

CIVIL ENGINEERING

Paper : I

Grade : V(A) - Degree

Full Marks - 200

Time - Three hours



The figures in the margin indicate full marks for the questions.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

Answer the following questions (Each answer should be restricted to 40 words.) : $6 \times 15 = 90$

1. State the steps involved in the manufacturing process of Portland cement by wet method.
2. What is the main property of refractory bricks ? Where are these bricks used ? Give the classifications of refractory bricks and uses.
3. State the various operations of the manufacturing process of bricks.

[Turn over

4. Name and describe, very briefly, the common defects in timber.
5. Define 'workability' of concrete. What are the common methods of measuring 'workability' of concrete?
6. What is the importance of compaction of concrete? Write down the points which should be looked into at the time of laying and compacting concrete.
7. A body is subjected to a tensile or compressive load. Explain the terms 'Primary strain' and 'Lateral strain' of this body as a result of application of the load. How do we get 'Poisson's ratio' from Primary strain and Lateral strain?
8. Define the terms, 'Network or Flow Diagram' and 'Total Float', used in CPM (Critical Path Method).
9. Name three earth moving equipments used for excavating and carrying and three equipments used only for excavating.
Also name some important works associated with such equipments.
10. State the various ways in which a riveted joint may fail.

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11. Distinguish between 'under reinforced sections' and 'over reinforced sections'.
 12. What are the reasons for using high strength concrete ?
 13. How columns are classified depending upon the type of Loading ?
 14. Explain the terms 'Modulus of Elasticity' and 'Elastic limit'.
 15. A beam is subjected to bending moment greater than the moment of resistance of maximum available rolled steel section and the depth of the beam is also to be restricted. How beam is to be strengthened to meet the situation ?

GROUP - B

Choose the correct answer from the four alternatives provided with each question :

2×40=80

1. Results for testing efflorescence of a brick show 10 to 25% precipitation. The efflorescence of the brick is
 - (a) Slight
 - (b) Moderate
 - (c) Heavy
 - (d) Can be ignored



7/TR/TES/C-I/V(A)/13 (3)

[Turn over

2. Final setting time for rapid hardening cement is
- (a) 480 minutes
 - (b) 540 minutes
 - (c) 600 minutes
 - (d) 660 minutes

3. Annular rings in soft wood are
- (a) Distinct
 - (b) Less distinct
 - (c) Not visible
 - (d) Visible on scratching

4. Which of the following is not an artificial seasoning ?
- (a) Vapour seasoning
 - (b) Water seasoning
 - (c) Kiln seasoning
 - (d) Gas seasoning

5. Maximum water-cement ratio for M25 grade of concrete is

(a) 0.30

(b) 0.35

(c) 0.40

(d) 0.45

7/TR/TES/C-I/V(A)/13 (4)

6. Relation between Modulus of Elasticity 'E', Bulk Modulus 'K' and Shear Modulus or Modulus of Rigidity 'N' is

(a) $E = \frac{KN}{N + 2K}$

(b) $E = \frac{KN}{2N + 3K}$

(c) $E = \frac{3KN}{N + 3K}$

(d) $E = \frac{9KN}{N + 3K}$

7. A simply supported beam of length 'L' is loaded with a uniform load of 'W'/unit length. Maximum Bending Moment in the beam will be

(a) $\frac{WL^2}{4}$

(b) $\frac{WL^2}{6}$

(c) $\frac{WL^2}{8}$

(d) $\frac{WL^2}{12}$

8. In a double cover butt joint, two plates are placed end to end and are joined by plate known as

- (a) Bearing plate
- (b) Cover plate
- (c) Shearing plate
- (d) Butt plate



7/TR/TES/C-I/V(A)/13 (5)

[Turn over

9. Columns, struts, posts on sections, in a direction parallel to longitudinal axis, are subjected to

- (a) Tensile stress
- (b) Compression stress
- (c) Bending stress
- (d) Torsional stress

10. $0.80L$ is the effective length of a column of actual length 'L', which is effectively held in position at both ends and

- (a) restrained in direction at one end
- (b) restrained in direction at both ends
- (c) partially restrained in direction at one end
- (d) not restrained in direction at both ends

11. For a rivet of 20 mm diameter, diameter of rivet hole is

- (a) 21.0 mm
- (b) 21.5 mm
- (c) 21.8 mm
- (d) 20.8 mm

7/TR/TES/C-I/V(A)/13 (6)

12. For designing a Plate Girder, it is assumed that the shear intensity is uniform throughout the depth of the

- (a) Web
- (b) Top flange
- (c) Bottom flange
- (d) Girder

13. A rivet joint may fail if the shear stress in the rivet

- (a) exceeds the working shear stress of the rivet
- (b) equals the working shear stress of the rivet
- (c) is less than the working shear stress of the rivet
- (d) exceeds the bearing stress of the joint

14. The net sectional area of a bolt shall be taken as the

- (a) area of the threaded part
- (b) area of the unthreaded part
- (c) greater of (a) and (b)
- (d) smaller of (a) and (b)

7/TR/TES/C-I/V(A)/13 (7)

[Turn over

21. Back-hoe is an equipment used for

- (a) Excavating and carrying
- (b) Excavating
- (c) Hauling
- (d) Hoisting

22. One of the advantages of Tower Buckets is

- (a) Economical in the long run for high structures
- (b) Uniform flow of concrete
- (c) Low initial cost
- (d) High capacity

23. In a network on flow diagram, flow of events is normally from

- (a) Left to right
- (b) Right to left
- (c) Top to bottom
- (d) Bottom to top

24. Late Finish Time (LFT) is the latest time by which an activity can be completed
- (a) Allowing additional time
 - (b) Without delaying the project
 - (c) Without extra cost
 - (d) Deferring the project
25. In Tripura, where flow of construction materials is not certain, specially in rainy season and interruption in the smooth progress of work due to high rainfall is also a certainty, an effective method to take care of these is the technique of
- (a) PERT
 - (b) Bar Chart
 - (c) CPM
 - (d) T&P
26. A fictitious activity, used to maintain sequential order of activities in a network is known as
- (a) Dummy event
 - (b) Dummy activity
 - (c) Dummy occurrence
 - (d) Dummy action



27. The difference between the maximum time allowed for an activity and the time actually required by the activity is known as

- (a) Free Float (b) Interfering Float
- (c) Total Float (d) Net Float

28. PERT is the acronym of

- (a) Planning Evaluation and Review Technique
- (b) Project Evaluation and Review Technique
- (c) Project Evaluation and Rationalization Technique
- (d) Planning Evaluation and Review Treatment

29. One salient feature of Bar Chart is

- (a) Modification to the chart can be carried out easily
- (b) Modification to the chart can not be carried out easily
- (c) Sequence of activities is clearly defined
- (d) Each item of work is not shown separately

30. Final setting time for Portland Pozzolana cement is

- (a) 480 minutes (b) 600 minutes
- (c) 720 minutes (d) 900 minutes

31. The load on the prestressed member causing reduction in the stresses is

- (a) Dead load (b) Live load
- (c) Wind load (d) Seismic load

32. Method which is not adopted in prestressing is

- (a) Post tensioning
- (b) Circular prestressing
- (c) Vertical prestressing
- (d) Linear prestressing

33. One of the following is not a type of shear failure in beams

- (a) Shear tension
- (b) Shear compression
- (c) Shear bending
- (d) Shear stress



34. In the design of flexural member employing limit state of collapse, the acceptable stress-strain curve of concrete is assumed to be

- (a) Hyperbolic
- (b) Parabolic
- (c) Semicircular
- (d) Straight line

35. For structures subjected to the maximum design loads out of the possible combination of several types of load, limit state of collapse deals with

- (a) strength and stability
- (b) deflection
- (c) cracking
- (d) only stability

36. IS 456 : 2000 stipulates that for a cantilever beam, the span / effective depth ratio is

- (a) 5
- (b) 6
- (c) 7
- (d) 8

37. Yielding of longitudinal steel at the outermost row near the left edge of a column and crushing of concrete at the right edge occur simultaneously in

- (a) Compression failure (b) Tension failure
(c) Balanced failure (d) Shear failure

38. Let 'H' be the height of back fill, measured vertically above the heel of a retaining wall, 'W' be the density of soil and ' ϕ ' is the angle of repose. The lateral force acting on the vertical face on the retaining wall is

- (a) $\frac{WH^2}{4} \left(\frac{1 - \sin \phi}{1 + \sin \phi} \right)$ (b) $\frac{WH^2}{2} \left(\frac{1 - \sin \phi}{1 + \sin \phi} \right)$
(c) $\frac{WH^2}{4} \left(\frac{1 + \sin \phi}{1 - \sin \phi} \right)$ (d) $\frac{WH^2}{2} \left(\frac{1 + \sin \phi}{1 - \sin \phi} \right)$

39. Over reinforced sections are those

- (a) in which steel reaches the yield strain earlier than that of concrete.
(b) in which concrete reaches the yield strain simultaneously with steel.
(c) in which concrete reaches the yield strain earlier than that of steel.
(d) in which requirement of steel is small.

40. Let 'w' be the unit weight of soil, 'p' be the safe bearing capacity of soil under the footing and ' ϕ ' be the angle of repose. The minimum depth of foundation according to Rankine's theory is

- (a) $\frac{p}{w} \left(\frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$ (b) $\frac{p}{w} \left(\frac{1 + \sin \phi}{1 - \sin \phi} \right)^2$
- (c) $\frac{w}{p} \left(\frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$ (d) $\frac{w}{p} \left(\frac{1 + \sin \phi}{1 - \sin \phi} \right)^2$

GROUP - C

Answer the following questions. $5 \times 6 = 30$

1. A floor slab of a residential building, 4m by 6m and simply supported on all sides without any provision for torsion at corners, is to be designed using M-20 grade concrete and Fe-415 HYSD bars. Select the overall depth and check the same against bending moment.

Permissible stresses, bar diameter etc. are to be suitably assumed.

2. A T-beam is to be casted for an office floor with the following specifications :

Clear span = 8m

Centre to centre spacing of supports = 8.0m

Spacing of T-beams = 2m

Slab thickness = 150 mm

Materials : Concrete grade M-20, Fe-415 HYSD bars.

Design the main reinforcements. Also check if the stresses in steel and concrete are within safe permissible limits. Permissible stresses are to be suitably assumed.

3. A factored load of 1500 kN is supported on a circular column, 300 mm diameter, with helical reinforcement. The column has an unsupported length of 3 metre and is braced against side way. M-20 grade concrete and Fe-415 HYSD bars are to be used.

Design the longitudinal reinforcements for the column. ($f_{ck} = 20 \text{ N/mm}^2$ $f_y = 415 \text{ N/mm}^2$)

4. A riveted plate girder is to carry a superimposed load of 100 kN per metre on an effective span of 24 metre. The girder is to be laterally supported throughout.

Find the maximum bending moment and shear force. Maximum allowable stress in tension and compression is 165 MPa.

5. A solid footing has to transfer a dead load of 1000 kN from a square column 400×400 mm with 16 mm bars. Find the effective depth for one way shear and also from bending moment.

Assume $f_{ck} = 20 \text{ N/mm}^2$, $f_y = 415 \text{ N/mm}^2$ and safe bearing capacity of soil $= 200 \text{ kN/m}^2$. Any other data, if necessary, is to be suitably assumed.