2T^{-2}

28. A simply supported beam PQ is loaded by a moment of 1 kN-m at the mid-span of the beam as shown in the figure. The reaction forces RP and RQ at supports P and Q respectively are:



(a) 0.5 kN downward, 0.5 kN upward
(b) 1 kN downward, 1 kN upward
(c) 0.5 kN upward, 0.5 kN downward
(d) 1 kN upward, 1 kN downward

29. The room-temperature stress (σ) - strain (ε) curves of four materials P, Q, R, and S are shown in the figure below. The material that behaves as a rigid, perfectly plastic material is:

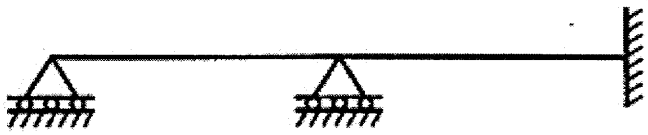


(a) P
(b) Q
(c) R
(d) S

30. Why is base plate provided in short roof trusses?

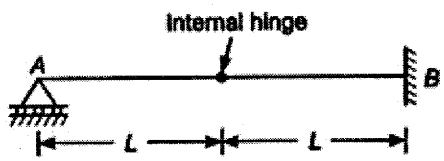
(a) For rigidity
(b) As provision for temperature related expansion/contraction
(c) To transmit load effectively
(d) For stability

31. What is the number of independent degrees of freedom (KI) of the two span continuous beam as shown in figure? (ignore axial deformation)



(a) 1
(b) 2
(c) 3
(d) 4

32. Carry over factor C_{AB} for the beam shown in the figure below is

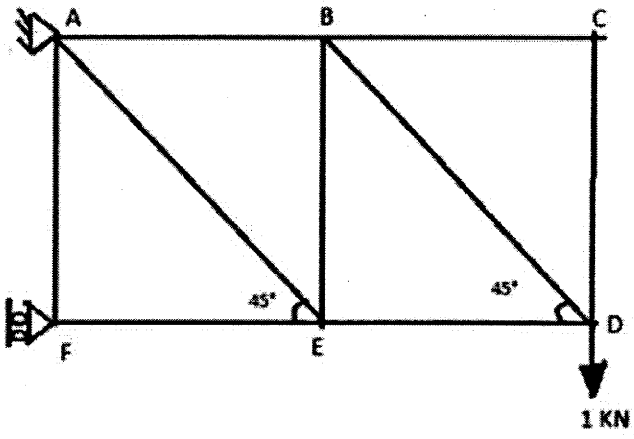


(a) 1/4
(b) 1/2
(c) 3/4
(d) 1

33. When the strain in a material increases with time under sustained constant stress, the phenomenon is known as

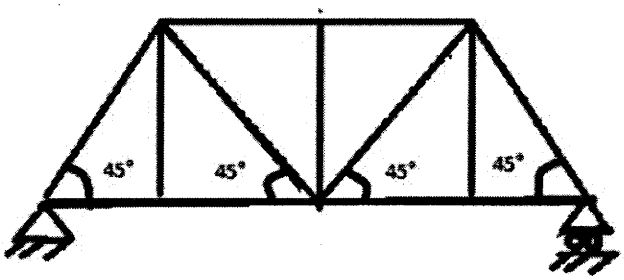
(a) creep
(b) strain hard
(c) visco type
(d) hysteris zone

34. Calculate the force in member BC.



(a) 19 kN
(b) 20 kN
(c) 0 kN
(d) 11 kN

35. Calculate the kinematic indeterminacy of the following pin jointed plane truss.

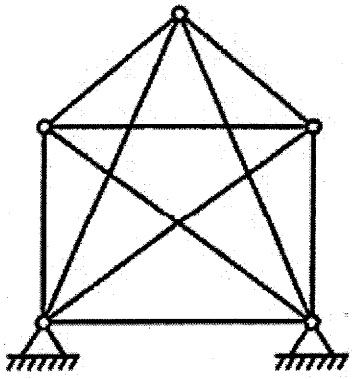


(a) 8
(b) 7
(c) 13
(d) 15

36. Which of the following is carried by truss members?

(a) axial load
(b) bending load
(c) shear load
(d) flexural load

37. What is the degree of static indeterminacy of the plane structure as shown in the figure below?



(a) 3
(b) 4
(c) 5
(d) 6

38. When a structural member of the uniform section is subjected to a moment at one end only, then the moment required so as to rotate that end to produce a unit slope, is called

(a) Stiffness of member
(b) Capacity of member
(c) Potential of member
(d) Resistance of member

39. If the gravitational acceleration at any place is doubled, the weight of a body, will

(a) be reduced to half
(b) be doubled
(c) not be affected
(d) none of these

40. The product of mass and velocity of a moving body, is called

(a) moment
(b) power
(c) impulse
(d) momentum

41. The angle which an inclined surface makes with the horizontal when a body placed on it is on the point of moving down, is called

(a) angle of repose
(b) angle of friction
(c) angle of inclination
(d) angle of velocity

42. Match the following types of stiffeners and their functions in the case of a plate girder.

Type of Stiffener		**Function**	
1	Load carrying stiffener	A.	To prevent local crushing of the web due to concentrated loading
2	Bearing stiffener	B.	To prevent local buckling of the web due to concentrated loading
3	Diagonal stiffener	C.	To improve the buckling strength of a slender web due to shear
4	Intermediate transverse web stiffener	D.	To provide local reinforcement to a web under shear and bearing

(a) 1 – C, 2 – A, 3 – D, 4 – B
(b) 1 – B, 2 – D, 3 – A, 4 – C
(c) 1 – B, 2 – A, 3 – D, 4 – C
(d) 1 – D, 2 – A, 3 – B, 4 – C

43. Which of the following statements are true?

1. When elastic analysis is used, the steel member shall be capable of developing the yield stress under compression without local buckling.
2. Plate elements of a cross-section may buckle locally due to compressive stresses.

(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2

44. If simple harmonic motion is represented by $x = A\cos(\omega t + \varphi)$, then '$\omega$' is

(a) Displacement
(b) Amplitude
(c) Angular frequency
(d) Phase constant

45. If a piece of material neither expands nor contracts in volume when subjected to stresses, then the Poisson's ratio must be

(a) 0.25
(b) 0.5
(c) 0.33
(d) Zero

46. To impart colour to plastics the pigment added is

(a) zinc oxide
(b) graphite
(c) camphore
(d) phosphate

47. When a body in equilibrium undergoes an infinitely small virtual displacement, work imagined to be done, is known as

(a) imaginary work
(b) negative work
(c) virtual work
(d) positive work

48. The maximum area of compression reinforcement in a beam of cross section B x D is limited to

(a) 1.04 BD
(b) 0.04 BD
(c) 0.14 BD
(d) 2.04 BD

49. Which of the following is false for a point nearby a fixed support?

(a) Slope is zero
(b) Displacement as well as slope is non-zero
(c) Displacement is zero
(d) Displacement as well as slope is zero

50. Which structure will perform better during earthquake?

(a) Both statically determinate and indeterminate
(b) Statically determinate
(c) Statically indeterminate
(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. Write short notes on Different test for cement concrete.

2. What do you mean by Green Building concept?

3. Write short note on Classification of Bricks as per IS-1077-1957

4. Explain the different types of losses in prestressed concrete members.

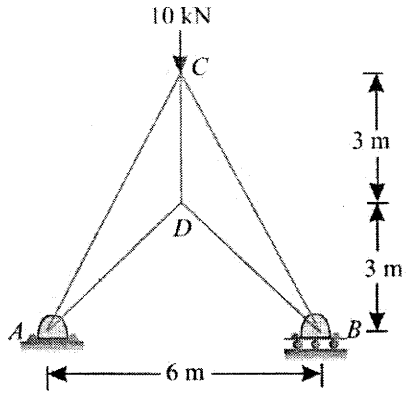
5. A rectangular concrete section, 25 cm wide, 50 cm overall depth, is reinforced with three 16 mm dia-high yield strength deformed bars at an effective cover of 4 cm from bottom face. If permissible stresses in concrete in bending compression and steel are 50 kg/cm^2 and 2300 kg/cm^2 respectively; modular ratio =19, calculate the moment of resistance of section using working stress method.

6. A slab base for a column ISHB 350@710.2 N/m is subjected to a factored axial compressive load of 2000 kN. The load is transferred to the base plate by the direct bearing of column flanges. The depth of the section and width of the flange are 350 mm and 250 mm, respectively. Determine the minimum thickness of the slab base in mm. [Assume a square base plate of 500 mm size and concrete of M20 grade, $f_y = 250$ N/mm^2]. Make necessary sketches.

7. Explain the types of loads on RCC structures.

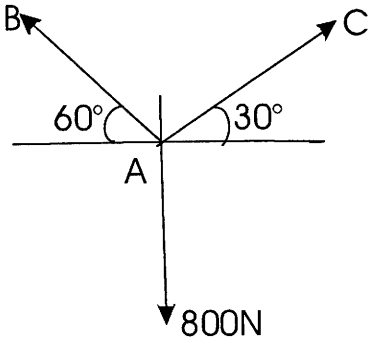
8. Explain Mohr's Circle w.r.t Full two-dimensional stress transformation equations.

9. A framed of 6 m span is carrying a central load of 10 kN as shown in Figure.



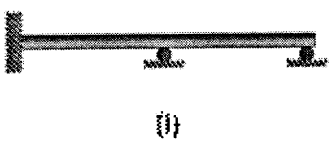
Find by any method, the magnitude and nature of forces in all members of the structure and tabulate the results.

10. If point A is in equilibrium under the action of the applied forces, Determine the value of tension in T_{AC} using Lami's theorem.



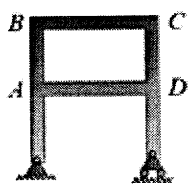
11. A spherical shell with an internal diameter of 320 mm and an external diameter of 640 mm is subjected to an internal fluid pressure of 75 N/mm^2. Calculate the hoop stress developed at the outer surface.

12. Classify each of the structures given below as statically determinate or statically indeterminate. If statically indeterminate, report the number of degrees of indeterminacy. The structures are subjected to external loadings that are assumed to be known and can act anywhere on the structures. (assume all types of displacement components are existent)

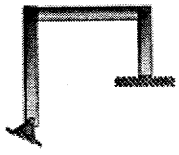


(i)

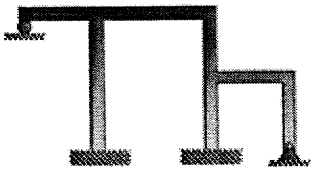
(ii)



(iii)



(iv)



(v)