MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO ASSISTANT ENGINEERING (CIVIL) CONTRACT BASIS UNDER TRADE AND COMMERCE DEPARTMENT, JULY 2016.

CIVIL ENGINEERING
PAPER - I

Time Allowed : 3 hours | Full Marks : 200

PART - A
(Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

Attempt all questions.

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

1. The process of mixing water in quick lime is known as
   (a) calcination (b) slaking
   (c) grinding (d) setting

2. For practical purposes, Portland cement may be considered as composed of four principal compounds namely Lime, Silica, Iron Oxide and
   (a) Magnesia (b) Soda
   (c) Alumina (d) Sulphur Oxide

3. Coal, petroleum, air and water are used in the production of this type of plastics. Identify the type.
   (a) Acrylic (b) Vinyl
   (c) Poly Vinyl Acetate (PVA) (d) Poly Vinyl Chloride (PVC)

4. Development of these trees takes place by addition of one annular ring every year. Identify the type of tree.
   (a) Endogenous (b) Exogenous
   (c) Cambium (d) Medullary

5. The first product in the process of conversion of Iron ore into Steel is
   (a) pig iron (b) cast iron
   (c) wrought iron (d) metallic iron

6. This is the most common type of floor covering in Indian buildings and it is also known as Indian Patent Stone flooring. Identify the type.
   (a) Concrete floor covering (b) Stone floor covering
   (c) Tile floor covering (d) Mosaic floor covering

7. A piece of timber attached in inclined position within a door frame is called a
   (a) mullion (b) louver
   (c) sash (d) horn

8. Sometimes the light entering from the windows in the walls of a building is inadequate. In this case, some more windows are provided on the flat roofs to admit more light into the room. This type of window is known as
   (a) Sky light
   (b) Dormer window
   (c) Clerestorey window
   (d) Lantern light

9. A type of roof, commonly adopted, sloping in two directions is known as
   (a) Shed roof
   (b) Gabble roof
   (c) Hip roof
   (d) Mansard roof

10. While planning buildings, the minimum distance of a septic tank from any source of drinking water must be
   (a) 22 metres
   (b) 20 metres
   (c) 18 metres
   (d) 16 metres

11. As per IS 456 : 2000, for spans upto 10 m, the vertical deflections limits may generally be assumed to be satisfied provided that the span to effective depth ratio in case of simply supported beams is not greater than
   (a) 7
   (b) 15
   (c) 20
   (d) 26

12. A limit state design should satistfy the serviceability requirements such as deflection and
   (a) flexure
   (b) shear
   (c) torsion
   (d) cracking

13. The permissible stresses in steel reinforcement (in N/mm^2) in Mild Steel Bars Conforming to Grade I of IS 432 (Part I) in Tension upto and including 20 mm diameter is
   (a) 130
   (b) 140
   (c) 190
   (d) 230

14. A column is treated as a short column if the slenderness ratio with respect to major and minor axes are both less than
   (a) 10
   (b) 12
   (c) 14
   (d) 16

15. In the case of sections near supports of continuous beams, which of the following statements is true?
   (a) compression at top fibre
   (b) tension at top fibre
   (c) compression at neutral axis
   (d) tension at neutral axis

16. The slenderness ratio of a steel member carrying compressive loads resulting from dead and imposed loads shall not exceed
   (a) 160
   (b) 180
   (c) 200
   (d) 220

17. The distance between centre of rivets (minimum pitch) should not be less than X times the nominal diameter of rivets. Find the correct replacement for X.
   (a) 1.50
   (b) 2.00
   (c) 2.50
   (d) 3.00

18. The body of a bolt is termed as

(a) shank
(b) nut
(c) head
(d) washer

19. Plug weld is also known as

(a) lap weld
(b) fillet weld
(c) butt weld
(d) slot weld

20. The black bolts cannot carry loads equal to those of a rivet with the same diameter. In such cases, the remedial measures adopted is the use of

(a) unfinished bolts
(b) turned bolts
(c) rough bolts
(d) common bolts

21. Which of the following is usually considered as a basic or fundamental quantity?

(a) Mass
(b) Length
(c) Time
(d) All of these

22. The energy developed by a force acting through a distance against resistance is known as

(a) power
(b) work
(c) moment
(d) torque

23. Forces whose line of action pass through a common point are called

(a) non-parallel forces
(b) non-concurrent forces
(c) coplanar forces
(d) concurrent forces

24. "If three coplanar forces acting at a point on a body keep it in equilibrium then each force is proportional to the sine of the angle between the other two forces".

The above statement is known as

(a) Triangle law of forces
(b) Lami's theorem
(c) Varignon's theorem
(d) Polygon law of forces

25. The rotational tendency of a force is called

(a) torque
(b) translation
(c) moment
(d) couple

26. Equilibrium conditions for coplanar concurrent forces are

(a) $\sum V = 0$
(b) $\sum H = 0$
(c) both (a) and (b)
(d) none of these

27. The force polygon for coplanar concurrent forces

(a) must close
(b) must not close
(c) may or may not close
(d) any of these

28. A rigid body in translation

(a) can move along a straight or curved path
(b) can only move in a straight line
(c) cannot move on a circular path
(d) must undergo curvilinear motion

29. Which of the following forms the basis of rigid bodies and strength of materials?
(a) Centroid
(b) Centre of gravity
(c) Moment of inertia
(d) any of these

30. Impulse gives a measure of the product of
(a) force and velocity
(b) force and accelaration
(c) force and displacement
(d) force and time

31. The combined effect of external forces acting on a body is called
(a) stress
(b) strain
(c) load
(d) work

32. The internal resistance which the body offers to meet with the external force is called
(a) stress
(b) strain
(c) load
(d) work

33. The ratio of linear compressive stress and compressive strain is termed as
(a) Modulus of rigidity
(b) Modulus of elasticity
(c) Poisson's ratio
(d) Bulk Modulus of elasiticity

34. The ratio of lateral strain to linear strain is known as
(a) Modulus of rigidity
(b) Modulus of elasticity
(c) Poisson's ratio
(d) Bulk Modulus of elasiticity

35. If Poisson's ratio = 1/m, E = Modulus of Elasticity and C = Modulus of Rigidity, then their relation is given by
(a) $E = C (1 + 1/m)$
(b) $E = 2 C (1 + 1/m)$
(c) $E = C (1 + 2/m)$
(d) $E = 2 C (1 + 2/m)$

36. If Poisson's ratio = 1/m, E = Modulus of Elasticity and K = Bulk Modulus of Elasticity, then their relation is given by
(a) $E = K (1 - 2/m)$
(b) $E = 2 K (1 - 2/m)$
(c) $E = 3K (1 - 2/m)$
(d) $E = 4 K (1 - 2/m)$

37. If E = Modulus of Elasticity, K = Bulk Modulus of Elasticity and C = Modulus of Rigidity, then their relation is given by
(a) $E = 9KC / (3K + C)$
(b) $E = (3K + C) /6KC$
(c) $E = 6KC / (K + 3C)$
(d) $E = 3KC / (3K + C)$

38. Which of the following statements is incorrect?
(a) Stress is directly proportional to strain within elastic limit
(b) The stress is force per unit area
(c) Hooke's law holds good upto the breaking point
(d) The ratio of linear stress to linear strain is called Young's Modulus.

39. A member is subjected to tensile force P. If its normal cross-section perpendicular to line of force is A, what will be the resulting normal stress in an oblique plane inclined at an angle θ to transverse plane?
(a) $(P/A) \cos 2\theta$
(b) $(P/2A) \cos 2\theta$
(c) $(P/A) \cos^2 \theta$
(d) $(P/A) \sin^2 \theta$

40. Bending moment at supports in case of simply supported beams is always

(a) zero
(b) unity
(c) less than unity
(d) more than unity

41. If b= width and d = depth of section, Moment of inertia of a rectangle about its XX – axis is given by

(a) $db^3/12$
(b) $bd^3/12$
(c) $bd^2/6$
(d) $bd^3/6$

42. A beam of length L, fixed at both ends, carries a point load W at its centre. If EI is the flexural rigidity of the beam, the maximum deflection of the beam is

(a) $WL^3/24EI$
(b) $WL^3/48EI$
(c) $WL^3/96EI$
(d) $WL^3/192EI$

43. A beam of length L, fixed at both ends, carries a uniformly distributed load of w per unit length throughout the span. If EI is the flexural rigidity of the beam, the maximum deflection of the beam is

(a) $wL^4/12EI$
(b) $wL^4/24EI$
(c) $wL^4/192EI$
(d) $wL^4/384EI$

44. A beam of length l, fixed at both ends, carries a uniformly distributed load of w per unit length throughout the span. The bending moment at the ends is

(a) $wl^2/8$
(b) $wl^2/12$
(c) $wl^2/16$
(d) $wl^2/24$

45. Generally influence lines are drawn for a / an X load moving on the span. Find the correct replacement for X.

(a) zero
(b) unit
(c) eccentric
(d) uniformly distributed

46. The sum of rotation factors at a point in Kani's Method of design is replacement for X.

(a) 0
(b) – 1/2
(c) 1/2
(d) 1

47. A beam of length L is fixed at one end and simply supported at the other end. If EI is the flexural rigidity , the stiffness factor of the beam is

(a) EI/L
(b) 2EI/L
(c) 3EI/L
(d) 4EI/L

48. A beam of length L is simply supported at both ends. If EI is the flexural rigidity, the stiffness factor of the beam is

(a) EI/L
(b) 2EI/L
(c) 3EI/L
(d) 4EI/L

49. Which of the following is the reason of unsymmetrical bending?

(a) The section is symmetrical but the load line is inclined to both principal axes.
(b) The section is unsymmetrical and the load line is along centroidal axis.
(c) neither (a) nor (b)
(d) both (a) and (b)

50. In the case of unsymmetrical bending, the direction of neutral axis is

(a) perpendicular to the plane of bending.
(b) not perpendicular to the plane of bending.
(c) neither (a) nor (b)
(d) both (a) and (b)

PART - B

(Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

Attempt all questions.

*This Part should be answered only on the **Answer Booklet** provided.*

1. Describe, in brief, the important steps for manufacture of hand- made common burnt clay building bricks as practiced in India.
2. Describe the various characteristics of defects in structural timber.
3. Describe the various types of Door Movements commonly adopted in India.
4. Briefly describe the various methods of damp proofing commonly adopted.
5. What are the basic assumptions for design of Reinforced Cement Concrete members based on elastic theory?
6. The reinforcement of a singly reinforced beam, of 200mm width and effective depth of 300 mm consists of 4 bars of 12 mm diameter. Determine the maximum stress in concrete when steel is stressed to 120 N/mm^2 . Take m = 19.
7. A short column of 400mm x 400 mm in section is reinforced with 8 bars of 20 mm diameter. Find the safe load on the column, as per IS Code, if the permissible stresses in steel and concrete are 180 N/mm^2 and 4 N/mm^2 respectively.
8. A simply supported pre-stressed concrete beam of cross-section 400mm x 600mm is loaded with a total uniformly distributed load of 256 KN over a span of 6 m. If the pre-stressing force is 1920 KN and the tendon is eccentric, located at 200mm above the bottom fibre, determine the extreme fibre stresses in concrete at mid-span.
9. A single steel angle discontinuous strut ISA 150mm x 150mm x 12mm with single riveted connection is 3.60 metres long . Calculate the safe load carrying capacity of the section in KN. Given (a) Sectional area, A= 3459 mm^2 (b) $r_{yy} = r_{xx} = 46.10$ mm (c) $r_{uu} = 58.30$ mm (d) $r_{vv} = 29.30$ mm. (e) allowable working stress = 52 N/ mm^2
10. A single riveted lap joint is made in 16 mm thick plates with 20 mm diameter rivets. Determine the strength of the joint if the pitch of the rivets is 6 cm. Take (a) safe permissible shear stress for the rivet material = 1000 kg/ cm^2 (b) safe permissible bearing stress for the rivet material = 1600 kg/ cm^2 and (c) Permissible tensile stress for the plate material = 1200 kg/ cm^2.
11. State Varignon's theorem. Define free body diagram. Draw the free body diagram of an aluminium box of mass 'm' at rest on a plane inclined at an angle of 30° to the horizontal.
12. A beam ADCB of 6 metres length is hinged at left support A and supported on rollers at right hand support B. Points D and C are at a distance of 2 metres and 4 metres from A respectively. A concentrated vertical load of 10 KN acts at D with uniformly distributed load of 3 KN/m acting between D and C. Besides, a concentrated load of 8 KN acts at C at an angle of 45° to the horizontal. Find the magnitude of support reaction at B.
13. A man and a boy carry a weight of 300 N between them by means of a uniform pole 2m long and weighing 100 N. Where must the weight be placed so that the man may bear twice as much of the weight as the boy?

14. Two forces acting at a point have their resultant 15 N when they act at right angles and their least resultant is 3 N. Find their greatest resultant and also the resultant when they act at an angle of 60°.

15. A uniform steel bar of 2 m long, 10mm diameter is subjected to a tensile force of 4 KN. Determine the tensile stress and its elongation if Young's Modulus E is 1.86 x 100000 N/mm².

16. A point in a strained bar is subjected to two mutually perpendicular tensile stresses of 200 N/ mm² and 100 N/mm². Determine the intensities of normal and resultant stresses on a plane inclined at 30° to the axis of the minor stress.

17. Write short notes on (a) Clayperon's Theorem of Three Moments (b) Moment Distribution Method.

18. A simply supported beam of 6 metre length carries a uniformly distributed load of 8KN/m throughout its whole span. Analyse the beam and Draw the Shear Force and Bending Moment diagrams for the beam.

19. What is an influence line diagram? A Cantilver beam AB, of length 3 metres, is fixed at A. A load of 1 N moves from the free end B towards A. Draw the influence line diagrams for Bending Moment and Shear Force.

20. A simply supported beam, 6 metres long, is carrying a concentrated load of 10 KN at its centre. If the slope at the ends of the beam is not to exceed 2°, find the deflection at the centre of the beam.

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