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CIVIL ENGINEERING
SSC-JE 2017
(15 hr demo class free of every subject)

by-IIITian & I.E.S.
B. Chand
BCM
Building
Construction
Material
1. If \( p \) is the standard consistency of cement the amount of water used in conducting the initial setting time test on cement is
   a) 0.65 \( p \)  
   b) 0.85 \( p \)  
   c) 0.6 \( p \)  
   d) 0.8 \( p \) (IES-1995)

2. For complete hydration of cement the \( w/c \) ratio needed is
   a) less than 0.25  
   b) more than 0.25 but less than 0.35  
   c) more than 0.35 but less than 0.45  
   d) more than 0.45 but less than 0.60  
   (IES-1996)

3. Blat furnace slag has approximately
   a) 45% calcium oxide and about 25% silica  
   b) 50% alumina and 20% calcium oxide  
   c) 25% magnesia and 15% silica  
   d) 25% calcium sulphate and 15% alumina  
   (IES-1996)

4. Gypsum is used as an admixture in cement grouts for
   a) accelerating the setting time  
   b) retarding the setting time  
   c) increasing the plasticity  
   d) reducing the grout shrinkage  
   (IES-1996)

5. Which of the following pairs in respect of ordinary Portland cement (OPC) are correctly matched.
   1. Initial setting time ......30 minutes  
   2. Final setting time ......10 hours  
   3. Normal consistency ......10%  
   Select the correct answer from the codes given below:
   a) 1, 2 and 3  
   b) 2 and 3  
   c) 1 and 2  
   d) 1 and 3  
   (IES-1997)

6. High alumina cement is produced by fusing together a mixture of
   a) Limestone and bauxite  
   b) Limestone, bauxite and gypsum  
   c) Limestone, gypsum and clay  
   d) Limestone, gypsum, bauxite, clay and chalk  
   (IES-1997)

7. The temperature range in a cement kiln is
   a) 500 to 1000 °C  
   b) 1000 to 1200 °C  
   c) 1300 to 1500 °C  
   d) 1600 to 2000 °C  
   (IES-1998)

8. Before testing setting time of cement one should test for
   a) Soundness  
   b) Strength  
   c) Fineness  
   d) Consistency  
   (IES-1998)
9. The role of superplasticizer in a cement paste is to
   a) Disperse the particles
   b) Disperse the particles and to remove air bubbles
   c) Disperse the particles, remove air bubbles and to retard setting
   d) Retard setting (IES-1999)

10. Increase the fitness of cement
    a) Reduces the rate of strength development and leads to higher shrinkage
    b) Increases the rate of strength development and reduces the rate of deterioration
    c) Decreases the rate of strength development and increases the bleeding of cement.
    d) Increases the rate of strength development and leads to higher shrinkage
       (IES-1999)

11. The fineness of cement is tested by
    a) air-content method
    b) air-permeability method
    c) Le-Chatelier apparatus
    d) Vicat’s apparatus

12. For marine works, the best suited cement is
    a) Low heat Portland cement
    b) Rapid hardening cement
    c) Ordinary Portland cement
    d) Blast furnace slag cement (IES-2001)

13. The proper size of mould for testing compressive strength of cement is
    a) 7.05 cm cube    b) 10.05 cm cube
    c) 15 cm cube       d) 12.05 cm cube
    (IES-2003)

14. The specific gravity of commonly available ordinary Portland cement is
    a) 4.92  b) 3.15  c) 2.05  d) 1.83 (IES-2003)

15. Consider the following statements:
    Low percentage of C_3S and high percentage of C_2S in cement will result in
    1. Higher ultimate strength with less heat generation
    2. Rapid hardening
    3. Better resistance to chemical attack
    Which of the statements given above are correct?
    a) 1 and 2   b) 2 and 3   c) 1 and 3   d) 1, 2 and 3 (IES-2004)

16. Match List-I (Apparatus) with List-II (Purpose) and select the correct answer using the code given
    below the Lists:
    List-I
    A. Le-chatelier
B. Vicat Needle with annular collar  
C. Vee-Bee  
D. Briquettes test machine  
List-II  
1. Workability of concrete  
2. Soundness of cement  
3. Tensile strength of cement  
4. Final setting time of cement  

Codes:  
\[
\begin{array}{cccc}
A & B & C & D \\
\text{a)} & 1 & 3 & 2 & 4 \\
\text{b)} & 2 & 4 & 1 & 3 \\
\text{c)} & 1 & 4 & 2 & 3 \\
\text{d)} & 2 & 3 & 1 & 4 \quad \text{(IES-2005)}
\end{array}
\]  

(IES-2007)  
17. Ultimate strength of cement is influenced by which one of the following?  
\begin{align*}
a) & \text{ Tricalcium silicate} \\
b) & \text{ Dicalcium silicate} \\
c) & \text{ Tricalcium aluminate} \\
d) & \text{ Tetracalciumalumino-ferrite} \quad \text{(IES-2007)}
\end{align*}

18. As per specifications, the initial setting time of ordinary Portland cement should not be less than  
\begin{align*}
a) & \text{ 10 minutes} \\
b) & \text{ 20 minutes} \\
c) & \text{ 30 minutes} \\
d) & \text{ 60 minutes} \quad \text{(IES-2006)}
\end{align*}

19. In cements, generally the increase in strength during a period of 14 days to 28 days is primarily due to  
\begin{align*}
a) & \text{ C_3A} \\
b) & \text{ C_2S} \\
c) & \text{ C_3S} \\
d) & \text{ C_4AF} \quad \text{(IES-2006)}
\end{align*}

20. What is the requirement of water (expressed as % of cement w/w) for the completion of chemical reactions in the process of hydration of OPC?  
\begin{align*}
\text{(a) } & 10 \text{ to } 15\% \\
\text{(b) } & 15 \text{ to } 20\% \\
\text{(c) } & 20 \text{ to } 25\% \\
\text{(d) } & 25 \text{ to } 30\% \quad \text{[IES-2009]}
\end{align*}

21. If \( P \) is the percentage of water required for determination of normal consistency of cement, then percentage of water to be added for determination of initial setting time is  
\begin{align*}
\text{(a) } & 0.70 \, P \\
\text{(b) } & 0.75 \, P \\
\text{(c) } & 0.80 \, P \\
\text{(d) } & 0.85 \, P \quad \text{[IES-2010]}
\end{align*}

22. A cement bag contains 0.035 cubic meter of cement by volume. How many bags will one tonne of cement comprise?  
\begin{align*}
\text{(a) } & 16 \\
\text{(b) } & 17 \\
\text{(c) } & 18 \\
\text{(d) } & 20
\end{align*}

23. Match List-I (Grade of cement & Age) with List-II (Compressive strength in N/mm\(^2\)) and select the correct answer using the code given below the lists:
List-I
A. Grade 33 (7 days)
B. Grade 43 (28 days)
C. Grade 53 (3 days)
D. Grade 43 (7 days)

List-II
1. 27
2. 43
3. 22
4. 33

Code:
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(b)</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(c)</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(d)</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

[IES-2011]

24. If 'W' is the percentage of water required for normal consistency of cement, water to be added for determination of initial setting time is
(a) 0.50 W  (b) 0.62 W
(c) 0.75 W  (d) 0.85 W  

[IES-2011]

25. Soundness test of cement is carried out to determine is
(a) alumina content
(b) iron oxide content
(c) free lime content
(d) durability under sea water

[IES-2013]

26. Fineness of cement is measured in the units of
(a) volume/mass
(b) mass/volume
(c) area/mass
(d) mass/area  

[IES-2012]

27. The initial setting time of cement depends most on
(a) tricalcium aluminate
(b) tricalcium silicate
(c) tricalcium aluminoferrite
(d) dicalcium silicate

[IES-2012]

28. Which compound of cement is responsible for strength of cement?
(a) Magnesium oxide  (b) Silica
(c) Alumina  (d) Calcium sulphate

[IES-2014]

29. Which type of cement is recommended in large mass concrete works such as a dam?
(a) Ordinary Portland
(b) High Alumina
(c) Low-heat Portland
30. One bag of Portland cement, 50 kg in weight, would normally have a bulk volume of
(a) 30 L (b) 35 L
(c) 40 L (d) 45 L

31. The split tensile strength of M15 grade concrete when expressed as a percentage of its
compressive strength is
(a) 10 to 15% (b) 15 to 20%
(c) 20 to 25% (d) 25 to 30%

32. The approximate ratio between the strength of cement concrete at 7 days and 28 days is
(a) 4/3 (b) 2/3
(c) 2/3 (d) 1/3

33. Modulus of elasticity of M25 concrete as determined by formula of IS 456 is
(a) 1,42,500 MPa (b) 90,125 MPa
(c) 28,500 MPa (d) 16,667 MPa

34. Tensile strength of concrete is measured by
(a) direct tension test in the universal testing machine
(b) applying compressive load along the diameter of the cylinder
(c) applying third point loading on a prism
(d) applying tensile load along the diameter of the cylinder.

35. The approximate ratio of strength of 15 cm x 30 cm concrete cylinder to that of 15 cm cube of
the same concrete is
(a) 1.25 (b) 1.00
(c) 0.85 (d) 0.50

36. Weigh-batching proceeds on
(a) the assumption of the declared weight in each bag of cement.
(b) weighing the contents of each bag
(c) accurately estimating the weight of each material to be used in each batch
(d) the assumption of correct dry weight of each size range of each material and the weight of
water

37. The modulus of elasticity (E) of concrete is given by
(a) \( E = 1000 f_{ck} \) (b) \( E = \sqrt{f_{ck}} \)
(c) \( E = 5700\sqrt{f_{ck}} \) (d) \( E = 10,000\sqrt{f_{ck}} \)

38. The optimum number of revolutions over which concrete is required to be mixed in a mixer
machine is.
(a) 10 (b) 20
(c) 50 (d) 100
39. The ultimate strength of cold drawn steel wires
(a) increases with the increase in the diameter of the bar
(b) increases with reduction in the diameter of the bar
(c) Does not depend upon the change in the diameter of the bar
(d) Depends only on the diameter of the bar.

40. The ratio of Young’s modulus of high tensile steel to that of mild steel is about
(a) 0.5   (b) 1.0
(c) 1.5   (d) 2.0

41. Polyvinyl chloride (PVC) is a
(a) thermosetting material
(b) thermoplastic material
(c) elasto-plastic material
(d) rigid plastic material

42. General shrinkage in cement concrete is caused by
(a) carbonation
(b) stresses due to external load
(c) drying with starting with a stiff consistency
(d) drying with starting with a water consistency

43. The carbon of structural steel is
(a) Less than 0.1%
(b) 0.10 to 0.25%
(c) 0.25 to 0.60%
(d) 0.60 to 1.00%

44. A splitting tensile test is performed on a cylinder of diameter ‘D’ and length ‘L’ if the ultimate load is ‘P’, then the splitting tensile strength of concrete is given by
(a) P/πDL
(b) 2P/πDL
(c) 4PL/πD
(d) 2PL/πL

45. Batching refers to
(a) Controlling the total quantity at each batch
(b) Weighing accurately, the quantity of each material for a job before mixing
(c) Controlling the quantity of each material into each batch
(d) Adjusting water to be added in each batch according to the moisture content of the materials being mixed in the batch

46. To make one cubic metre of 1 : 2 : 4 by volume of concrete, the volume of coarse aggregates required is
(b) 0.95 m³   (b) 0.85 m³
(c) 0.75 m³   (d) 0.65 m³

47. The ratio of direct tensile strength to that of modulus of rupture of concrete is
48. As per I.S. Code of Practice, concrete should be cured at
   (a) 5°C  (b) 10°C  
   (c) 27°C  (d) 45°C  
   [IES-2000]

49. Which one of the following types of concrete is most suitable in extreme cold climates?
   (a) Air-entrained concrete
   (b) Ready mix concrete
   (c) Vacuum concrete
   (d) Coarse concrete
   [IES-2001]

50. Which one of the following aggregate gives maximum strength in concrete?
   (a) Rounded aggregate
   (b) Elongated aggregate
   (c) Flaky aggregate
   (d) Cubical aggregate
   [IES-2001]

51. In building construction, the place for providing damp proof course is at the
   (a) Basement level
   (b) Window sill level
   (c) Lintel level
   (d) Roof level

52. What is the range of fineness modulus of sand which is least suitable for making good concrete?
   (a) 3.5-4.5  (b) 2.9-3.2  
   (c) 2.6-2.9  (d) 2.2-2.6  
   [IES-2004]

53. Slump and compaction factors are two different measures of workability of concrete. For a slump of 0 to 20 mm, what is the equivalent range of compaction factor?
   (a) 0.50-0.70  (b) 0.70-0.80  
   (c) 0.80-0.85  (d) 0.85-0.92  
   [IES-2004]

54. On which one of the following factors, does strength of concrete depend primarily?
   (a) Quality of coarse aggregate
   (b) Quality of fine aggregate
   (c) Fineness of cement
   (d) Water-cement ratio
   [IES-2005]

55. The mix design for pavement concrete I based on
   (a) the flexural strength
   (b) The characteristics compressive strength
   (c) The shear strength
   (d) The bond strength
   [IES-2006]

56. In what context is the slump test performed?
(a) Strength of concrete
(b) Workability of concrete
(c) Water-cement ratio
(d) Durability of concrete

IES-2007

57. Transportation of concrete-mix by pumps is very convenient method, particularly in case of
(a) Housing complex
(b) Cement concrete pavement
(c) Low-rise buildings
(d) Tunnel-lining

IES-2006

58. What is the correct sequence of operations involved in concrete production?
(a) Batching – Mixing – Handling – Transportation
(b) Mixing – Batching – Handling – Transportation
(c) Transportation – Handling – Mixing – Batching
(d) Handling – Transportation – Mixing – Batching

IES-2006

59. Which one of the following is the correct expression for the target mean strength \( f_t \) of concrete mix?
(a) \( f_t = k f_{ck} \)
(b) \( f_t = f_{ck} + k S \)
(c) \( f_t = f_{ck} + S \)
(d) \( f_t = k f_{ck} + k \)

IES-2007

60. What is the representative geometric mean size of an aggregate sample if its fineness modulus is 3.0?
(a) 150 \( \mu \)m
(b) 300 \( \mu \)m
(c) 600 \( \mu \)m
(d) 12 \( \mu \)m

IES-2009

61. What is the ratio of flexural strength \( f_{ck} \) to the characteristic compressive strength of concrete \( f_{ck} \) for M25 grade concrete?
(a) 0.08
(b) 0.11
(c) 0.14
(d) 0.17

IES-2009

62. If one intends to obtain the best workability of concrete, the preferred shape of aggregate is
(a) round
(b) annual
(c) triangular
(d) flinty

IES-2012

63. According to the Indian Standard Specifications, concrete should be cured under a humidity of
(a) 90%
(b) 80%
(c) 70%
(d) 60%

IES-2012

64. Which of the following tests compares the dynamic modulus of elasticity of samples of concrete?
(a) Compression test
(b) Ultrasonic pulse velocity test
(c) Split test
(d) Tension test

IES-2013
65. A good brick should not absorb water by weight more than
   (a) 10%  (b) 20%  
   (c) 25%   (d) 30%  
   [IES-1995]

66. The coefficient of linear expansion of granite is in the range of that of
   (a) glass (b) mild steel
   (c) high carbon steel (d) bamboo  
   [IES-1996]

67. A good brick when immersed in water bath for 24 hours should not absorb more than
   (a) 20% of its dry weight
   (b) 30% of its saturated weight
   (c) 10% of its dry weight
   (d) 20% of its saturated weight  
   [IES-1996]

68. For good bonding in brick masonry
   (a) all bricks need not be uniform in size
   (b) bats must be used in alternate courses only
   (c) the vertical joints in alternate courses should fall in plumb
   (d) cement mortar used must have surkhi as additive

69. Window sills in residential house are normally kept at
   (a) 83 to 90 cm above the floor level
   (b) 80 to 9 cm above the floor level
   (c) 78 to 88 cm above the floor level
   (d) 75 to 85 cm above the floor level  
   [IES-1996]

70. For one cubic metre of brick masonry, the number of modular bricks needed is
   (a) 400 or less  (b) 400 to 450
   (c) 500 to 550   (d) 600 to 650  
   [IES-1997]

71. In brick masonry,
   (a) Mortar strength should match brick strength
   (b) Mortar strength should exceed brick strength
   (c) Brick strength should exceed mortar strength
   (d) The strength of masonry and brick are independent  
   [IES-1998]

72. The crushing strength of a good building stone should be at least
   (a) 50 MPa  (b) 100 MPa
   (c) 150 MPa  (d) 200 MPa  
   [IES-1998]

73. The slenderness ratio for masonry walls should NOT be more than
   (a) 50  (b) 40
   (c) 30   (d) 20  
   [IES-1998]

74. The most important purpose of frog in a brick is to
(a) Emboss manufacturer’s name
(b) Reduce the weight of brick
(c) Form keyed joint between brick and mortar
(d) Improve insulation by providing ‘hollows’

[IES-1999]

75. Bricks are burnt at a temperature range of
   (a) 500º to 700ºC
   (b) 700º to 900ºC
   (c) 900º to 1200ºC
   (d) 1200º to 1500ºC  [IES-1999]

76. A king closer is a
   (a) Full brick  (b) ¼ brick
   (c) longitudinally ½ brick  (d) crosswise ½ brick  
   [IES-2000]

77. The number of bricks required per cubic metre of brick masonry is
   (a) 400   (b) 450
   (c) 500   (d) 550  
   [IES-2001]

78. The maximum permissible slenderness ratio for masonry walls is
   (a) 40   (b) 30
   (c) 20   (d) 10  
   [IES-2000]

79. When the corner of a brick is removed along the line joining mid-points of adjoining sides, the portion left is called
   (a) Closer   (b) Squint brick
   (c) Queen closer   (d) King closer  
   [IES-2000]

80. The minimum compressive strength of first class bricks should be
   (a) 5 N/mm²   (b) 7.5 N/mm²
   (c) 9 N/mm²   (d) 10 N/mm²  
   [IES-2001]

81. Which one of the following is the correct statement?
   Refractory bricks resist:
   (a) high temperature
   (b) chemical action
   (c) dampness
   (d) all of the above  
   [IES-2005]

82. What is the effective height of a free-standing masonry wall for the purpose of computing slenderness ratio?
   (a) 0.5 L   (b) 1.0 L
   (c) 2.0 L   (d) 2.5 L  
   [IES-2005]
83. When a 1st class brick is immersed in cold water for 24 hours, it should not absorb water by weight more than
   (a) 15%   (b) 20%
   (c) 25%   (d) 30%
   [IES-2006]

84. The temperature at which the bricks are burnt in kiln varies from
   (a) 500° to 800° C
   (b) 800° to 1000° C
   (c) 1000° to 1200° C
   (d) 1200° C to 1500° C
   [IES-2006]

85. Which one of the following is the nominal size of standard modular brick?
   (a) 25 cm x 13 cm x 8 cm
   (b) 25 cm x 10 cm x 8 cm
   (c) 20 cm x 10 cm x 10 cm
   (d) 20 cm x 15 cm x 10 cm
   [IES-2007]

86. Why are bricks soaked in water before using in brick masonry?
   (a) For removing dust
   (b) For reducing air voids
   (c) For preventing depletion of moisture from mortar
   (d) For reducing efflorescence
   [IES-2007]

87. In load-bearing wall, the depth of horizontal chassis should not exceed which one of the following?
   (a) 1/3 thickness of masonry
   (b) ¼ thickness of masonry
   (c) 1/5 thickness of masonry
   (d) 1/6 thickness of masonry
   [IES-2007]

88. When a column is supported throughout its length either by masonry walls or by construction on all the sides, then its slenderness ratio is
   (a) Infinite   (b) Zero
   (c) Reasonably high   (d) Low
   [IES-2011]

89. Maximum slenderness ratio for load-bearing masonry wall built in cement mortar, as per IS code, shall not exceed
   (a) 13   (b) 20
   (c) 27   (d) 30
   [IES-2011]

90. The standard size of a brick is
   (a) 20 cm x 10 cm x 10 cm
91. As per IS classification, the minimum compressive strength of a first class brick should be
   (a) 75 kg/cm² (b) 100 kg/cm²
   (c) 125 kg/cm² (d) 150 kg/cm²
   [IES-2012]

92. The compressive strength of heavy duty bricks, as per IS : 2980-1962, should be not less than
   (a) 400 kg/cm² (b) 175 kg/cm²
   (c) 100 kg/cm² (d) 75 kg/cm²
   [IES-2014]

93. According to the relevant IS code, the weight of the timber is to be reckoned at a moisture
   content of
   (a) zero   (b) 4%
   (c) 8%    (d) 12%
   [IES-1995]

94. The strength of timber is maximum when load applied is
   (a) parallel to grain
   (b) perpendicular to grain
   (c) inclined at 45 to grain
   (d) inclined at 60 to grain
   [IES-1995]

95. The nail diameter should not be more than (t= least thickness of the wooden member to be
   connected)
   (a) t/6   (b) t/8
   (c) t/10  (d) t/12
   [IES-1996]

96. The expansion and shrinkage of plywoods are comparatively very low as
   (a) they are held in position by adhesives
   (b) they are glued under pressure
   (c) plies are placed at right angles to each other
   (d) they are prepared from veneers
   [IES-1996]

97. Seasoning of timber is required to
   (a) soften the timber
   (b) harden the timber
   (c) straighten the timber
   (d) remove sap from the timber
   [IES-1996]

98. The modulus of elasticity of timber is about
   (a) 0.5 to 1.0 x 10⁴ N/mm²
   (b) 1.0 to 1.5 x 10⁴ N/mm²
   (c) 1.5 to 2.0 x 10⁴ N/mm²
   (d) 2.0 to 2.0 x 10⁴ N/mm²
   [IES-1997]
99. During the conversion of timber by sawing, in order to obtain strong timber pieces, the cut should be made by
   (a) Ordinary sawing (b) Tangential sawing
   (c) Quarter sawing  (d) Radial sawing
   [IES-1997]

100. The moisture content in structural timber should be
   (a) less than 5%  (b) 5 to 10%
   (c) 10 to 20%  (d) 15 to 25%
   [IES-1998]

101. Radial splits in timber originating from ‘Bark’ and narrowing towards the ‘Path’ are known as
   (a) Heart shakes  (b) Star shakes
   (c) Cup shakes  (d) knots
   [IES-1999]

102. The moisture content in a property seasoned timber will in the range of
   (a) 5% to 8%  (b) 8% to 10%
   (c) 10% to 12%  (d) 12% to 15%
   [IES-2000]

103. The strength of timber is maximum in the direction
   (a) Perpendicular to the grains
   (b) Parallel to the grains
   (c) 45° to the grains
   (d) At all angles
   [IES-2000]

104. On application of external stress on timbers, it behaves like
   (a) An elastic material
   (b) Non-elastic material
   (c) Viscoelastic material
   (d) Non-viscoelastic material
   [IES-2001]

105. The ratio of tangential shrinkage to radial shrinkage of wood due to reduction in moisture content is
   (a) In the range from 3.1 to 5.1
   (b) In the range from 2 to 3
   (c) In the range from 1 to 2
   (d) Less than or equal to 1
   [IES-2001]

106. Timber can be made reasonably fire-resistant by
   (a) soaking it in Ammonium Sulphate
   (b) coating with Tar plant
   (c) pumping creosote oil into timber under high pressure
   (d) seasoning process
   [IES-2002]

107. A well-seasoned timber has a moisture content of about
   (a) 15% to 20%  (b) 10% to 12%
   (c) 5% to 8%  (d) 2% to 3%
   [IES-2003]
107. Dry rot in timber is caused by
(a) Lack of ventilation
(b) Lack of light
(c) Immersion in water
(d) Alternative wet and dry atmosphere

[IES-2003]

108. Wood is impregnated with creosote oil in order to
(a) change its colour
(b) protect against fungi
(c) protect the annular layers
(d) fill up the pores

[IES-2003]

109. The timber preservative “creosote” belongs to the group of
(a) Water soluble salts
(b) Organic solvent type
(c) Tar oil type
(d) Inorganic solvent type

[IES-2006]

110. The strength of timber is maximum in a direction
(a) Parallel to the grains
(b) Perpendicular to the grains
(c) 45° to the grains
(d) 30° to the grains

[IES-2006]

111. Which one of the following is the most preferred wood for high quality and durable furniture?
(a) Sandalwood (b) Deodar wood
(c) Teakwood (d) Shisham wood

[IES-2007]

112. As a natural material, timber is which one of the following?
(a) Isotropic (b) Anisotropic
(c) Homogeneous (d) Sapwood

[IES-2007]

113. Shear strength of timber depends on which one of the following?
(a) Lignin with fibres (b) Medullary rays
(c) Heartwood (d) Sapwood

[IES-2007]

114. The defect which develops due to uncontrolled and non uniform loss of moisture from wood is known as which one of the following?
(a) Knot (b) Shake
(c) Warping (d) Cross grain

[IES-2007]

115. The moisture content of timber used in building frames can be
(a) 2% to 5% (c) 8% to 12%
(b) 12% to 18% (d) > 20%

[IES-2007]

116. What is the ratio of the elastic modulus of structural timber in longitudinal direction to that in the transverse direction?
117. What is the modulus of elasticity of standard timber (Group in (MN/cm²)?
(a) 0.5 to 1.0  (b) 1.0 to 1.25  
(c) 1.25 to 1.5  (d) 1.5 to 1.75  
[IES-2009]

118. What is the treatment for marking timber fire-resistant?
(a) ASCU treatment  (b) Abel’s process  
(c) Creosoting  (d) Tarring  
[IES-2009]

119. The radial splits which are wider on the outside of the log and narrower towards the pith are known as
(a) star shakes  (b) annular rings  
(c) cup shakes  (d) heart shakes  
[IES-2012]

120. The age of a log of timber can be estimated by
(a) diameter of pith 
(b) thickness of bark 
(c) number of annular rings 
(d) number of medullary rays  
[IES-2012]

121. What treatment is adopted for making timber fire-resistant?
(a) ASCU treatment  (b) Abel’s process  
(c) Creosoting  (d) Tarring  
[IES-2013]

122. The plies in plywood are so placed that the grains of each ply are
(a) parallel to each other  
(b) at right angle to one another  
(c) 45° oblique to adjacent grain  
(d) not constrained by any consideration  
[IES-2014]

123. Which IS code is used for classification of timber for seasoning purposes?
(a) IS : 4970-1973 
(b) IS : 1708-1969 
(c) IS : 1141-1958 
(d) IS : 399-1963  
[IES-2014]

124. In paints, linseed oil is used as
(a) A thinner  (b) A drier  
(c) A vehicle  
(d) A water-proofing base  
[IES-1998]

125. An arrangement for temporarily supporting a structure from beneath for safety, is known as
(a) Jacking  (b) Underpinning
(c) Supporting  (d) Hauling

[IES-2000]

ANSWER KEY

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CIVIL ENGINEERING/IES/GATE/PSU/SSC-JE/State AEn/JEn

CAREER GUIDANCE SESSION

with IITian & I.E.S. B. CHAND

Why you should work hard during B.Tech?
Job options for civil engineers?
Comparison b/w govt. & pvt. sector jobs?
Benefits of preparing for competitive exams during B.Tech?
Making balance b/w college stuffs & IES prep?
Free digital study material for IES/GATE/SSC-JE?
Effective self-study strategy?
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FM
Fluid
Mechanics
1. Which one of the following pressure units represents the LEAST pressure?
   (a) millibar   
   (b) mm of mercury
   (c) N/mm²   
   (d) kgf/cm²

   [IES-1997]

2. Which one of the following statements is correct?
   (a) Dynamic viscosity of water is nearly 50 times that of air
   (b) Kinematic viscosity of water is 30 times that of air
   (c) Water in soil is able to rise a considerable distance above the groundwater table due to viscosity
   (d) Vapour pressure of a liquid is inversely proportional to the temperature

   [IES-2003]

3. Multi U-tube manometers with different fluids are used to measures
   (a) Low pressures
   (b) Medium pressures
   (c) High pressures
   (d) Very low pressures

4. The absolute pressure at a point 2.5 m below the clear water surface is measured as 125.703 kN/m². If the atmospheric pressure is taken as 101.325 kN/m², the gauge pressure in kN/m² at this point would be
   (a) 113.514   
   (c) 24.378
   (c) 45.401   
   (d) 56.757

   [IES-2013]

5. The standard atmospheric pressure is 101.32 kPa. The local atmospheric pressure is 91.52 kPa. If a pressure at a flow path is recorded as 22.48 kPa (gauge), it is equivalent to
   (a) 69.04 kPa (abs)   
   (b) 88.84 kPa (abs)
   (c) 114.0 kPa (abs)   
   (d) 123.0 kPa (abs)

   [IES-2014]

6. As the depth of immersion of a vertical plane surface increases, the location of centre of pressure
   (a) Comes closer to the centre of gravity of the area
   (b) Moves apart from the centre of gravity of the area
   (c) Ultimately coincides with the centre of gravity of the area
   (d) Remains unaffected

   [IES-1995]
7. If a water tank, partially filled with water is being carried on a truck, moving with a constant horizontal acceleration, the level of liquid will

(a) rise and fall alternately on the front side of the tank
(b) fall on the rear side of the tank
(c) remain the same on both sides of the tank
(d) rise on the rear side and fall on the front side of the tank  [IES-2001]

8. The flow of water in a wash hand basin when it is being emptied through a central opening, is an example of

(a) free vortex    (b) forced vortex
(c) rotational vortex    (d) Rankine vortex  [IES-1995]

9. In a fluid flow, the line of constant piezometric head passes through two points which have the same

(a) elevation    (b) pressure
(c) velocity    (d) velocity potential  [IES-1995]

10. In an open cylindrical tank filled with water, a hole is made at the mid-point at the bottom. The spiral motion of the outgoing water is

(a) Rotational    (b) Irrotational
(c) Forced vortex    (d) Turbulent  [IES-2010]

11. The movement of air mass in the case of Tornado can be described as:

(a) Forced vortex throughout
(b) Free vortex throughout
(c) Forced vortex at the core and free vortex outside
12. The Bernoulli’s equation is applicable to:
   (a) Both steady and unsteady flows
   (b) Real fluids
   (c) All fluids and flows along a stream tube
   (d) Steady flow of ideal fluids along a stream tube. [IES-2013]

13. The relative thickness ($\delta/x$) of turbulent boundary layer on a flat plate
   (a) decreases with distance (x)
   (b) increases with distance (x)
   (c) remains constant
   (d) depends on relative roughness [IES-1996]

14. The loss of head in a pipe carrying turbulent flow varies:
   (a) Inversely as the square of the velocity of flow.
   (b) inversely as the square of the diameter of pipe
   (c) Directly as the square of the velocity of flow
   (d) Directly as the velocity of flow [IES-2013]

15. “Eddy viscosity” means that it is
   (a) A physical property of the fluid
   (b) Same as the kinematic viscosity
   (c) Always associated with laminar flow
   (d) An apparent viscosity due to turbulent nature of flow [GATE-1990]

16. The friction factor for a turbulent flow in smooth pipes varies
   (a) Inversely as Reynolds number
   (b) Directly as Reynolds number
   (c) As square of Reynolds number
   (d) Inversely as $1/4^{th}$ power of Reynolds number [GATE-1991]

17. The stresses that arise due to fluctuations in the velocity components in a turbulent flow are
   (a) Euler stresses  (b) Limit stresses
18. The Prandtl maxing length for turbulent flow through pipes is
(a) Independent of shear stress
(b) A universal constant
(c) Zero at the pipe wall
(d) Independent of radial distance from pipe axis

19. The ratio of the coefficient of friction drag in laminar boundary layer compared to that in turbulent boundary layer is proportional to
(a) $R_L^{1/2}$
(b) $R_L^{1/5}$
(c) $R_L^{3/10}$
(d) $R_L^{-3/10}$

20. What is the momentum thickness for the boundary layer with velocity distribution $\frac{u}{U} = \frac{Y}{\delta}$?
(a) $\delta/6$
(b) $\delta/2$
(c) $3\delta/2$
(d) $2\delta$

21. Stream line inside a boundary layer over a flat plate
(a) Are parallel
(b) Diverge
(c) Converge
(d) Are normal to the flow direction

22. Boundary layer is a thin fluid region close to the surface of a body where
(a) Viscous forces are negligible
(b) Velocity is uniform
(c) Inertial forces can be neglected
(d) Viscous forces can not be neglected

23. The cavitation and pitting can be prevented by creating which one of the following conditions?
(a) Reducing the pressure head
(b) Reducing the velocity head
(c) Increasing the elevation head
(d) Reducing the piezometric head
24. Which one of the following phenomena in a pipe flow is termed as water hammer?
   (a) The sudden rise of pressure in a long pipe due to sudden closure of valve
   (b) The rise of a pressure in a pipe flow due to gradual closure of valve
   (c) The rise of negative pressure
   (d) The zero pressure in a pipe flow [IES-2003]

25. Flow duration curve is a plot of
   (a) Flow against its time of occurrence in chronological order
   (b) Flow in ascending order against percentage time in chronological order
   (c) Flow that equaled or exceeded against percentage time
   (d) Flow against duration of time for which it is sustained [IES-2003]

26. In a pipe network of municipal water supply, a parallel pipe is sometime installed over a potion of the pipe mainly for
   (a) reducing water hammer pressure
   (b) decreasing the pumping power need
   (c) increasing the head available at the node
   (d) increasing the discharge [IES-2010]

27. If the velocity of flow as well as the diameter of the flowing pipe are respectively doubled through a pipe system in use since long, the head loss will thereafter be
   (a) Halved (b) Doubled
   (c) Increased 4 times (d) No change [IES-2012]

28. Branching–pipe problems are usually solved
   (a) By assuming the head loss is the same through each pipe
   (b) By equivalent lengths
   (c) By assuming the elevation of the hydraulic gradient line at the junction point and trying to satisfy continuity
   (d) By assuming a distribution which satisfies continuity and computing a correction. [GATE-1994]
29. In network of pipes

(a) The algebraic sum of discharge around each circuit is zero
(b) The algebraic sum of pressure + datum head drops around each circuit is zero
(c) The elevation of hydraulic gradient line is assumed for each junction point
(d) Elementary circuits are replaced by equivalent pipes.

[GATE-1996]

30. For steady incompressible flow through a closed-conduit of uniform cross-section the direction of flow will always be

(a) From higher to lower elevation
(b) From higher to lower pressure
(c) From higher to lower velocity
(d) From higher to lower piezometric head

[GATE-2015 SET-I]

31. The Reynolds number of a flow is the ratio of

(a) Gravity forces to viscous forces
(b) Gravity forces to pressure forces
(c) Inertial forces to viscous forces
(d) Viscous forces to pressure forces

[GATE-1989]

32. Dynamic similarity is said to exist between two fluid flows when at corresponding points there are:

(a) Geometric similarity and similarity of forces involved
(b) Kinematic similarity and geometric similarity
(c) Interactions of inertia and viscous forces
(d) Interactions between inertia, viscous and pressure forces

[GATE-1990]

33. The repeating variables in dimensional analysis should

(a) Include the dependent variable
(b) Have amongst themselves all the basic dimensions
(c) Be derivable from one another
(d) Exclude one of the basic dimensions

[GATE-1996]

34. Both Reynolds and Froude numbers assume significance in one of the following examples

(a) Motion of submarine at large depths
(b) Motion of ship in deep seas
(c) Cruising of a missile in air
(d) Flow over spillways

[GATE-1997]
35. Though Manning's formula is dimensionally non-homogeneous, it is commonly used in practice because.

(a) it is in a simple form
(b) it was derived from extensive field data
(c) it can be made dimensionally homogeneous
(d) it can be related to Chezy's coefficient or Darcy-Weisbach's friction factor

36. In the step methods (both direct and standard), the computations must

(a) Proceed downstream in subcritical flow
(b) Proceed upstream in subcritical flow
(c) Always proceed upstream
(d) Always start at a control section

37. Which one of the following statements is not correct? A control section in an open channel is the site

(a) where the flow quantity can be controlled
(b) at which flow is known to be critical
(c) where the discharge can be measured
(d) where the specific energy is determined

38. A depth-discharge relationship of the canal section is maintained at a notch fall because the sill of the notches is:

(a) Level with downstream canal bed
(b) Below the upstream canal bed
(c) Level with upstream canal bed
(d) Above the upstream canal bed

39. If the Froude number characterizing flow in an open channel is less than unity, an increase in channel width causes the water surface elevation to

(a) Form ripples
(b) remain same
(c) decrease
(d) increase
40. Uniform flow in a channel is characterized by one or more of the following statements

(a) Gradient of the total energy is parallel to the channel bed
(b) Total energy remains constant along the channel
(c) Specific energy remains constant along the channel
(d) Total energy line either rises or falls depending on Froude number.

41. If is most appropriate to say that uniform flow in an open-channel occurs when there is a balance between

(a) Gravity and frictional forces
(b) Gravity and inertial forces
(c) Inertial and frictional forces
(d) Inertial and viscous forces [GATE-1990]

42. In deriving the equation for the hydraulic jump in a rectangular channel in terms of the conjugate depths and the initial Froude number

(a) Continuity equation and energy equation are used
(b) Continuity equation and momentum equation are used
(c) Equations of continuity, momentum and energy are used
(d) Gradually varied flow equation is used [GATE-1995]

43. Flow at critical depth takes place in an open channel when

(a) For a given specific energy, discharge is maximum.
(b) For a given discharge, specific energy is maximum.
(c) Discharge is minimum for a given specific force.
(d) Discharge is maximum for a given specific force. [GATE-1996]

44. A pumped storage plant is a

(a) high head plant (b) run-off river plant
(c) Peak load plant (d) base load plant [IES-1995]

45. The correct sequence, in the direction of the flow of water for installations in a hydro-power plant is

(a) Reservoir, surge tank, turbine penstock
(b) Reservoir, penstock, surge tank, turbine
(c) Reservoir, penstock, turbine surge tank
(d) Reservoir, surge tank, penstock, turbine [IES-1997]
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About the Author - Mr. B. Chand, a young, honest and talented officer of Indian Engineering Services (I.E.S.) is currently working with the Indian Railways (IRSE) in Rajasthan, holds 1st Class B. Tech degree in Civil Engineering from IIT Guwahati. Apart from his professional duties, Mr. B. Chand has been associated with the thousands of Engineering Graduates since 2012. Teaching, guiding and motivating the needy students is an inbuilt quality of IES B. Chand.

Other Academics Achievements-

- Academics Excellence Award by Rajasthan Patrika
- 1st Class B.Tech Civil Engineering IIT Guwahati-2012
- Assistant Commandant- 2012 AIR(GEN)-06
- SSC-JE-2013 AIR(Gen)-04
- Teacher/guide/motivator IES/GATE/SSC-JE Since-2012

Other Non-Academics Achievements-

- Welfare Secretary, Student’s Welfare Board, IIT Guwahati-2010
- General Secretary, External Affairs, ACE, IIT Guwahati-2012
- Secretary, Youth Empowerment Club, IIT Guwahati-2012
- Art of Living Fellow
- Certified Vastu Expert (Ayaadi Calculations)
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Interests-

Rural Development, Reform in Indian Education System, Youth Empowerment, Service to old aged people, Politics

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1. **Purpose of this Guide Book**

As per National Employability Report 2016, only 6.48% civil engineering graduates are capable of working in core sector that means approximately 93% of civil engineers have got the degree but not the knowledge. *India Today* (July 13, 2016) also reported on the same issue that only 7% of engineering graduates are employable. This figure of 7% (*employable engineers*) is a national average in that graduates of IITs, NITs and other reputed technical institutions are included but if similar type of survey is carried out on any ordinary private engineering college then shockingly this figure might reach up to 1%. These days, hundreds of similar media reports are available which clearly put a big question mark on the quality of engineering graduates of India.

Of course for this, Indian education system, engineering institutions and student community all are collectively responsible but ultimately who is going to suffer? There is no doubt that in a broader sense India’s development will get obstructed but at an individual’s level it’s the engineering student who is going to suffer a lot in his/her life.

As of now it is very difficult for me to reform the India’s education system for better but being a civil engineer I feel that it is my duty to aware all the civil engineering students and graduates in order to improve the quality of engineering knowledge. This booklet is written with the single objective of guiding civil engineering students in such a way that if they follow what is mentioned over here they can become outstanding engineers without any much support from government system and engineering colleges.

Further many IIT/NIT graduates are jobless so it can’t be said that there is a big role of engineering colleges. It’s the individual who perform, it’s the individual who work hard and it’s the individual who dreams. Therefore you have to identify the true potential of yours and work hard accordingly to achieve your goals.

2. **Advantage of preparing for competitive exams during B.Tech**

It does not really matter whether you want to work in Government sector or in Private sector, the thing which matters is your *knowledge*. When you approach some government sector job then you have to prove your potential through a series of written
examinations/interviews and on the other hand getting a private job might be easier but after getting into it you have to prove your-self with best engineering skills. So in nut-shell it can be said that having good command over all the engineering subjects is need of the hour. To achieve mastery on all the engineering subjects you need support of good faculty team, you need to have good study material, motivation, proper guidance and most importantly sufficient time. Most of the students do not study during college days and wait for either 4\textsuperscript{th} year or completion of degree to start the preparation for a job but by that time they have lost all the opportunities and after that they are not able to complete such a vast engineering syllabus in just one year. Not studying during college days means inviting tension and depression for the future. I would say not studying during college days is suicidal. Interestingly When I suggest the students to prepare for competitive exams such as ESE,GATE, SSC-JE etc. during 04 years of their B.Tech ,they make so many excuses and few of them are as under -

1) Why should I prepare during B.Tech? It is too early. Exam will be at the end of 4\textsuperscript{th} year.
2) It’s very difficult to manage both college stuffs and preparation of competitive examinations.
3) My college faculty is not supportive. How can I prepare?
4) I will attend some coaching in Delhi after B.Tech and in one year I will crack IES/GATE/SSC-JE.
5) It is a college time and I should enjoy.

Well, I do not know which one is your excuse but today I will through some light on all these excuses.

**Q.1 Why should I prepare during B.Tech? Exam will be at the end of 4\textsuperscript{th} year.**

**Answer**- There are so many subjects in engineering and you have to learn all of them one by one gradually in 4 years of B.Tech. These subjects are not that much easy that’s why government has kept provision of 04 long number of years for B.Tech otherwise it would have kept one or two years for B.Tech. If you wait for final year then you will not be able to understand all the subjects in just one year. Remember competition is very high. Only in depth understanding of all the subjects can sail you through these highly competitive examinations.

**Q.2 It’s very difficult to manage both college stuffs and preparation of competitive examinations.**
Answer- It is very genuine question. For this you just have proper planning, time management, adopt effective preparation methodology, arrange good study material and get into touch with friends/seniors who are having same goal. This write-up is aimed to provide you all these things easily in order to make balance between college stuffs and preparations of competitive exams.

Q.3 How to prepare sir? Our college faculty is not good.

Answer- Trust me, I have seen many IIT students complaining about their faculty so it is you who have to work hard for your future. This guide book is designed in such a way that the poor quality of faculty will not affect your preparation. You just read section 11 and 12 of this guide book to solve this issue.

Q.4 I will attend some coaching in Delhi after B.Tech and in one year I will crack IES/GATE/SSC-JE.

Answer- Engineering is not cakewalk. You can’t master it in just one year. In Delhi in one class room 500+ students sit and asking doubts is not allowed so it is difficult to learn over there in just one year especially if you are an average or below average student. Secondly, coaching institutes do not have laboratory facilities. Without practical it is very difficult to learn an engineering subject properly. In Delhi, I have been teaching since 2012 and realized that only those who are from IITs, NITs or those who have studied a lot during college time are only able to crack competitive exams in one year with the help of coaching institute and other students simply go back home without any job so work hard during college.

Q.5 It is college time and I should enjoy?

Answer- Your enjoyment at this time will spoil your life and life of your family members. Delay this enjoyment just for 04 years. You can become class 1 gazetted officer of Indian government at the age of 21 and in India class 1 officer is like a king. Trust me a King can enjoy his life in a better way. Your life will be heaven if you crack IES at the age of 21.

In brief it can be said that if you study during B.Tech, you can get following benefits-

1. You can achieve mastery on all the subjects because you have got lot of time and laboratory facilities during B.Tech. For better results joining a good coaching is always a great idea during college days itself. Do you know how to identify a good coaching institute?
2. Coaching institutes complete the whole syllabus in just 4-5 months so in such a short period you will not be able to understand all the subjects properly if you join coaching institute after B.Tech. So preparation after B.Tech must be avoided.

3. Preparing in Delhi for 1 year means spending 2-3 lakh rupees of your parents and selection in just one year is not guaranteed. So be cautious!

4. Selection at the age of 21 or 22 year will take you to the highest post of the department that you join and it is possible only when you prepare during B.Tech only.

5. If you have good job just with your B.Tech, people will respect you and your family, you will have good status in society, you will be free from any stress, anxiety, pressure. I have seen many students going into depression just because they do not have good job after becoming engineers from reputed engineering colleges.

6. Preparing after B.Tech means wasting important time and money. The feeling of joblessness after becoming an engineer will put heavy mental pressure on you and lower down your self-confidence. Delaying the selection in IES by 2-3 years means losing seniority and of course grand salary/perks (approximately 2CR). Seniority lost is irrecoverable in this lifetime.

Some major Benefits (in-brief) of Preparing for Competitive Examinations during B.Tech:

1. If you are planning to prepare for various competitive exams (ESE/GATE/SSC-JE/State(AEn/JEn)) after B.Tech then Be Alert!!!! In the market Coaching Institutes accommodate 500-800 Students in one class room and finishes the huge syllabus of engineering in just 04 months and that too without any lab instrument/field exposure. Just think over it 10 times! The engineering that you could not learn in long 04 years with all the resources available with you like faculty/Lab facility/field exposure/tension free mind (after B.Tech you will be under pressure due to joblessness)/sufficient time, How will you learn this engineering in some coaching institute in just 04 months where 800 students sit in a single classroom. Trust me you are not going to learn anything from there. In such a crowded classroom you cannot clear your basic doubts. You simply wasting the hard earned money of your parents. That's Y 95% Engineers as on date are jobless in India. (See 15/09/2016 NDTV report/Ravish Kr)

2. I agree, your college faculty may not be so good that's why just take help from some local outside coaching that can teach you subjects semester-wise. Prepare all the subjects semester wise according to UPSC ESE/GATE syllabus and be tension free. Enjoy your college life.

3. If you do so, you can get very good CGPA/CPI/%, Very good image in the College, and in the end a very good job at the age of 21 without wasting any money and time after B.Tech. On an average Engineers waste 06 years and 4 lakh rupees to get a job after completion of B.Tech.
3. Private sector vs. Government sector for Civil Engineers

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Element</th>
<th>Private</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Job Security</td>
<td>No</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>Status in Society</td>
<td>Possible when you rise high</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>Promotion</td>
<td>Performance based. Sky is the limit for talented people</td>
<td>Mostly time bound promotion irrespective of performance and talent</td>
</tr>
<tr>
<td>4</td>
<td>Money</td>
<td>Performance based</td>
<td>Fixed not based on performance</td>
</tr>
<tr>
<td>5</td>
<td>After retirement benefits</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Note1**- Those civil engineers who want to excel in private sector, please achieve very good communication skill and good command over Building materials, SOM, TOS, RCC and Foundation Engineering. You will earn 100 times more than so called government employees. Good Luck!

4. Various career options in Government sector for Civil Engineering Graduates

- Indian Engineering Services (IES) conducted by UPSC
- GATE (PSUs)
- GATE (M.Tech From IITs)
- PSUs through their own exams
- SSC-JE
- State Government- Assistant Engineers/Junior Engineers

**Note**- If you prepare for IES then you can get selected in all the above examinations without any extra preparation.

5. M.Tech/ PhD from IITs

Admission in M.Tech can be taken in any IIT with good score in GATE. After M.Tech you can join a post of lecturer in some good government college and can pursue PhD from there only and after completion of that, you can become assistant professor. On the other hand you can do both M.Tech and PhD from IIT and after that you can become assistant professor directly in any good Government college like IIT/NIT/State Govt. etc. Teaching is a best profession to serve the nation and at the same time you will have sufficient time for your personal life. *I always recommend girls to do M.Tech+Phd from IITs and to become Professor in IITs/NITs.* For more details please see the GATE notification. GATE exam is conducted...
by some IIT in month of Feb. Every year different IIT conduct the exam so please check the website accordingly.

6. Right time to start the preparation for competitive exams
   B.Tech 1st year is the right time. YES it is.

7. Things to get done in 1st year of B.Tech/B.E./Diploma
   Learn English Grammar and English Speaking. Try to develop effective communication skills. For an engineer good English is must and for any profession, effective communication is the key to success. I know, many of the engineering students have got Hindi medium schooling, but what to say? Even I studied in Hindi medium Government School of Rajasthan. I agree that language can be learned well in childhood but still it is not too late. Please! Please! Please! Learn English anyhow during your first year because from 2nd year onwards you will be completely busy in your core subjects. That’s enough for 1st Year. Enjoy your fresher’s parties and interactions with seniors. Remember interaction with seniors is not ragging, take it lightly and build your network. Also try to play at least one game as per your interest. Learning yoga and meditation is best thing in 1st year. I learned yoga from Art of Living. http://www.artofliving.org/in-en

8. What to study in 2nd year of B.Tech/B.E./Diploma
   Prepare only following subjects during 2nd year as per IES B. Chand’s Method of Self-Study
   1. Building Materials and Concrete Technology(BMC)
   2. Surveying
   3. Strength of Materials(SOM)
   4. Fluid Mechanics(FM) and Hydraulic Machines
   5. Engineering Mathematics

   Prepare only following subjects during 3rd year as per IES B. Chand’s Method of Self-Study
   1. Theory of Structures(TOS)
   2. Geotechnical Engineering(Soil Mechanics+ Foundation Engineering)
   3. Environmental Engineering(Drinking water+ Waste Water)
10. **What to study in 4th year of B.Tech/B.E./Diploma**

Prepare only following subjects during 4th year as per **IES B. Chand’s Method of Self-Study**

1. Theory of Steel Structures
2. Construction planning, management and equipments
3. Hydrology and Water resource engineering
4. General Studies notes

11. **Sources of free Digital study material**

- Detailed Hand written coaching notes(all subjects) for IES/Gate available at Facebook group of Engineers Pride-  [https://www.facebook.com/CHANDBIRDHI/](https://www.facebook.com/CHANDBIRDHI/)
- For all Technical subjects of civil engineering IITs have made Video lectures/Text lectures and uploaded on [http://nptel.ac.in/](http://nptel.ac.in/). These videos lectures/text lectures are free and can be downloaded by anybody in India. You can also buy the DVDs of all these video lectures from this website at nominal prices.
- SSC-JE last 15 years papers are available at-  [https://www.facebook.com/groups/somATengineerspride/](https://www.facebook.com/groups/somATengineerspride/)
- For free e books of various reputed authors- [https://www.facebook.com/groups/somATengineerspride/](https://www.facebook.com/groups/somATengineerspride/)
- Soon IES and GATE old papers with detailed solutions will be available at-  [http://engineerspride.org/](http://engineerspride.org/)
- For any technical query-  [https://www.facebook.com/CHANDBIRDHI/](https://www.facebook.com/CHANDBIRDHI/)
- For IES notification and Old papers-  [http://www.upsc.gov.in/](http://www.upsc.gov.in/)
- For SSC JE notification-  [http://ssc.nic.in/](http://ssc.nic.in/)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Text Book/Basic Level</th>
<th>Text Book/Advance Level</th>
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<tr>
<td>4.</td>
<td>RCC and PSC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Transportation Engineering(Highways+Railways+Airports+Harbours)</td>
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</table>
### 12. Effective methodology of preparing an Engineering Subject for IES/GATE/SSC-JE by Self Study (IES B.Chand’s Method)

This is the most important section of this guidebook. To secure top rank in any exam you have to be master at all the subjects of civil engineering and for that you have to read the subject with the help of very good study material and well qualified/experienced teaching experts.

Before starting any new subject (for example Design of Steel Structures) with self-study please arrange following material-

1. Some good text book of this subject (see the list of all the good books for each subject at [www.engineerspride.com](http://www.engineerspride.com) and buy from market)
2. Hand written notes of good coaching (link already provided)
3. College class notes (its very important if you are a college student)
4. NPTEL video lectures
5. NPTEL text lectures
6. At-least 25 years old papers of IES/GATE/SSC-JE
7. Have good physical and mental health
8. Have good friends who can help you
9. Maintain good relation with college faculty
10. Join Engineers Pride Facebook group for technical queries
11. Keep positive attitude and think that you will succeed in all exams in future
12. Purchase one big 500 pages note book and one small 100 pages note book
13. Download UPSC Engineering Services syllabus

**Note- Here I am assuming that from tomorrow in your college this subject (example-Design of Steel Structures) will be taught by some faculty**

After arranging above materials adopt the following steps

**Step1**- First of all take the bigger note book (500 pages) and write-down the syllabus of that subject as per UPSC notification on the initial pages and keep it at room.

**Step2**- Make some another (rough) note book of few pages and write down college class lecture notes. Try to clear all your doubts in the class room as much as possible.

**Step3** By the time the 1st chapter is completed in your college, you might have learned something but it is not sufficient for UPSC ESE/GATE so therefore you have to do some self-study at your room to understand this very 1st chapter of this subject(Example-Design of Steel Structures/DSS). Read this chapter from text book that you have already purchased. In case not getting the feel 😞 I mean not getting understood the concepts, please read coaching notes (downloaded from Engineers Pride FB group), still not getting? Read NPTEL text lectures, still any doubt? Watch NPTEL video lectures of this very 1st chapter of DSS. I am sure if you put this much effort with due sincerity and honesty nobody can stop you to get the actual feel 😊 of this 1st chapter of DSS. After getting complete understanding of this chapter write down detailed notes in your bigger note book (500 Pages). Doing this much is not enough, remember you are getting ready for a war, for a biggest exam of civil engineers in India i.e. UPSC ESE. After making your own hand written notes of this chapter please solve the last 25 years question papers (both objective and conventional) of ESE/GATE/SSC-JE examinations.

Trust me, it does not matter how well you have prepared your 1st chapter of DSS, you will not be able to solve all the questions of UPSC ESE , you might face problems in approximately
10% questions then for these remaining questions please read something extra with the help of Internet and update your notes accordingly. Now your 1st chapter of DSS is over.

Similarly complete all the remaining chapters, write down detailed notes in that bigger notebook and solve old papers. Keep safely this 500 pages booklet (in that you have written your own detailed notes of DSS) for future use.

Wait! wait! It is not over. Remember you have also purchased one small note book (100 pages). What will you do with that? Please write down short notes for frequent revision in this small note book. In future you will not get a complete semester to revise this subject, you should be able to revise this subject in one single day as and when required therefore make short notes covering the full syllabus within 10-15% pages of detailed notes. Please keep both the booklets safely, first one that is of 500 pages and contains detailed notes written by you and second one that is of 100 pages containing short notes for quick revision purpose. (You can through-out the college class notes now 😊) In this way you have to prepare all the civil engineering subjects during your B.Tech with self-study only.

13. Need/Importance of a good Coaching Institute

The strategy for self-study that I have discussed above is effective and result oriented but it requires lot of hard work, enthusiasm, sincerity and patience. On the other hand it is the nature of human beings to look for easier options. Well, coaching institute is that easier option for you because here everything is provided ready-made. After joining some good coaching institute you will not have to purchase any study material from market/internet, you do not have to study so many books and notes, no need of watching long video lectures, internet searching is not required, ultimately you can save lot of important time and can utilize this saved time in practising more questions and can get better command over the subject. Caution!! While joining coaching institute remember one important thing that the coaching institute should be really very good otherwise you may not get what you deserve and may become hopeless because it is quite obvious that after using the last life line (coaching institute) if somebody does not get the result he/she may go into depression/hopelessness therefore choose the coaching institute carefully. As per my experience, as I have been in this industry since 2012, 99% of the coaching institutes are fraud, their ultimate target is taking benefit of your helplessness as your college faculty could not teach you well. Do not worry! Just read the next section to know about the necessary features of a good coaching institute.

14. How to identify whether a coaching institute is good or not?
This is also important section of this guidebook especially for those who want to join some coaching institute along with their college or after the degree. I have been teaching, guiding and motivating young engineers of India since 2012 especially in Delhi and gained experience of teaching with smallest to biggest institute so far. In this period of four and half year I learned that coaching play very crucial role for selection in various examinations because competition is increasing exponentially. Of course intelligent students can crack ESE/GATE without coaching also but if they also attend some coaching institute then top rank is assured to them. Most importantly for average and below average students coaching institute is must. When your competitors are attending a good coaching then you should also attend good coaching otherwise it will be very difficult for you to compete with them. Following are the some of the important features of a good coaching institute-

I. Faculty should be well qualified and experienced
II. Lecture duration for each subject should be adequate
III. Class room strength room be limited
IV. Syllabus must be completed as per standard syllabus of UPSC ESE and GATE
V. All the previous 25 year questions should be solved in the classroom
VI. Syllabus should be completed well before exam so that revision can be done properly
VII. Weekly test series is must
VIII. Fee should be affordable by everybody and 100% scholarship should be given to needy ones

Interestingly every single institute will claim to provide all these above mentioned facilities but in reality there is not a single institute that provides all the above features. If you find any such institute please let me know because in that case I will shut down my own Institute and I will start teaching over there, I always support honest and genuine people.

Frankly speaking in the market broadly two types of coaching institutes exist- bigger ones and smaller ones.

Bigger ones are working at national level, they have got branches in many cities of India, they hire IIM graduates for marketing and publicity, manage the business from Delhi, they claim 50% to 70% selection out of total in all the exams every year, they charge very high fee, most of engineering students want to join these coaching institutes, infect many engineering students do not study during college and wait to join these coaching institutes after degree. Now listen the inside story, there is no doubt they have got good faculty but what is the use of that good faculty when class room strength is 500+ and students are not allowed to ask their doubts.
Average and below average student are not able to build basic concepts in such an environment. Even though these institutes keep separate classes for doubt clearance after few weeks and in that class some other low paid faculty comes, these things make the doubt clearance classes useless because by that time students have forgotten the theory part, since faculty is now different so the way of explaining things is different, ultimately it can be said that these big coaching institutes curtail the standard duration of lectures by making the excuse of keeping special doubt classes by some other low paid faculty.

Ultimately these things are spoiling the career of average or below average students. If I talk about more regarding these institutes they are having approximately 20-30 batches of IES/GATE across the country for each branch and in each batch 500+ students sit. Just imagine, if from each batch of 500+, 2-3 students get selected then total selection will be somewhere near to 100 and some more results are purchased with the help of money so ultimately in the market they will show 125 selection from their classroom coaching program or in other words 50% of total selection and trust me it is enough for them to attract new students across the country.

Believe me in every batch of 500 students there are always few intelligent students so their selection is not dependent on the quality teaching of faculty, they just need some direction and make it possible to the final list with their own talent.

Since these coaching institutes are not worried about the selection of students because as I have already explained that in every big batch of 500+ students few are very intelligent, so these students will get selected no matters how worst is the faculty or institute. It is quite obvious when you do not have pressure of giving result why would you work hard? These coaching institutes run new batches every week and finishes all the subjects in shortest possible time. Don’t solve old question papers in classroom. They charge very high fee. Yes I agree they have good test series but that can be availed online also without admission in classroom program.

In the last I can conclude that these big coaching institutes are beneficial only for very intelligent students who do not need much help from faculty. If you are an average or below average then do not even think to join these coaching institutes. Do not take your decision just by looking at advertisement and fake results.

Now I will talk about small coaching institutes, good things first- they have small batch size which is good for average or below average students to have one to one interaction with faculty, also fee is relatively low, but the bad thing is that they do not have good faculty because when batch size is small then they can’t afford good faculty, they also finishes the syllabus in shortest possible time, they also do not have good test series so ultimately I can
conclude that these small coaching institutes are good neither for intelligent students nor for average/below average students.

If you do not have any faith on my opinion then please see the GATE2016 report of civil engineering stream. 1,18,000 students appeared and only 900 students(0.8%) scored more than 50 marks out of 100. How is that possible? When so many coaching institutes are there, all are claiming to be the best, and only 900 students are scoring 50+ marks. Also remember in this list of 900 many IIT and NIT students are also included who appeared with self –study. So choose the coaching institute carefully because most of them are fraud. I have been in this industry so I got to know all these things and now stopped teaching in all these so called best coaching institutes and ultimately decided to start my own Institute “ENGINEERS PRIDE” containing all the 8 above listed features with due honesty and feeling of welfare of student community.

Note- To judge the quality of coaching institute, take demo classes for each subject, do not give them all your money in one go otherwise they will make you helpless. After attending demo class solve old papers and observe what they have taught you.

15. Importance of Test series and Mock Test

It is must for all the students. It will help you to score very high in final exam but remember one thing before writing any test please, complete your syllabus and write the test with full preparation otherwise there is no point in attending test series.

16. Cut-off analysis for ESE/GATE/SSC JE

ESE- It is little higher than 50% for final selection. Try to score at-least 60% for choice posting and seniority benefits.

GATE- 70% enough for PSU and 50% enough to get M.Tech seat in IITs

SSC-JE- 50% enough for selection but score 60% for choice posting and seniority benefits

Note- For year/category wise cut-off analysis search on net.Data is large.Cant be put here.

17. Importance of rank in ESE/GATE/SSC-JE examinations
ESE- Higher rank means you will get IRSE (Indian railways service of engineers)-highly prestigious and powerful post for a civil engineer in India. Further if you have very good rank among all IRSE officers then you will get posting in your home town and will get promotion very fast as compared to your batch mates. Remember in Railways zone allotment is decided completely on the basis of UPSC rank. If you have low rank, be ready to spend your rest of life in the Jungles of Nagaland or Arunachal Pradesh 😊

GATE- High rank means job in Maharatna PSUs and M.Tech admission in any IIT of your choice with desired stream.

SSC-JE- Higher rank means good department like CPWD, desired place of posting and seniority benefits. Remember there is no point in working at 2000km away from your family and parents for just 30k salary job. Think over it, secure good rank.

18. Importance of good physical and Mental Health

All the successful people on earth have got very good health so if you want to become successful just get the good health. Yes it is fact and infect it is the only health which allows you to work hard and work more and take you to the success. Without good health no one can succeed in life. Most of the students do not focus on this part and indirectly losing so many opportunities in their life.

Many students complain me about having very low concentration, weak memory, not feeling studying, low confidence level, depression, stress etc. and trust me all these signs indicates the poor physical and mental health. I will suggest you do to Yoga, Pranayama and meditation on daily basis. Spending one hour a day will make you 10 times more efficient so this investment is highly beneficial. As per my personal experience Art of Living (AOL) teaches very good yoga, pranayama and meditation techniques. I am sharing the link here - http://www.artofliving.org/in-en

19. Some important Questions and Answers

Q.1 I am a student of an ordinary private engineering college and average in studies. I am not confident about IES. Can I join SSC –JE batch in some coaching institute? Or should I go for IES batch?

Answer By IES B. Chand- First thing in India there are very limited seats in Government Colleges so most of the students have to join private engineering colleges therefore being a student of private engineering does not mean that you are not capable. Secondly selection in IES means you must be hardworking with little bit of intelligence therefore never ever underestimate yourself.
At-least from your side give your 100% and join IES batch. In the worst case your will secure top rank in SSC-JE if not selected in IES. Many people these days attracting students to prepare for SSC-JE only and I believe this is not good because everybody in his/her life time should try for the best at least once. So do not join SSC-JE batch. Just Join IES batch only.

Q.2 I am very weak in English. Will I get selected in IES?

Answer By IES B.Chand- Yes, you will be selected. Language is not the parameter of becoming an IES officer.

Q.3 Should I go to Delhi after B.Tech or should I prepare during B.Tech only with the help of some local coaching institute?

Answer by IES B.Chand- In Delhi Coaching centres will finish your whole course in just 04 months, you may not learn enough there in just 04 months so it is better to learn gradually during 04 years of B.Tech with the help of some good local coaching institute and self-study that I have discussed above.

Q.4 What is the right to Join coaching institute for IES?

Answer by IES B.Chand- From 2017 onwards ESE prelims is conducted in January and GATE is conducted in February so new batches start in the month of February after GATE exam. Best time is 4th semester because your coaching will be finished in 4th and 5th semester and during 6th and 7th semester you can revise the syllabus and practise old questions without any hurry. Joining coaching institute in 6th semester is also ok but your time management should be good because in one year you have to finish both the syllabus and last 25 years old papers. Therefore it might be little stress taking task. In the last, you can join coaching institute in 8th semester also but now you have to drop one year.

20. Introduction to Engineers Pride

In last 4-5 years, I have realized that there is not a single coaching which is fulfilling all the requirements of needy students. Off-course intelligent students will always get selected irrespective of coaching’s quality. Many students requested me during last few years to run my own institute so that I can teach without any such limitations as mentioned in above sections. I never wanted to enter in this business but now I have decided to help these students with a single objective of welfare towards student community.

My coaching institutes will fulfil all the requirements of every type of student from 2017 onwards. My purpose is just to provide you a very good platform on that you guys can learn and pass the IES/GATE/SSC-JE exams very easily with minimum fee and time. As I have already discussed that currently in the market thousands of coaching institutes are there with a single objective of profit making. They simply attract students on the basis of fake selections and high level marketing tactics. I request you to
ask any coaching institutes about the number of students taught by them in a particular year and selection achieved in that year. You will be surprised that out of 100 students only 1 or even less student are finally getting selected. But no coaching institutes will give you details in this matter but Engineers Pride publish these details because Engineers Pride is bound to get 100% success rate and working on the foundation of honesty.

So guys just to improve the quality of Indian engineers, I have started a genuine platform for you. The main features of ENGINEER’S PRIDE are as under-

- Any students can take admission in any individual subject after attending 10-15 hours of demo lectures free of cost, no need of taking admission in all the courses in one go. I am keeping this provision so that new students can have an idea about the quality teaching of Engineer’s Pride. This facility is not available in other institute because they do not have confidence on their teaching quality.
- Class room strength will be very limited. It is highly advantageous for average/below average students. Teacher- student interaction will be very much effective. I have adopted the IIT Guwahati classroom methodology for Engineers Pride.
- Unlimited teaching hours. I guarantee you, there is not a single Institute in India, that is offering unlimited teaching hours with such a minimum fee.
- I have teaching experience of around 4.5 years (My first class was on 4th Nov 2012 at Delhi, SOM for Mechanical Engineers, name of institute can’t be mentioned here due to obvious reasons). Also I am an IES at present and B.Tech from IIT Guwahati so you can have comparatively more faith on me. So the quality teaching is assured for you at Engineer’s Pride.
- Syllabus will be covered as per standard UPSC ESE/GATE/SSC-JE examinations.
- The whole syllabus will be completed at-least 03 months before the exam so that you can revise the syllabus properly and can build the concepts strongly with test series.
- Standard tests will be conducted fortnightly/weekly for both objective and subjective questions.
- Scholarship available for meritorious and financially backward students so financial conditions will not be obstacle to you at Engineer’s Pride.
- Free Personality development classes which are focused on communication skills and stress management.
- Any new feature can be added on the demand of students as the prime objective of the Engineer’s Pride is welfare of student community.
- Those who get selected in IES, will get full fee returned on the day of result so you can say that Engineers Pride is totally free for hardworking students.
- Most importantly, you will not find much publicity of Engineer’s Pride, because I always try to invest money of the students in improving the class room infrastructures such as ACs/Projectors/Digital notebooks/3D presentations/video lectures /Fields experiments/advanced Laboratory instruments. So please spread this write-up to maximum people so that your money should not be wasted in publicity.
- In nut-shell, it can be said that after attending classes at Engineer’s Pride, every Engineer will have a proud feeling of being an engineer.
How to select a good coaching institute? Read out following points carefully.

1. Take admission on the name of faculty not on the name of Coaching Institute

2. Do not ever trust the previous selections of any coaching because more than 90% results are either fake or purchased.

3. In every coaching faculty team changes every year, you never know the inside story so before taking admission make sure which faculty is teaching which subject and what are their previous feedbacks?

4. Make sure the owner of the coaching is successful person (IES/IITian) because unsuccessful person can not make you successful.

5. Try to know the goal of the coaching. If coaching owner is a hard working and intelligent teacher then his goal is to spread the knowledge but if the coaching owner is simply a business then trust me he/she will spoil your career like anything. His/Her target is making money at your career’s risk.

6. In case you are not able to utilize above 05 points then use following master trick - just take free demo classes of each subject. Remember take demo class of each subject and take admission subject-wise only. In this way no coaching wala’s can make you fool.

Note1 - Engineers Pride is the only Institute of India that provides free Demo classes (15hrs) of each subject and also provides facility of subject-wise admission.

Note2 - Take feedback from old/current students of IES B Chand.

Difference between Engineer’s Pride & Other Institutes

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Other Institutes (There are of mainly 02 types of coachings in the market, smaller and bigger ones)</th>
<th>Engineer’s Pride</th>
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<tbody>
<tr>
<td></td>
<td>Smaller Institutes</td>
<td>Bigger Institutes</td>
</tr>
<tr>
<td>Faculty &amp; Classroom strength</td>
<td>They have very less students and very low fee structure so it is impossible for them to hire highly qualified and well experienced faculty. As on</td>
<td>Yes, These institutes have got good faculty but at the same time class room strength is 500+ and in such a big class it’s practically impossible to</td>
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<td></td>
<td>In the Engineer’s Pride, Chief faculty is Mr. B. Chand, who is I.E.S.(Indian Railways)+IITian (B.Tech/CE/IITG)+5 Years of teaching experience with Delhi’s big coaching Institutes + SSC-</td>
<td></td>
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<tr>
<td>today good faculty charges minimum Rs. 4000/- per hour but these Institutes can afford up-to Rs. 400-1200/- per hour only</td>
<td>maintain one to one student-teacher interaction. Average/below average students are not able to learn fundamental concepts properly. 95% students sit in the class like a statue</td>
<td>JE/AIR(Gen)-04 rank. Here Class room strength is strictly kept limited so that average/below average students can clear their doubts in the classroom easily.</td>
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<tr>
<td><strong>Number of teaching hours</strong></td>
<td>These coaching institutes always try to minimize the standard duration of teaching to survive in the market</td>
<td>These institutes also curtail the standard duration of teaching to save the time of faculty so that more number of new batches can be run because in the market there is a big shortage of good faculty so they try to utilize the available faculty for maximum output.</td>
</tr>
<tr>
<td><strong>Last 25 years IES/GATE/SSC-JE class room paper solution</strong></td>
<td><strong>Note</strong> - As on today no coaching institute in India is solving last 25 years papers of IES/GATE/SSC-JE in their class room. As you might be aware that in the final exam of ESE/GATE/SSC-JE almost 80% concepts are directly being repeated every year and generally cut-off is around 50-60% for most of the examinations so solving these old papers means sure shot selection</td>
<td>Engineer’s Pride solves last 25 years papers of these examinations in the classroom. This unique feature is available only with Engineer’s Pride in entire India.</td>
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<td><strong>Test Series</strong></td>
<td>Very poor quality.</td>
<td>Good quality. HIGHLY Good quality.</td>
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### Free demo classes

<table>
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<tr>
<th>Description</th>
<th>Details</th>
<th>Engineer’s Pride provide free demo classes for each subject to all the students.</th>
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<tbody>
<tr>
<td>They do not have good faculty so can’t provide demo classes. They will take your money first. They are running institutes completely with the help of marketing tactics. At max they can provide demo class of one subject and will take your whole money. Who and how will be taught other subjects? No-body knows.</td>
<td>For them neither your admission matters nor selection so they do not provide demo classes. They have developed big business brand so every year thousands of students are becoming fool just after seeing fake results and misleading marketing tactics.</td>
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### Identification of Owner

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<tr>
<th>Description</th>
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<th>The Director is successful person so he can understand the situation of students and can make better and effective policies for them. JUST MEET ENGINEERS PRIDE STUDENTS ONCE.</th>
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<td>These Institutes are run by people who never qualified in IES/GATE exams. How can they take good decision for the students who are preparing for IES/GATE? They are hidden faces. They never display about them on their website also.</td>
<td>These are pure businesses. Business of education is very dangerous for the society. It should be stopped.</td>
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### Unique Features of Engineers Pride

1. Engineers Pride is run by an **IITian and I.E.S. (Indian Railways) officer- Mr. B. Chand.** who is teaching, guiding and motivating **civil engineering students since 2012**

2. **All the technical subjects are taken by I.E.S.- B. Chand only at Engineers Pride**

3. No student is asked for fee for 1st 15 hours of each subject whereas in other institutes 1st of all you have to deposit the fee and after that only you can enter the classroom

4. No institute of India provides subject-wise admission but **Engineers Pride provides you subject-wise admission.** Engineers pride has got highly talented and well qualified faculty so providing demo classes for each subject is pleasure here but other institutes are afraid of providing demo classes of each subject, at the max they will provide you demo class of one or two subject but not for all subjects because their faculty is not so good for all the subjects
5. In other coaching institutes some faculty might be good but not all. Here at Engineers Pride all tech subjects are taught by B. Chand sir so you are in the safe hands.

6. As you know that in the paper of ESE/GATE/SSC-JE, every year approx. 80% questions have repetitive concepts so Engineers Pride solves last 25 years questions in classroom itself. No coaching in India is doing so.

7. I.E.S. -B. Chand is available to his classroom students 24hrs on Whatsapp for all kind of doubts. In other institutes students never get a chance to meet their teachers.

8. In other coaching institutes faculty come and teach and then go. After that if you face any doubt who will clear?? Just think about it. At Engineers Pride I.E.S. B. Chand is available for all the technical subjects for the complete year.

9. Engineers Pride is making Digital Library for highly weak students. The library will have all the classroom videos of I.E.S. B. Chand. These videos can be watched any number of times free of cost.

10. Engineers Pride conducts personality development workshops for their classroom students so that they can learn public speaking, yoga, pranayama and meditation techniques, which are the need of the hour in such a competitive environment.

**Important message to students**

Hello everyone! It’s very important message for the students of civil engineering who are preparing for IES/GATE/SSC-JE examinations. I have been teaching and guiding civil engineering students since 2012 for the IES, GATE and SSC-JE exams in Delhi and in last 4.5 years I realized that most of the coaching institutes either don’t have well qualified faculty or their classroom strength is very high (500 +). Faculties are paid on per hour basis so coaching always tries to cut down the number of teaching hours. Due to these problems average and below average students don’t get selected in these exams in spite of spending lot of money and time.

Therefore to help all the civil engineering students, I have started my own institute (Engineer’s Pride) in Jaipur. Some of the salient features of Engineers Pride are as under-

1. **Free 3-4 demo classes for each subject** (Other coaching institutes will take your complete money in advance and make you helpless)
2. **Well qualified and Experienced faculty**
3. **Unlimited teaching hours**
4. **Last 25 years ESE/GATE/SSC-JE paper solving classes**
5. Special class for weak students
6. Weekly class test and solutions
7. Free English and Yoga classes by Experts because IES B.Chand believes that good health is key to success*

Subject-wise fee for IES/GATE (Note-for SSC_JE its Half)

<table>
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<tr>
<th>Subject</th>
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<tr>
<td>1.SOM</td>
<td>5000/-</td>
<td>5.BMC</td>
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<td>9.TRANSPRO</td>
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<td>6.PERT/CPM</td>
<td>4000/-</td>
<td>10.SOIL</td>
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<td>3.RCC&amp;PSC</td>
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<td>7.FM&amp;HMT</td>
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<td>4.DSS</td>
<td>5000/-</td>
<td>8.ENVIRO</td>
<td>5000/-</td>
<td>12.HYDROLOGY</td>
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<td>13.Mathematics</td>
<td>4000/-</td>
<td>14.GS and Apti</td>
<td>10,000/-</td>
<td>15.English/Yoga</td>
<td>Free*</td>
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Class Room Centres- Pratap Nagar, Jaipur, Rajasthan
Class Timing- 4PM-8PM on weekdays and 8AM to 8PM on weekends/holidays
Final decision will be of management in any matter

Contact- www.engineerspride.org Phone/whatsapp-7014320833 , 1st Floor, Khushi Tower, Opposite HDFC Bank , Main Kumbha Marg, Pratap Nagar, Jaipur, Rajasthan
DON'T BURN YOUR OPPORTUNITIES FOR A TEMPORARY COMFORT.
Highway Engineering
1. The length of National Highways as per 3rd 20 year (Lucknow) road plan is given by
   (a) Area of the country /75  
   b) Area of the country /50  
   c) Area of the country /40  
   d) Area of the country /25       (IES-2000)

2. In which one of the following location surveys of the road soil profile, is sampling done upto a depth of 1 m to 3 m below the existing ground level?
   a) Preliminary survey  
   b) Final location survey  
   c) Construction survey  
   d) Material location survey      (IES-2003)

3. Under the Nagpur Road Plan, which of the following are NOT relevant in planning the road development programme in a backward district?
   1. Existing agriculture drainage network of drain canals.  
   2. Existing number of Panchayat unions  
   3. Existing of villages mud-track roads  
   4. Total reaction time of a driver does not depend upon  
   a) Perception time  
   b) Brake reaction time  
   c) Condition of mind of the the driver  
   d) Speed of vehicle       (IES-2000)

5. Light reflecting devices used to guide the driver along the proper alignment are called
   a) Rumble strips   b) Delineators  
   c) Attenuators      d) Litter bin     (IES-2010)

6. If superelevation is not provided on a horizontal curve of a highway, then on which portion of the road, are potholes likely to develop?
   a) Outer edge of road  b) Inner edge of road  
   c) Centre of road    d) Shoulder of road     (IES-2010)

7. Full amount of superelevation on a horizontal curve is provided at the
   a) beginning of the transition curve  
   b) centre of the circular curve  
   c) end of the transition curve  
   d) centre of the transition curve     (IES-2010)

8. An ideal horizontal transition curve is a
   a) parabola   b) Circle  
   c) Clothoid spiral   d) Hyperbola     (IES-2012)

9. In which one of the following grades of a highway is an emergency escape ramp provided?
   a) 1 in 200   b) Zero grade  
   c) Down grade    d) Up grade       (IES-1996)
10. It is a common practice to design a highway to accommodate the traffic volume corresponding to
   a) 30th hour  
   b) Peak hour  
   c) ADT  
   d) 15-min peak period (IES-1998)

11. Which one of the following is the purpose of divisional island?
   a) To divert the traffic into a definite travel path at the intersection
   b) To reduce the speed of traffic entering the intersection
   c) To divert traffic from obstacles and expedite the flow of traffic
   d) To segregate opposing flow of traffic in a multi-lane highway (IES-2001)

12. Which one of the following is taken into consideration for computing traffic capacity per lane of the
    highway?
   a) Passenger cars and light vehicles
   b) Trucks and buses
   c) Two-wheelers
   d) Equivalent of passenger cars (IES-2003)

13. In urban transportation planning, the ‘Modal Split’ is the process of which one of the following?
   a) Staggering of working hours
   b) Segregation of fast and slow modes
   c) Separation of traffic streams by flyovers
   d) Deciding the choice for a mode (IES-2008)

14. In modal choice studies which one of the following factors influences the shape of diversion curves?
   a) Trip length
   b) Trip length
   c) Income
   d) Residential density (IES-2008)

15. Which one of the following geometric features requires the magnitudes of weaving angle and weaving
    distance for its design?
   a) Rotary design
   b) Right-angle intersection
   c) Roundabout
   d) Grade-separated junction (IES-2009)

16. Which set of traffic studies is needed for functional design as well as for highway capacity’ design?
   a) Origin and destination studies
   b) Parking and accidental studies
   c) Speed and volume studies
   d) Axle load studies (IES-2009)

17. Which one of the following traffic survey schemes is most relevant when deciding on locating major
    ‘routes’ in a city?
   a) Traffic volume survey
   b) Origin and destination survey
   c) Speed survey
   d) Traffic capacity survey (IES-2009)
18. Which one of the following equipments is useful in determining spot speed in traffic engineering?
   a) Enoscope       b) Periscope
   c) Radar   d) Tachometer
   (IES-2009)

19. Which one of the following traffic signal systems is useful when there is continuous operation of
group of vehicles along the main road?
   a) Simultaneous system
   b) Alternate system
   c) Simple progressive system
   d) Flexible progressive system
   (IES-2010)

20. Traffic capacity is the :
   a) Ability of roadway to accommodate traffic volume in terms of vehicles/hr
   b) Number of vehicles occupying a unit length of roadway at a given instant expressed as vehicles/km
   c) Capacity of lane to accommodate the vehicles widthwise (across the road)
   d) Maximum attainable speed of vehicles
   (IES-2013)

21. The duration of green time in a traffic signal depends on
   a) traffic density  b) traffic volume
   c) traffic speed   d) All of the above

22. In the Los Angeles Abrasion Test on aggregate, if the speed of the drum is increased to 50 rpm, then
   the abrasion value will
   a) increase   b) decrease
   c) remain unchanged   d) be unpredictable
   (IES-1995)

23. The plasticity index of the fraction passing 425 micron IS sieve in case of sub-base/base course
    should be
   a) less than 6    b) greater than 6
   c) greater than 9              d) between 15 & 30
   (IES-1996)

24. For carrying out bituminous patch during the rainy season, the most suitable binder is
   a) Road tar
   b) Hot bitumen
   c) Cutback bitumen
   d) Bituminous emulsion
   (IES-1999)

25. Which one of the following tests is performed in the laboratory to determine the extent of
    weathering of aggregates for roadworks?
   a) Soundness test b) Crushing test c) Impact test  d) Abrasion test   (IES-2009)
26. Which one of following is not a desirable property of the subgrade soil as a highway material?
   a) Stability  b) Ease of compaction
c) Good drainage   d) Bitumen adhesion
   (IES-2009)

27. Effect of impact on the design of rigid pavements is accounted for by
   a) Increasing the thickness as would be calculated with static wheel load
   b) Providing a base course
   c) adopting a reduced flexural strength of concrete through a factor of safety
d) adopting an increased stress relative to that produced by static wheel load
   (IES-1996)

28. The general requirement in constructing a reinforced concrete road is to place a single layer of
    reinforcement
   a) Near the bottom of the slab
   b) Near the top of the slab
c) At the middle
d) Equally distributed at the top and bottom
   (IES-1998)

29. As per latest IRC guidelines for designing flexible pavement by CBR method, the load parameter
    required is
   a) Number of commercial vehicles per day
   b) Cumulative standard axles in msa
c) Equivalent single axle load
d) Number of vehicles (all types) during design life
   (IES-1999)

30. In cement concrete pavements, tie bars are installed in
   a) expansion joints  b) contraction joints
c) warping joints   d) longitudinal joints
   (IES-1999)

31. Which one of the following methods is used in the design of rigid pavements?
   a) CBR method b) Group index method
c) Westergaard’s method
d) McLeod’s method   (IES-2009)

32. Radius of relative stiffness of cement concrete pavement does not depend upon which one of the
    following?
   a) Modulus of subgrade reaction
   b) Wheel load
c) Modulus of elasticity of cement concrete
d) Poisson’s ratio of concrete
   (IES-2009)
33. For conditions obtaining in India, at which location in a cement concrete pavement will the combined stresses due to traffic wheel load and temperature have to be critically checked during design?
   a) Corner     b) Corner and interior
   c) Corner and edge d) Corner, edge and interior
   (IES-2009)

34. In a concrete pavement, during summer, and soon after mid-day, the combined stress at the interior of the slab is equal to:
   a) Wheel load stress + Temperature warping stress + Sub grade resistant stress
   b) Wheel load stress + Temperature warping stress - Sub grade resistant stress
   c) Wheel load stress - Temperature warping stress + Sub grade resistant stress
   d) Wheel load stress - Temperature warping stress - Sub grade resistant stress
   (IES-2010)

35. In a flexible pavement
   a) Vertical compressive stresses decreases with depth of the layer
   b) The vertical compressive stress is the maximum at the lowest layer
   c) Tensile stress get developed
   d) Traffic stress induced by a given traffic load is independent on the location of the load on the pavement surface
   (IES-2004)

36. With addition of lime in soil
   a) L.L. increases and P.L. decreases
   b) Plasticity index increases
   c) L.L changes very slightly and P.L. increases
   d) L.L. and P.L. both decreases
   (IES-2002)

37. Which one of the following items of hill road construction does not help in the prevention of landslides during the monsoon season?
   a) Breast walls     b) Hair-pin bends
   c) Catch-water drains   d) Retaining walls
   (IES-2015)
## ANSWER KEY

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### Difference between Engineer's Pride & Other Institutes

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<td><strong>Faculty &amp; Class room strength</strong></td>
<td>They have very less students and very low fee structure so it is impossible for them to hire highly qualified and well experienced faculty. As on today good faculty charges minimum Rs. 4000/- per hour but these Institutes can afford up-to Rs. 800-1200/- per hour only.</td>
<td>Yes, These institutes have got good faculty but at the same time class room strength is 500+ and in such a big class it’s practically impossible to maintain one to one student- teacher interaction. Average /below average students are not able to learn fundamental concepts with confidence. In the Engineer’s Pride, Chief faculty is Mr. B. Chand, who is I.E.S. (Indian Railways) + B.Tech (B.Tech/CE/IT&amp;T) + 5 Years of teaching experience with Delhi’s big coaching Institutes + SSC-JE/AIR(Gener.)-04 rank. Also Class room strength is strictly kapt below 100 so that average/below average students can clear their doubts in the classroom itself.</td>
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<td><strong>Number of teaching hours</strong></td>
<td>These coaching institutes always try to minimize the standard duration of teaching to save the time of faculty so that more number of new batches can be run because in the market there is a big shortage of good faculty so they utilize the only available faculty with them.</td>
<td>These institutes also curtail the standard duration of teaching to minimize the time of faculty.</td>
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<td><strong>Last 25 years IES/GATE/SSC-JE class room paper solution</strong></td>
<td>As on today no coaching institute in India is solving last 25 years papers of IES/GATE/SSC-JE in their class room. As you might be aware that in the final exam of ESE/GATE/SSC-JE almost 80% concepts are directly being repeated every year and generally cut-off is around 50-60% for most of the examinations so solving these old papers means sure shot selection.</td>
<td>Engineer’s Pride solves last 25 years papers of these examinations in the classroom itself by the concerned faculty just after the completion of the subject chapter wise. This unique feature is only available with Engineer’s Pride in entire India.</td>
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Irrigation Engineering
1. A sprinkler irrigation system is suitable when
(a) the land gradient is steep and the soil is easily erodible
(b) the soil is having low permeability
(c) the water table is low
(d) the crops to be grown have deep roots
[GATE-2004]

2. Delta (\(\Delta\)) in cm, Duty (\(D\)) in hectare/cumec and Base period (\(B\)) in days are related as
(a) \(\Delta = 864 B / D\)
(b) \(B = 864 D / \Delta\)
(c) \(B = \frac{864 \Delta}{D}\)
(d) \(D = \frac{8.64}{\Delta}\)
[GATE-1996]

3. As per the Lacey’s method for design of alluvial channels, identify the true statement from the following.
(a) Wetted perimeter increase with an increase in design discharge
(b) Hydraulic radius increases with an increase in silt factor
(c) Wetted perimeter decreases an increase in design discharge
(d) Wetted perimeter increases with increase in silt factor
[GATE-2007]

4. On which of the canal systems, R.G. Kennedy, executive engineer in the Punjab Irrigation Department made his observations for proposing his theory on stable channels?
(a) Krishna Western Delta canals
(b) Lower Bar Doab canals
(c) Lower Chenab canals
(d) Upper Bari Doab canals
[GATE-2005]

5. A stable channel is to be designed for a discharge of \(Q\) m\(^3\)/s with silt factor \(f\) as per Lacey’s method. The mean flow velocity (m/s) in the channel is obtained by
(a) \(\sqrt[6]{\frac{Q f^2}{140}}\)
(b) \(\sqrt[3]{\frac{Q f^2}{140}}\)
(c) \(\sqrt[6]{\frac{Q^2 f^2}{140}}\)
(d) \(0.48 \sqrt[3]{\frac{Q f}{140}}\)
[GATE-2008]

6. In a siphon aqueduct, the most severe condition of uplift on the floor occurs when
(a) the canal and drainage run full
(b) the canal runs full; the drainage channel is dry, and the water table is at the stream bed.
(c) the canal is dry, the drainage floor is at HFL, and the water table is at the HFL of the drainage flow
(d) the canal runs full; and the drainage is dry
[GATE-1991]

7. The base width of an elementary profile of a gravity dam of height \(H\) is \(b\). The specific gravity of the material of the dam is \(G\) and uplift pressure coefficient is \(K\). The correct relationship for no tension at the heel is given by
(a) \(\frac{b}{H} = \frac{1}{\sqrt{G - K}}\)
(b) \(\frac{b}{H} = \frac{\sqrt{G - K}}{G - K}\)
(c) \(\frac{b}{H} = \frac{1}{G - K}\)
(d) \(\frac{b}{H} = \frac{1}{K \sqrt{G - K}}\)
[GATE-2008]

8. The most economical method of soil conservation is to
a) construct check dams  
b) construct contour bunds  
c) drain the soil  
d) afforest the area  

(IES-1995)

9. The moisture tension for a soil is 8 atmospheres. The soil is then at  
a) Permanent wilting point  
b) Field capacity  
c) Optimum moisture content  
d) Equivalent moisture  

(IES-2006)

10. Consumptive Use refers to the loss of water as a result of  
a) Evaporation and Transpiration  
b) Crop Water Requirement  
c) Evaporation and Infiltration  
d) Evaporation and Transpiration from the cropped area  

(IES-2015)

11. The spacing of tile drains to relieve waterlogged land is directly proportional to the  
a) Depth of drain below the ground surface  
b) Depth of impervious strata from the drain  
c) Depth of drain below the water level  
d) Coefficient of permeability of the soil to be drained  

(IES-1999)

12. Acidic soils are reclaimed by  
a) leaching of the soil  
b) using limestone as a soil amendment  
c) using gypsum as a soil amendment  
d) provision of drainage  

(IES-2002)

13. Leaching is a process  
a) By which alkali salts present in the soil are dissolved and drained away  
b) By which alkali salts in soil come up with water  
c) Of draining excess water of irrigation  
d) Which controls waterlogging  

(IES-2003)

14. A drainage coefficient  
a) Decides the choice of the method of the drainage
b) Decides the kind of crop that can be grown on the land

c) Is the depth of water that can be removed from the drainage area in unit time

d) Is the flow of water from the soil into the tile laterals per unit time

(IES-2006)

15. Balanced depth of cutting of canal is

a) half the total depth of a canal

b) half of full supply depth

c) the maximum cut that an excavator can take

d) where volume of cutting is equal to volume of filling

(IES-2002)

ANSWER KEY

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<td>13</td>
<td>A</td>
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<td>15</td>
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</table>
Time table of Summer special subject-wise program for combined IES+GATE+SSC-JE/CIVIL-2019@ ENGINEERS PRIDE JAIPUR
(Most difficult 08 subjects of civil engineering will be covered during summer of 2018)

<table>
<thead>
<tr>
<th>S.NO</th>
<th>SUBJECT</th>
<th>From-to</th>
<th>Duration</th>
<th>FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SOM</td>
<td>16th-21st May 2018</td>
<td>60hrs</td>
<td>4000/-</td>
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<tr>
<td>2.</td>
<td>TOS</td>
<td>22nd-27th May 2018</td>
<td>60hrs</td>
<td>4000/-</td>
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<td>3.</td>
<td>GEOTECH</td>
<td>28th-3rd June 2018</td>
<td>70hrs</td>
<td>4000/-</td>
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<tr>
<td>4.</td>
<td>ENVIRO</td>
<td>8th-13th June 2018</td>
<td>60hrs</td>
<td>4000/-</td>
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<tr>
<td>5.</td>
<td>RCC</td>
<td>14th-19th June 2018</td>
<td>60hrs</td>
<td>4000/-</td>
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<tr>
<td>6.</td>
<td>FM+OCF</td>
<td>20th-29th June 2018</td>
<td>100hrs</td>
<td>6000/-</td>
</tr>
<tr>
<td>7.</td>
<td>STEEL</td>
<td>30th-5th July 2018</td>
<td>60hrs</td>
<td>4000/-</td>
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<td>8.</td>
<td>HYDROLOGY</td>
<td>6th-10th July 2018</td>
<td>50hrs</td>
<td>3000/-</td>
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</table>

4th-7th June 2018 PERSONALITY DEVELOPMENT WORKSHOP/YOGA/MEDITATION/PRANAYAM/PUBLIC SPEAKING/STRESS MANAGEMENT/MEMORY SHARPEN/TIME MANAGEMENT

Note 1: Free demo class of each subject for 15 hrs will be available. Class Time 9AM to 8PM. Those who score 80% and in class test will get Rs1100/- Cash Reward for each test. Total number of tests 09.

Note 2: Study material - Detailed class notes, GATE+IES+SSC-JE previous years papers with solutions, Work books, whatsapp support till final exam.

Note 3: Fee/schedule/number of seats can be changed any time.

Note 4: This summer program is highly important to those students who have passed B.Tech 1st yr, 2nd yr or 3rd yr and want to crack IES/GATE with 4th year itself but their city does not have good coaching. So this course is for you.

Note 5: Seating capacity = only 100. You may not get seat in the last moment.

Note 6: Approach Objective+Conventional

Address: 1st Floor, Khushi Tower, Main Kumbha Marg, Pratap Nagar, Jaipur, Rajasthan, 7014320833, wwww.engineerspride.org
RCC
Reinforced
Cement
Concrete
1. Workability of concrete can be measured using slump, compaction factor and Vebe time. Consider the following statements for workability of concrete.
   (i) As the slump increases, the Vebe time increases
   (ii) As the slump increases, the compaction factor increases
Which of the following is TRUE?
   (a) Both (i) and (ii) are True
   (b) Both (i) and (ii) are False
   (c) (i) is True and (ii) is False
   (d) (i) is False and (ii) is True

2. Maximum possible value of Compacting factor for fresh (green) concrete is:
   (a) 0.5
   (b) 1.0
   (c) 1.5
   (d) 2.0

3. The cross-section of a thermo-mechanically treated (TMT) reinforcing bar has
   (a) soft ferrite-pearlite throughout.
   (b) hard martensite throughout.
   (c) a soft ferrite-pearlite core with a hard martensitic rim
   (d) a hard martensitic core with a soft pearlite-bainitic rim.

4. If the characteristic strength of concrete $f_{ck}$ is defined as the strength below which not more than 50% of the strength below which not more than 50% of the test result are expected to fall, the expression for $f_{ck}$ in terms of mean strength $f_m$ and standard deviation $\sigma$ would be
   (a) $f_m - 0.1645\sigma$
   (b) $f_m - 1.645\sigma$
   (c) $f_m$
   (d) $f_m + 1.645\sigma$

5. Modulus of elasticity of M25 grade concrete in MPa is
   (a) 25000
   (b) 36000
   (c) 45600
   (d) 54000

6. The characteristic strength of concrete is defined as that compressive strength below which not more than
   (a) 10% of results fall
   (b) 5% of results fall
   (c) 2% of results fall
   (d) None of these

7. The cylinder strength of the concrete is less than the cube strength because of
   (a) The difference in the shape of the cross section of the specimens
   (b) The difference in the slenderness ratio of the specimens
(c) The friction between the concrete specimens and the steel plate of the testing machine
(d) The cubes are tested without capping but the cylinders are tested with capping

8. The permissible tensile stress in concrete made of M 25 concrete is
   (a) 3.5 N/mm²  (b) 60 N/mm²
   (c) 2.5 N/mm²  (d) None of the above

9. The permissible bending tensile stress in concrete for the vertical wall of an RC water tank made of M25 concrete is
   (a) 8.5 N/mm²  (b) 6.0 N/mm²
   (c) 2.5 N/mm²  (d) 1.8 N/mm²

10. The modulus of rupture of concrete gives
    (a) the direct tensile strength of the concrete
     (b) the direct compressive strength of the concrete
     (c) the tensile strength of the concrete under bending
     (d) the characteristic strength of the concrete

11. Workability of concrete is influenced most by its
    (a) Water-cement ratio
     (b) Aggregate-cement ratio
     (c) cement content
     (d) Water content

12. Portland cement is manufactured by burning in a kiln the following materials
    (a) limestone and alumina
     (b) limestone and clay
     (c) limestone and sand
     (d) lime and clay

13. Grading of aggregate in a concrete mix is necessary to achieve
    (a) adequate workability
     (b) higher density
     (c) reduction in voids
     (d) better durability
14. Setting time of cement sample is tested by
   (a) Slump test
   (b) higher density
   (c) Le-Chatelier's test
   (d) better durability

15. Tensile strength of cement mortar is usually found by:
   (a) briquette test (b) slump test
   (c) Vicat needle test (d) split cylinder test

16. If $f_{cu}$ and $f_y$ are cube compressive strength of concrete and yield stress of steel respectively and $E_s$ is the modulus of elasticity of steel, for all grades of concrete, the ultimate flexural strain in concrete, can be taken as
   (a) $0.002$ (b) $f_{cu}/1000$
   (c) $0.0035$ (d) $f_y/1.15E_s+0.002$

17. The maximum strain in concrete at the outermost compression fibre in the limit state design of flexural member is (as per IS: 456-1978)
   (a) $0.0020$ (b) $0.0035$
   (c) $0.0065$ (d) $0.0050$

18. Deflections can be controlled by using the appropriate
   (a) aspect ratio (b) modular ratio
   (c) span/depth ratio (d) water/cement ratio

19. In limit state approach spacing of main reinforcement controls primarily
   (a) collapse (b) cracking
   (c) deflection (d) durability

20. The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from as–cast level of supports of floors, roofs and all other horizontal members should NOT exceed
   (a) span/350 (b) span/300
   (c) span/250 (d) span/200

21. Flexural collapse in over-reinforced beams is due to
   (a) Primary compression failure
   (b) Secondary compression failure
   (c) Primary tension failure
   (d) Bond failure

22. The limiting compressive strain in concrete is
When assessing the strength of a structure as per the limit state of collapse, the value of partial safety factor for steel is taken as

(a) 2.0  
(b) 1.5  
(c) 1.15  
(d) 1.00

Combination of partial safely factors for loads under limit state of collapse and limit state of serviceability will be

(a) \(1.5 (D.L+L.L) \) or \(1.5 (D.L+W.L)\) OR \(1.2(D.L+L.L+W.L)\) and \(D.L+0.8 (L.L-W.L)\)

(b) \(1.5 (D.L+L.L)\) and \(D.L+0.8 (L.L+W.L)\)

(c) \(1.5 (D.L+L.L)\) or \(1.5 (D.L+W.L)\) or \(1.2(D.L+L.L+W.L)\) and \(1.0 (D.L+L.L)\) or \(1.0 (D.L+W.L)\) or \(D.L+0.8(L.L+W.L)\)

(d) \(1.2(D.L+L.L+W.L)\) and \(1.0 (D.L+L.L)\) or \(1.0 (D.L+W.L)\) or \(D.L+0.8(L.L+W.L)\)

The assumption that the plane sections normal before bending remain normal after bending is used.

(a) Only in the working stress method of design  
(b) Only in the limit-state method of design  
(c) In both working stress and limit-state methods of design  
(d) Only in the ultimate load method of design

As per IS: 456-1978, the ratio of stress in concrete to its characteristic strength at collapse in flexure for design purposes is taken as

(a) 0.67  
(b) 0.576  
(c) 0.447  
(d) 0.138

Partial safety factor for concrete and steel are 1.5 and 1.15 respectively, because

(a) Concrete is heterogeneous while steel is homogeneous  
(b) The control on the quality of concrete is not as good as that of steel  
(c) Concrete is weak in tension  
(d) Voids in concrete are 0.5% while those in steel are 0.15%

As compared to working stress method of design, limit state method takes concrete to

(a) A high stress level  
(b) A lower stress level  
(c) The same stress level  
(d) Sometimes higher but generally lower stress level
29. As per IS : 456, for a singly reinforced rectangular section,
   (a) $x_{u,\text{max}}/d$ for Fe415 steel is 0.48
   (b) The depth of centroid of compression is $0.43x_{u,\text{max}}$
   (c) The depth of the rectangular portion of the stress block is $0.38x_{u,\text{max}}$
   (d) The maximum value of lever arm $d - xx_{u,\text{max}}$

30. The probability of failure implied in limit state design is of the order of
   (a) $10^{-2}$    (b) $10^{-3}$
   (c) $10^{-4}$    (d) $10^{-5}$

31. If $\sigma_{\text{cbc}}$ is permissible compressive stress in flexural compression in N/mm$^2$ in service, the modular ratio is of the order of
   (a) $280/3\sigma_{\text{cbc}}$    (b) $280/4\sigma_{\text{cbc}}$
   (c) 19    (d) 13

32. Long term elastic modulus in terms of creep coefficient ($\theta$) and 28-day characteristic strength ($f_{ck}$) is given by
   (a) $5000\sqrt{f_{ck}}/(1+\theta)$ MPa    (b) $5000\sqrt{f_{ck}}/(1+\theta)$ MPa
   (c) $5000f_{ck}/(1+\sqrt{\theta})$ MPa    (d) $5000\sqrt{f_{ck}}\sqrt{1+\theta}$ MPa

33. Consider the following statements:
   1. The limit state of collapse is defined as the acceptable limit for the stresses in the materials.
   2. Limit state method is one that ensures adequate safety of structure against collapse
   3. In the limit state design method, actual stresses developed at collapse differ considerably from the theoretical values

34. Which one of the following statements is correct?
   The characteristic strength of concrete is
   (a) Higher than the average cube strength
   (b) Lower than the average cube strength
   (c) The same as the average cube strength
   (d) Higher than 90% of the average cube strength

35. What should be the minimum grade of reinforced concrete in and around sea coast construction?
   (a) M 35    (b) M 30
   (c) M 25    (d) M 20

36. What is the value of flexural strength of M 25 concrete?
   (a) 4.0 Mpa    (b) 3.5 Mpa
   (c) 3.0 Mpa    (d) 1.75 Mpa
37. On which one of the following concepts is the basic principle of structural design based?
   (a) Weak column strong beam
   (b) Strong column and weak beam
   (c) Equally strong column-beam
   (d) Partial weak column-beam

38. Which one of the following sections performs better on the ductility criterion?
   (a) Balanced section
   (b) Over-reinforced section
   (c) Under-reinforced section
   (d) Non-prismatic section

39. As per IS 456-2000, which one of the following correctly express the modulus of elasticity of concrete? (read with the relevant units)
   (a) $E_c = 0.7\sqrt{f_{c'k}}$
   (b) $E_c = 500\sqrt{f_{c'k}}$
   (c) $E_c = 5000\sqrt{f_{c'k}}$
   (d) $E_c = 5700\sqrt{f_{c'k}}$

40. The final deflection due to all including effects of temperature, creep and shrinkage measured from as-cast level of the supports of floor, roofs and all other horizontal members of reinforced concrete should not normally exceed
   (a) Span/350
   (b) Span/250
   (c) (Span/350) or 20 mm whichever is less
   (d) $(5/348)$ of span

41. Which one of the following is employed to determine strength of hardened existing concrete structure?
   (a) Bullet test
   (b) Kelly ball test
   (c) Rebound hammer test
   (d) Cone penetrometer

42. Which one of the following is the correct expression for the target mean strength $f_t$ of concrete mix?
   (a) $f_t = f_{c'k} + S$
   (b) $f_t = f_{c'k} + KS$
   (c) $f_t = f_{c'k} + S$
   (d) $f_t = K f_{c'k} + K$

43. Modulus of elasticity of concrete is increased with
   (a) Higher W/C ratio
   (b) Shorter curing period
   (c) Lesser vibration
   (d) Increase in age

44. In limit state approach, spacing of main reinforcement controls primarily
   (a) Cracking
   (b) Deflection
   (c) Durability
   (d) Collapse
45. In a R.C. section under flexure, the assumption that a plane section before bending remains plane after bending leads to
   (a) Strain distribution being linear across the depth
   (b) Stress distribution being linear across the depth
   (c) Both stress and strain distribution being linear across the depth
   (d) Shear stress distribution being uniform along the depth

46. Grade of steel is designated as Fe 415. If
   (a) the upper yield stress of the steel is 415 N/mm²
   (b) the ultimate stress of the steel is 415 N/mm²
   (c) the partial safety factor is 1.15
   (d) the characteristic strength is 415 N/mm²

47. The additional cover thickness to be provided in reinforced concrete members that are totally immersed in seawater is
   (a) 25 mm
   (b) 30 mm
   (c) 35 mm
   (d) 40 mm

48. The minimum grade of reinforced concrete in seawater as per IS 456-2000 is
   (a) m 15
   (b) m 20
   (c) m 30
   (d) m 40

49. The distance between the centroid of the area of tension reinforcement and the maximum compressive fibre in a reinforced concrete beam design is known as
   (a) overall depth
   (b) effective depth
   (c) lever arm
   (d) depth of neutral axis

50. What is the pH value of table water, as specified by IS 456-2000?
   (a) Equal to 7
   (b) Between 6 and 9
   (c) Less than 6
   (d) Not less than 6

51. A certain RC structure has to be constructed along a sea coast. The minimum grade of concrete to be used as per IS 456: 2000 IS
   (a) More than M 20
   (b) More than M20 and less than M30
   (c) Less than 6
   (d) Less than M45 and more than M30

52. 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
53. In a reinforced concrete retaining wall, a shear key is provided, if the
(a) Shear stress in the vertical stem is excessive
(b) Shear force in the toe slab is more than that in the heel slab
(c) Retaining wall is not safe against sliding
(d) Retaining wall is not safe against overturning

54. The safe shear resistance of an anchor connector is given by (K is a coefficient and other symbols have the usual meanings)
(a) \( V = k f_{sy} A_t \)
(b) \( V = k f_{sy}^2 A_t \)
(c) \( V = k f_{sy} A_t \)
(d) \( V = k f_{sy}^2 A_t \)

55. The maximum permissible shear stress \( t_{cmax} \) given in BIS 456-1978 is based on
(a) Diagonal tension failure
(b) Diagonal compression failure
(c) Flexural tension failure
(d) Flexural compression failure

56. A beam is designed for uniformly distributed loads causing compression in the supporting columns. Where is the critical section for shear? (\( d \) is effective depth of beam the \( L_d \) is development length)
(a) A distance \( L_d/3 \) from the face of the support
(b) A distance \( d \) from the face of the support
(c) At the centre of the support

57. In a reinforced concrete section, the shape of the nominal shear stress diagram is
(a) parabolic over the full depth
(b) parabolic above the neutral axis and rectangular below the neutral axis
(c) rectangular over the full depth
(d) rectangular above the neutral axis and parabolic below the neutral axis

58. As per IS 456-2000, the maximum permissible shear stress, \( t_{cmax} \) is based on
(a) Diagonal tension failure
(b) Diagonal compression failure
(c) Flexural tension failure
(d) Flexural compression failure

59. In a reinforced concrete section, shear stress distribution is diagrammatically
(a) Wholly Parabolic
(b) Wholly Rectangular
(c) Parabolic above NA and Rectangular below NA
(d) Rectangular above NA and Parabolic below NA
60. A rectangular 230mm×350mm beam is (effective depth). The factored shear force acting at a section is 80 kN. If the permissible shear stress in concrete is 0.25 MPa, the design shear force is nearly
   (a) 100 kN (b) 80 kN
   (c) 60 kN (d) 20 kN

61. In limit state design, permissible bond stress in the case of deformed bars is more than that in plain bars by
   (a) 60% (b) 50%
   (c) 40% (d) 25%

62. Which one of the following statement is correct?
   In a reinforced concrete member, the best way to ensure adequate bond is
   (a) To provide minimum number of large diameter bars
   (b) To provide large number of smaller diameter bars
   (c) To increase the cover for reinforcement
   (d) To provide additional stirrups

63. Which one of the following is the correct expression to estimate the development length of deformed reinforcing bar as per IS code in limit state design?
   (a) $\phi \sigma_s / 4.5 t_{bd}$  (b) $\phi \sigma_s / 5 t_{bd}$
   (c) $\phi \sigma_s / 6.4 t_{bd}$  (d) $\phi \sigma_s / 8 t_{bd}$

   $\phi$ where is diameter of reinforcing bar, $\sigma_s$ is the stress in the bar at a section and $t_{bd}$ is bond stress

64. Which one of the following is correct?
   When HYSD bars are used in place of mild steel bars in a beam, the bond strength
   (a) Does not change  (b) increases
   (c) decreases  (d) becomes zero

65. What is the bond stress acting parallel to the reinforcement on the interface between bar and concrete?
   (a) Shear stress  (b) Local stress
   (c) Flexural stress  (d) Bearing stress

66. What is the anchorage value of a standard hook of a reinforcement bar of diameter D?
   (a) 4D  (b) 8D
   (c) 12D  (d) 16D

67. Lap length of reinforcement in compression shall not be less than.
   (a) 30$\phi$  (b) 24$\phi$
   (c) 20$\phi$  (d) 5$\phi$
68. The appropriate expression in assessing development length is
   (a) \( L_d = \frac{\phi \sigma_s}{4\tau bd} \)
   (b) \( L_d = \frac{\phi \sigma_b c}{t bd} \)
   (c) \( L_d = \frac{\sigma_s}{4\tau bd} \)
   (d) \( L_d = \frac{\phi \sigma_s}{8\tau bd} \)

69. A beam of rectangular cross-section (b×d) is subjected to a torque \( T \). What is the maximum torsional stress induced in the beam?
   (a) \( T/\alpha b^2 d \)
   (b) \( T/\alpha bd^2 \)
   (c) \( T/\alpha bd \)
   (d) \( T/\beta d \)
   (where \( b<d \), and \( \alpha \) is a constant)

   \[ \text{[IES-2005]} \]

70. An R.C. structural member rectangular in cross section of width \( b \) and depth \( D \) is subjected to a combined action of bending moment \( M \) and torsional moment \( T \). The longitudinal reinforcement shall be designed for a moment \( M_e \) given by
   (a) \( M_e = M + T \left(1 - \frac{D}{b}\right) / 1.7 \)
   (b) \( M_e = M + T \left(1 - \frac{b}{D}\right) / 1.7 \)
   (c) \( M_e = T \left(1 - \frac{D}{b}\right) / 1.7 \)
   (d) \( M_e = T \left(1 - \frac{b}{D}\right) / 1.7 \)

   \[ \text{[IES-2006]} \]

71. Torsion reinforcement provided at the corners of a two-way slab
   (a) Distributes bending moment uniformly
   (b) Prevents corners from lifting
   (c) Controls cracking at corners
   (d) Does not allow any twist at corners

   \[ \text{[IES-2012]} \]

72. Yield line theory results in
   (a) Elastic solution
   (b) Lower bound solution
   (c) upper bound solution
   (d) unique solution

73. Limit state of serviceability for deflection including the effects due to creep, shrinkage and temperature occurring after erection of partitions and application of finishes as applicable to floors and roofs in restricted to
(a) Span/150  (b) Span/200
(c) Span/250  (d) Span/350

74. Shrinkage deflections in case of rectangular beams and slabs can be eliminated by putting

(a) compression steel equal to tensile steel
(b) compression steel more than tensile steel
(c) compression steel less than tensile steel
(d) compression steel 25% greater than tensile steel

75. In case of 2-way slab, the limiting deflection of the slab is

(a) primarily a function of the long span
(b) primarily a function of the short span
(c) independent of long or short span
(d) dependent on both long and short spans

76. From limiting deflection point of view, use of high strength steel in RC beam results in

(a) reduction in depth
(b) no change in depth
(c) increase in depth
(d) increase in width

77. For maximum sagging bending moment at support in a continuous RC beam, live load should be placed on

(a) spans adjacent to the support plus alternate spans
(b) all the spans except the spans adjacent to the support
(c) spans next to the adjacent spans of the support plus alternate spans
(d) spans adjacent to support only
78. For a bridge-deck the most economical section shall be

(a) a double-Tee section
(b) an I section
(c) a box section
(d) a channel section

79. Side face reinforcement is provided in a beam when the depth of web exceeds

(a) 300 mm    (b) 450 mm
(c) 500 mm    (d) 750 mm

80. In an RCC beam, side face reinforcement is provided if its depth exceeds

(a) 300 mm    (b) 500 mm
(c) 700 mm    (d) 750 mm

81. The bending moment coefficients for continuous RC slabs in IS 456-1978 code is based on

(a) Pigeaud’s method
(b) Marcus method
(c) Yield-line theory
(d) Westergaard’s mathematical analysis

82. The sum of nodal forces at any yield line intersection in a slab

(a) Zero
(b) infinity
(c) independent of the reinforcement
(d) indeterminate

83. In the limit state method of design, the failure criterion for reinforced concrete beams and columns is

(a) Maximum principal stress theory
(b) Maximum principal strain theory

(c) Maximum shear stress theory

(d) Maximum strain energy theory

84. In a RCC beam of breadth $b$ and overall depth $D$ exceeding 750 mm, side face reinforcement required and the allowable area of maximum tension reinforcement shall be respectively.

\[(a) \ 0.2\% \ and \ 0.02\ bD \quad (b) \ 0.3\% \ and \ 0.03bD \]

\[(c) 0.1\% \ and \ 0.04bD \quad (d) 0.4\% \ and \ 0.1bD \]

[IES-1999]

85. The effective width “$b_f$” of flange of a continuous T-beam in a floor system is given by

\[b_f=L_0/6+b_w/6D_f\]

where $L_0$ represents the

(a) Distance between point of contraflexure in a span
(b) Effective span of beams
(c) Clear span of beams
(d) Spacing between beams

86. Beam sections of reinforced concrete designed in accordance with ultimate strength or limit state design approach, as compared to sections designed by working stress method for the same conditions of load and span, and the same width, usually have

(a) A larger depth and smaller amount of reinforcement

(b) The same depth and same reinforcement

(c) Smaller depth and more reinforcement

(d) Same depth as that of a deep beam

87. A doubly reinforced beam is considered less economical than a singly reinforced beam because

(a) Tensile steel required is more than that for a balanced section

(b) Shear reinforcement is more

(c) Concrete is not stressed to its full value

(d) Compressive steel is under-stressed
88. As per IS: 456-1978 the vertical deflection limit for beams may generally be assumed to be satisfied provided that the ratio of span to effective depth of a continuous beam of span upto 10 m is not be greater than
(a) 35  (b) 26  
(c)20  (d) 18  

89. Which one of the following components of the bridge deck is analyzed by using Courbon's method?
(a) Slabs  (b) Diaphragms  
(c) Cross-beams  (d) Girders  

90. According to Whitney's theory, the maximum depth of concrete stress block in a balanced RCC beam section of depth 'd' is
(a) 0.3 d  (b) 0.43 d  
(c) 0.5 d  (d) 0.53 d  

91. For the purpose of design as per IS:456, deflection of RC slab or beam is limited to
(a) 0.2% of span  
(b) 0.25% of span  
(c) 0.4% of span  
(d) 0.45% of span  

92. In a reinforced concrete T-beam (in which the flange is in compression). The position of neutral axis will
(a) Be within the flange  
(b) Be within the web  
(c) Depend on the thickness of flange in relation to total depth and percentage of reinforcement  
(d) At the junction of flange and web  

93. In case of deep beam or in thin webbed RCC members, the first crack from is
(a) Flexural crack  
(b) Diagonal crack due to compression  
(c) Diagonal crack to tension  
(d) Shear crack
94. The specified span to depth ratios of beams satisfying the limits of vertical deflection are for spans up to 10 m.

1. For higher spans, these are to be modified by multiplying the ratios by \(\left(\frac{10}{\text{span in meters}}\right)^2\)

2. For higher spans, these are to be modified by multiplying the ratios by \(\left(\frac{\text{span in meters}}{10}\right)\)

3. They get further modified depending on area and type of tension reinforcement.

4. However, they do not change further with the area and type of compression reinforcement.

Select the correct answer using the codes given below:

(a) 1 & 3 are correct
(b) 2 & 3 are correct
(c) 1 & 4 are correct
(d) 2 & 4 are correct

[IES-2002]

95. As the span of a bridge increases, the impact factor

(a) decreases
(b) increases
(c) remains constant
(d) increases up to a critical value of span and then decrease

96. A buttress in a wall is intended to provide

(a) lateral support to roof slab only
(b) lateral support to wall
(c) to resist vertical loads only
(d) increases up to a critical value of span and then decrease

97. Shrinkage in a concrete slab
(a) causes shear cracks
(b) causes tension cracks
(c) causes compression cracks
(d) does not cause any cracking

98. The reinforcement for tension, when required in members, shall consists of
(a) only longitudinal reinforcement in the tension face
(b) only longitudinal reinforcement in the compression face
(c) only two legged closed loops enclosing the corner reinforcement
(d) both longitudinal and transverse reinforcement

99. In case of two-way slab, the deflection of the slab is
(a) Primarily a function of the long span
(b) Primarily a function of the short span
(c) independent of the span, long or short
(d) Mostly long span but sometimes short span

[IES-2003]

100. A reinforced concrete beam is subjected to the following bending moments:
Dead load 20 kNm
Live load 30 kNm
Seismic load 10kNm

The design bending moment for limit state of collapse is
(a) 60kNm (b) 75kNm
(c) 72kNm (d) 80kNm
101. What is the value of minimum reinforcement (in case of Fe 415) in a slab?

(a) 0.1%  (b) 0.12%
(c) 0.15%  (d) 0.2%

[I.E.S-2004]

102. Which one of the following statements is correct?

In a cantilever beam carrying gravity load, main reinforcement is provided

(a) Above the neutral axis
(b) As vertical stirrups
(c) As a helical reinforcement
(d) Below the neutral axis

103. Drop panel is a structural component in

(a) Grid floor
(b) Flat plate
(c) Flat slab
(d) Slab-beam system of floor

104. At T-beam behaves as a rectangular beam of width equal to its flange if its neutral axis

(a) Coincides with centroid of reinforcement
(b) Coincides with centroid of T-section
(c) Remains within the flange
(d) Remains in the web

105. In the case of a continuous RC beam, in order to obtain the maximum positive span moment, where should the live load be placed?

(a) On all the spans
(b) On alternate spans starting from the left
(c) On spans adjacent to the spans under consideration
(d) On the span plus alternate spans
106. Usually stiffness of a simply supported beam is satisfied if the ratio of its span to depth does not exceed which one of the following?

(a) 7  
(b) 10  
(c) 20  
(d) 26

107. When is an R.C.C. roof slab designed as a two way slab?

(a) If the slab is continuous over two opposite edges only  
(b) If the slab is unsupported at one edge only  
(c) If the ratio of spans in two directions is >2  
(d) If the ratio of spans in two directions is <2

108. In a single reinforced beam, the tensile steel reaches its maximum allowable stress earlier than concrete. What is such a section known as?

(a) Under-reinforced section  
(b) Over-reinforced section  
(c) Balanced section  
(d) Economic section

109. In a singly reinforced concrete beam section, maximum compressive stress in concrete and tensile stress in steel reach their permissible stresses simultaneously. What is such a section called?

(a) Under-reinforced section  
(b) Economic section  
(c) Balanced section  
(d) Over-reinforced section
110. For shorter storey height, cheaper form work and better lighting facilities, what is the recommended slab floor?

(a) T beam and slab  
(b) Two way slab  
(c) Flat slab  
(d) Framed structure

111. What is the assumption in the steel beam theory of doubly reinforced beams?

(a) Only steel bars will resist tension  
(b) Only concrete will resist tension  
(c) Stress in tension steel equals the stress in compression steel  
(d) Both concrete and steel will resist compression

112. What shall be the maximum area of reinforcement (i) in compression and (ii) in tension to be provided in an RC beam, respectively, as per IS456?

(a) 0.08% and 2 %  
(b) 2% and 4%  
(c)4% and 2 %  
(d) 4% and 4%

113. In limit state design method, the moment of resistance for a balanced section using M20 grade concrete and HYSD steel of grade Fe 415 is given by \( M_{n,\text{lim}} = K b d^2 \), what is the value of ‘K’?

(a) 2.98  
(b) 2.76  
(c)1.19  
(d) 0.89

114. How is the deflection in RC beams controlled as per IS456?

(a) By using large aspect ratio  
(b) By using small modular ratio  
(c) By controlling span/depth ratio  
(d) By moderating water-cement ratio

115. How is the base-level bending moment of a cantilever retaining wall expressed as a function of its height H?
116. The maximum percent of moment redistribution allowed in RCC beams is

(a) 10%  (b) 20%  
(c) 30%  (d) 40%  

117. The minimum strain at failure in the tensile reinforcement ($f_y = 400$ MPa) or RCC beam as per limit state method is

(a) 0.0020  (b) 0.0028  
(c) 0.0037  (d) 0.0045  

118. Minimum clear cover in mm to the main steel bars in slab, beam, column and footing respectively, are

(a) 10, 15, 20 and 25  (b) 15, 25, 40 and 75  
(c) 20, 25, 30 and 40  (d) 20, 25, 40 and 75  

119. For a continuous slab of $3 \times 3.5$ m size the minimum overall depth of slab to satisfy vertical deflection limits is

(a) 120 mm  (b) 100 mm  
(c) 75 mm  (d) 50 mm  

120. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is

(a) 6 mm diameter  (b) 8 mm diameter  
(c) 10 mm diameter  (d) 50 mm diameter  

121. A reinforced concrete cantilever porch has thickness $t$. The main reinforcing steel will be placed

(a) At mid-thickness
(b) At 1/3 from bottom surface

(c) Close to the bottom surface

(d) Close to the top surface

122. Consider the following statements:

Cement mortars richer than 1:3 are not used in masonry work because.

1. There is no gain in strength of masonry
2. There is high shrinkage.
3. They are prone to segregation.

Which of these statements are correct?

(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1 and 3 only

123. If the depth of actual neutral axis in a beam is more than the depth of critical axis, then the beam is called

(a) Over-reinforced beam
(b) Under-reinforced beam
(c) Balanced beam
(d) Deep beam

124. If a two-way slab is found to be unsafe in shear, then the preferred remedy is

(a) to provide shear stirrups
(b) to increase the flexural reinforcement by 15 %
(c) to increase the thickness of the slab adequately
(d) to increase the distribution reinforcement in edge strips

[IES-2012]

125. Magnitudes of minimum reinforcement recommended for reinforced concrete using mild steel in slabs/columns are
126. A simply supported beam has an effective span of 16m. What shall be the limiting ratio of span to effective depth as per IS 456-2000?

(a) 26  (b) 20  
(c) 12.5  (d) 7

127. A simply supported beam is considered as a deep beam if the ratio of effective span to overall depth is less than

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

128. Splicing of rebars in RCC beams can be done at section where

(a) bending moment is zero  
(b) bending moment is less than half of the maximum bending moment in beam.  
(c) bending moment is maximum  
(d) shear force is zero

[IES-2013]

129. As per IS 456-2000, side face reinforcement in a beam is provided where depth of the web exceeds.

(a) 750 mm  (b) 250mm  
(c) 500mm  (d) 1000mm

130. The enlarged head of the supporting column of a flat slab is called

(a) capital  (b) drop  
(c) panel  (d) block
131. Flexural collapse in over-reinforced beams is due to

(a) Primary compression failure

(b) Secondary compression failure

(c) Primary tension failure

(d) Bond failure

132. A T-beam becomes identical to a rectangular beam with width equal to its flange width when the neutral axis is

(a) Through the geometrical centre of the beam

(b) At the junction of the rib and the flange

(c) Below the slab

(d) Within the flange

133. Minimum clear cover (in mm) to the main steel bars in slab, beam, column and footing respectively are

(a) 10, 15, 20, 25

(b) 15, 25, 40, 75

(c) 20, 25, 30, 40

(d) 20, 35, 40, 75

[IES-1995]

134. The limits of percentage $p$ of the longitudinal reinforcement in a column is

(a) 0.15\% to 2\%

(b) 0.8\% to 4\%

(c) 0.8\% to 6\%

(d) 0.8\% to 8\%

[IES-1996]

135. Minimum percentage area of HYSD reinforcement in a 150 mm thick water tank wall is

(a) 0.16

(b) 0.20

(c) 0.23

(d) 0.24

136. The maximum spacing of vertical reinforcement in RCC wall should NOT exceed.

(a) The thickness of wall

(b) 1.5 times the thickness of wall

(c) 2 times the thickness of wall

(d) 3 times the thickness of wall

[IES-1998]
137. The ratio of the lateral pressure of the bulk storage material at the time of emptying to that at the time of filling is
   (a) less than one
   (b) equal to or less than one
   (c) equal to one
   (d) greater than one

138. Lateral ties in RC columns are provided to resist
   (a) Bending moment
   (b) Shear
   (c) Bucking of longitudinal steel bars
   (d) Both bending moment and shear

139. In an axially loaded spirally reinforced short column, the concrete inside the core is subjected to
   (a) Bending and compression
   (b) Biaxial compression
   (c) Triaxial compression
   (d) Uniaxial compression

140. Cross sectional area of metal core in composite column should not be more than
   (a) 4%
   (b) 8%
   (c) 16%
   (d) 20%

141. In a Pedestal, the factor by which the effective length should not exceed the least lateral dimension is
   (a) 2
   (b) 3
   (c) 4
   (d) 5

142. Which of the following are the additional moments considered for design of slender compression member in lieu of deflection in x and y directions?
   (a) $P_u L_{ex}^2/2000D$ and $P_u L_{ey}^2/2000D$
   (b) $P_u L_{ex}^2/2000$ and $P_u L_{ey}^2/2000$
   (c) $P_u L_{ex}^2/200D$ and $P_u L_{ey}^2/2000b$
   (d) $P_u L_{ex}^2/200D$ and $P_u L_{ey}^2/200D$
   (where $P_u$ is axial load; $L_{ex}$ and $L_{ey}$ are effective lengths in respective directions; $D$ depth of section perpendicular to major axis; $b$ width of the member)

143. What is the minimum number of longitudinal bars provided in a reinforced concrete column of circular cross section?
   (a) 4
   (b) 5
   (c) 6
   (d) 8
144. What is the minimum nominal percentage longitudinal reinforcement to be provided in a concrete pedestal as per relevant IS code?
   (a) 0.4  (b) 0.2
   (c) 0.15  (d) 0.1

145. The purpose of lateral ties in R.C. columns is to
   (a) Increase the load carrying capacity of column
   (b) Facilitate compaction of concrete
   (c) Facilitate construction
   (d) Avoid bucking of longitudinal bars

146. According to IS 456, maximum slenderness ratio for a short concrete column is
   (a) Less than 12
   (b) Between 12 and 18
   (c) Between 18 and 24
   (d) More than 24

147. Which one of the following represents the ratio of volume of helical reinforcement to volume of core?
   (a) \(0.36 \left( \frac{A_g}{A_c} - 1 \right) f_{ck}/f_y\)
   (b) \(0.36 \left( \frac{A_g}{A_c} - 1 \right) f_{ck}/f_y\)
   (c) \(0.36 \left( \frac{A_g}{A_c} - 1 \right) f_{ck}/f_y\)
   (d) \(0.36 \left( \frac{A_g}{A_c} - 1 \right) f_{ck}/f_y\)
   Where \(A_g\), \(A_s\) and \(A_c\) are gross cross-sectional area of the member, area of steel and core area and \(f_{ck}\) and \(f_y\) are characteristic strength of concrete and steel respectively.

148. The effective height of a masonry wall of height \(H\) restrained fully at its top and partially at its bottom, is
   (a) 0.75 \(H\)
   (b) 0.85 \(H\)
   (c) 1.00 \(H\)
   (d) 1.50 \(H\)

149. The effective length of masonry wall stiffened by buttresses on both ends and continuing beyond these buttresses at both ends is
   (a) 1.0 \(L\)
   (b) 2.0 \(L\)
   (c) 0.9 \(L\)
   (d) 0.8 \(L\)

150. Design of foundation for a large generator is guided, primarily by
   (a) Frequency  (b) deformation
   (c) strength  (d) stiffness

151. Given that \(\phi\) is angle of internal friction, \(p\) is the safe bearing capacity and \(\gamma\) is the unit weight of soil, the maximum depth of foundation of masonry footing is given by
   (a) \(P \gamma (1 + \sin\phi / \sin\phi)\)
   (b) \(P \gamma (1 - \sin\phi / \sin\phi)\)
   (c) \(P \gamma (1 + \sin\phi / \sin\phi)^2\)
   (d) \(P \gamma (1 - \sin\phi / \sin\phi)^2\)
152. The critical section for two-way shear of footing is at the
(a) Face of the column
(b) Distance \(d\) from the column face
(c) Distance \(d/2\) from the column face
(d) Distance \(d/2\) from the column face

(Where \(d\) is the effective depth of the footing)

153. In an isolated reinforced concrete column footing of effective depth \(d\), the stress in punching shear is checked
(a) at the centre of the column
(b) at the face of the column
(c) at a distance \(d/2\) away from the face of the column
(d) at a distance \(d/2\) away from the centre of the column

154. The critical section for maximum bending moment in the footing under masonry wall is located at
(a) the middle of the wall
(b) the face of the wall
(c) mid-way between the face and the middle of the wall
(d) a distance equal to the effective depth of footing from the face of the wall

155. Which one of the following systems of pre-stressing is suitable for pre-tensioned members?
(a) Freyssinet system
(b) Magnel-Blaon system
(c) Hoyer system
(d) Gifford-Udall system

156. Which one of the following method is employed to manufacture pre-stressed concrete sleepers for the railway?
(a) Post-tensioning
(b) Pre-tensioning
(c) Hoyer system
(d) Partial pre-stressing

157. The profile of the centroid of the tendon is parabolic with a central dip \(h\). Effective prestressing force is \(P\) and the span \(L\). What is the equivalent upward acting uniform load?
(a) \(8hL/P\)
(b) \(8hP/L^2\)
(c) \(8h^2L/P\)
(d) \(8h^2P/L\)
158. What is the uplift at centre on release of wires from anchors due to pretensioning only for force $P$ and eccentricity $e$ for a pre-tensioned rectangular plank?
   (a) $PeL^2/6EI$  
   (b) $Pe^2L/6EI$
   (c) $PeL^2/8EI$  
   (d) $Pe^2/8EI$

159. Which one of the following is the correct statement?

   Prestressing anchorage units multiple wire cables exist in the
   (a) Freyssinet system
   (b) Lee-Mc call system
   (c) Gifford-Udall system
   (d) Hoyer system

160. What is the allowable upward deflection in a prestress concrete member under serviceability limit state condition?
   (a) $\text{Span}/250$  
   (b) $\text{Span}/300$
   (c) $\text{Span}/350$  
   (d) $\text{Span}/500$

161. What is the limiting principle tensile stress in prestress uncracked concrete member of M 25 grade?
   (a) 1 MPa  
   (b) 1.5 MPa
   (c) 2 MPa  
   (d) 2.5 MPa

162. For a rectangular prestressed beam designed for operating stress conditions, what is the maximum prestressing force?
   (a) $bdsc$  
   (b) $1/2(bdo_c)$
   (c) $1.3(bdo_c)$  
   (d) $1.6(bdo_c)$

163. What is a tendon profile, in which the eccentricity is proportional to the bending moment caused by any loading on a rigidly supported indeterminate structure, at all cross-section?
   (a) Cable profile  
   (b) Resultant profile
   (c) Concordant profile  
   (d) Reduced profile

164. At the time of initial tensioning, the maximum tensile stress immediately behind the anchorage should not exceed which one of the following?
   (a) $0.50 \times$ ultimate tensile stress
   (b) $0.60 \times$ ultimate tensile stress
   (c) $0.70 \times$ ultimate tensile stress
   (d) $0.80 \times$ ultimate tensile stress

165. In pre-tressed concrete members, the shear force depends upon
   (a) Distributed load
   (b) Torsion
   (c) Concentrated load
(d) Variation in net bending moment

166. A simply supported rectangular beam is uniformly loaded and is prestressed. The tendon provided for prestressing should be

(a) Straight, above centroidal axis

(b) Straight, below centroidal axis

(c) Parabolic, with convexity upward

(d) Parabolic, with convexity downward

167. A concordant cable profile in prestressed concrete is

(a) parallel to the beam axis

(b) one which coincides with the centroidal axis of beam

(c) one which does not cause secondary stresses

(d) one which eliminates primary stresses

168. In a pre-stressed member, it is advisable to use

(a) low-strength concrete

(b) high-strength concrete

(c) high-strength concrete and high-tension steel

(d) high-strength concrete and high-tension steel
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ADVANCED SSC-JE /CIVIL BATCH 2018

AT ENGINEERS PRIDE JAIPUR
(10TH JAN 2018)

CRACK SSC-JE 2017
with 100% Guarantee
Soil Mechanics
1. Lacustrine soils are soils
   (a) transported by river and streams
   (b) transported by glaciers
   (c) deposited in sea beds
   (d) deposited in lake beds
   [IES-1996]

2. Acidic soils are reclaimed by
   (a) leaching of the soil
   (b) using limestone as a soil amendment
   (c) using gypsum as a soil amendment
   (d) provision of drainage
   [IES-2002]

3. The collapsible soil is associated with
   (a) Dune sands       (b) Laterite soils
   (c) Loess       (d) Black cotton soils
   [IES-2003]

4. A dry soil has mass specific gravity of 1.35. If the specific gravity of solids is 2.7, then the void ratio will be
   (a) 0.5   (b) 1.0
   (c) 1.5   (d) 2.0
   [IES-1996]

5. A clay sample has a void ratio of 0.50 in dry state and specific gravity of solids=2.70. Its shrinkage limit will be
   (a) 12%   (b) 13.5%
   (c) 18.5%   (d) 22%
   [IES-1996]

6. A soil has liquid limit of 60% plastic limit of 35% and shrinkage limit of 20% and it has a natural moisture content of 50%. The liquidity index of soil is
   (a) 1.5   (b) 1.25
   (c) 0.6   (d) 0.4
   [IES-1996]

7. A clayey soil has liquid limit = $w_L$; plastic limit = $W_p$ and natural moisture content = $w$. The consistency index of the soil is given by
   (a) $\frac{w_L - w}{w_L - W_p}$   (b) $\frac{w_L - w}{W_L - W_p}$
   (c) $\frac{W_p - W_p}{W_L - W_p}$   (d) $\frac{W_p - W_p}{W_L - W_p}$
   [IES-1998]

8. A soil has mass unit weight ‘$\gamma$’, water content ‘$w$’ (as ratio), the specific gravity of soil solids =G, unit weight of water = $\gamma_w$ ; ‘$S$’ the degree of saturation of the soil is given by
   (a) $S=\frac{\frac{W_L - w}{w_L - W_p} - \frac{1}{G}}{\gamma_w (1+w) - \frac{1}{G}}$
   (b) $S=\frac{\frac{W_L - w}{W_L - W_p} - \frac{1}{G}}{\gamma_w (1+w) - \frac{1}{G}}$
   (c) $S=\frac{\frac{W_L - w}{W_p - W_p} - \frac{1}{G}}{\gamma_w (1+w) - \frac{1}{G}}$
   (d) $S=\frac{\frac{W_L - w}{W_L - W_p} - \frac{1}{G}}{\gamma_w (1+w) - \frac{1}{G}}$
   [IES-1998]

9. If an unconfined compressive strength of 4 kg/cm² in the natural state of clay reduced by four times in the remoulded state, then its sensitivity will be
10. Based on grain distribution analysis, the D_{10}, D_{30} and D_{60} values of a given soil are 0.23 mm, 0.3 mm and 0.41 mm respectively. As per IS Code, the soil classification will be
(a) SW   (b) SP
(c) SM   (d) SC

11. Which one of the following correctly represents the dry unit weight of a soil sample which has a bulk unit weight of \( \gamma_t \) at a moisture content of \( w \) %?
(a) \( \frac{w \gamma_t}{100} \)  
(b) \( \gamma_t \left(1 + \frac{w}{100}\right) \)  
(c) \( \gamma_t \left(100 + w\right) \)  
(d) \( \gamma_t \left(100 - w\right) \)  

12. Consistency as applied to cohesive soils is an indicator of its
(a) Density  
(b) Moisture content  
(c) Shear strength  
(d) Porosity

13. A clay sample has a void ratio of 0.54 in dry state. The specific gravity of soil solids is 2.7. What is the shrinkage limit of the soil?
(a) 8.5%  
(b) 10.0%  
(c) 17.0%  
(d) 20.0%  

14. Which one of the following relation gives the value of degree of saturation \( s \), in terms of unit weight \( \gamma \), water content \( w \) (as ratio) and specific gravity of soil solids \( G_s \), \( \gamma_w \) is unit weight of water?
(a) \( s = \frac{w}{(\gamma/\gamma_w)(1+w) - 1/G_s} \)  
(b) \( s = \frac{w}{(\gamma/\gamma_w)(1+w) + 1/G_s} \)  
(c) \( s = \frac{w}{(\gamma_w/\gamma)(1+w) + 1/G_s} \)  
(d) \( s = \frac{w}{(\gamma_w/\gamma)(1+w) - 1/G_s} \)  

15. For a sandy soil with grains spherical in shape and uniform in size, what is the theoretical void ratio?
(a) 0.61  
(b) 0.71  
(c) 0.91  
(d) 0.81

16. The porosity of a soil sample having its void ratio equal to unity would be
(a) 33.33%  
(b) 50.0%  
(c) 66.66%  
(d) 75.0%

17. A soil sample has a void ratio of 0.5; its porosity will be
(a) 50 %  
(b) 66%  
(c) 100%  
(d) 33%  

18. The ratio of dry unit weight to unit weight of water represents
(a) Specific gravity of soil solids
19. The standard plasticity chart by cassagrande to classify fine-grained soils is shown in the figure. The area marked P represents.
(a) Inorganic clays of high plasticity
(b) Organic clays and highly plastic organic silts
(c) Organic and inorganic silts and silt clays
(d) Clays  [IES-2016]

20. Which technique of stabilization for the sub-base is preferred for a heavy plastic soil?
(a) cement stabilization
(b) mechanical stabilization
(c) lime stabilization
(d) bitumen stabilization  [IES-2016]

21. The correct sequence of plasticity of minerals in soil in an increasing order is
(a) Silica, Kaolinite, Illite, Montmorillonite
(b) Kaolinite, Silica, Illite, Montmorillonite
(c) Silica, Kaolinite, Montmorillonite, Illite
(d) Kaolinite, Silica, Montmorillonite, Illite  [IES-2002]

22. The predominant mineral responsible for shrinkage and swelling in black cotton soil is
(a) Ilite   (b) Kaolinite
(c) Mica   (d) Montmorillonite  [IES-2003]

23. Sheep-foot rollers are recommended for compacting
(a) granular soils
(b) cohesive soils
(c) hard rock   (d) any type of soil  [IES-1996]

24. In a compaction test if the compacting effort is increased. It will result in
(a) increase in maximum dry density but OMC
(b) Increase in maximum dry density but OMC remains unchanged
(c) Increase in maximum dry density and decrease in OMC
(d) NO change in maximum dry density but decrease in OMC  [IES-2003]

25. Soil is compacted at which one of the following when a higher compactive effort produces highest increase in dry density?
(a) Optimum water content
(b) Dry side of the optimum moisture content
(c) Wet side of the optimum moisture content
(d) Saturation moisture content  [IES-2004]

26. When the compaction energy increases the compaction of soils:
(a) Specific gravity of soil mass
(b) Specific gravity of dry soil
(c) Shrinkage ratio

[IES-2016]
27. An upward hydraulic gradient $i$ of a certain magnitude will initiate the phenomenon of boiling in granular soils. The magnitude of this gradient is
   (a) $0 \leq i \leq 0.5$  
   (b) $0.5 \leq i \leq 1.0$
   (c) $i \approx 1.0$  
   (d) $1 < i \leq 2$
   [IES-1996]

28. A deposit of fine sand has a porosity 'n' and specific gravity of soil solids is $G$. The hydraulic gradient of the deposit to develop boiling condition of sand is given by
   (a) $i_c = (G - 1) (1 - n)$
   (b) $i_c = (G - 1) (1 + n)$
   (c) $i_c = \frac{G-1}{1-n}$  
   (d) $i_c = \frac{G-1}{1+n}$
   [IES-1996]

29. Which one of the following equations correctly give the relationship between the specific gravity of soil grains ($G$) and the hydraulic gradient ($i$) to initiate 'quick' condition in a sand having a void ratio of 0.5?
   (a) $G = 0.5 i + 1$  
   (b) $G = i + 0.5$
   (c) $G = 1.5 i + 1$  
   (d) $G = 1.5 i - 1$
   [IES-1997]

30. To make certain that the backfill material is more pervious than the soil to be drained, the relationship used is
   (a) $(D_{15})_{\text{filter}} \leq 5(D_{85})_{\text{protected soil}}$
   (b) $(D_{15})_{\text{filter}} \geq 5(D_{85})_{\text{protected soil}}$
   (c) $(D_{15})_{\text{filter}} \leq 5(D_{15})_{\text{protected soil}}$
   (d) $(D_{15})_{\text{filter}} \geq 5(D_{15})_{\text{protected soil}}$
   [IES-1997]

31. A sand deposit has a porosity of 0.375 and a specific gravity of 2.6, the critical hydraulic gradient for the sand deposit is
   (a) 2.975  
   (b) 2.225
   (c) 1  
   (d) 0.75
   [IES-2009]

32. For a vertical concentrated load acting on the surface of a semi-infinite elastic soil mass, vertical normal stress at depth $z$ is proportional to
   (a) $z$  
   (b) $1/z$
   (c) $z^2$  
   (d) $1/z^2$
   [IES-1997]

33. In the case of stratified soil layers, the best equation that can be adopted for computing the pressure distribution is
   (a) Prandl’s  
   (b) Skempton’s
   (c) Westergaard’s
   (d) Boussinesq’s
   [IES-2000]

34. Westergaard’s formula for vertical stress gives greater value of stress than that by the Boussinesq’s formula, when $r/z$ exceeds:
35. An isobar is a line which connects all points below the ground surface at which
(a) The local ground elevation is same
(b) The settlement is same
(c) The vertical stress is the same
(d) The ground elevation is varying
[IES-2012]

36. A clay layer 5 m thick in field takes 300 days to attain 50% consolidation with condition of
double drainage. If the same clay layer is underlain by hard rock then the time taken to attain
50% consolidation will be
(a) 300 days  (b) 600 days
(c) 900 days  (d) 1200 days
[IES-1996]

37. Which one of the following soils has stress strain response similar to that of dense sand? (OCR
stands for overconsolidation ratio)
(a) Overconsolidated clay having high OCR
(b) Overconsolidated clays having low OCR
(c) Normally consolidated clays
(d) Unconsolidated clays
[IES-1998]

38. Terzaghi’s consolidation theory is applicable to one-dimensional consolidation test
(a) For small load increment ratios
(b) For large load increment ratios
(c) For a load increment ratio of nearly one.
(d) In situations where there is no excess pore pressure
[IES-1998]

39. Reduction in volume of soil primarily due to squeezing out of water from the voids is called.
(a) Primary consolidation
(b) Plastic flow
(c) Creep
(d) Secondary consolidation
[IES-2000]

40. Which one of the following statements regarding coefficient of consolidation \( C_v \) is correct?
(a) \( C_v \propto k \)
(b) \( C_v \propto 1/k \)
(c) \( C_v \propto m_v \)
(d) \( C_v \propto a_v \)
[IES-2002]

41. If instead of single drainage, the number of drainage faces is increased to two in corresponding
soils, the rate of compression will be
(a) 4 times slower
(b) 2 times slower
(c) 4 times faster
(d) 2 times faster
[IES-2011]

42. Settlement due to creep in soils is contingent on
(a) Primary consolidation
(b) Secondary consolidation
43. Compression index developed by Casagrande is
   (a) $C_v = 0.009 (LL+10\%)$
   (b) $C_v = 0.009 (LL-10\%)$
   (c) $C_v = 0.0009 (LL+10\%)$
   (d) $C_v = 0.0009 (LL-10\%)$

44. When a structural load is applied on a soil stratum, which of the following soil types will have the minimum settlement?
   (a) Over-consolidated clay stratum
   (b) Clayey silt stratum
   (c) Normally silt stratum
   (d) Normally clay stratum

45. In the consolidated drained test on a saturated soil sample, pore water pressure is zero during?
   (a) Consolidation stage only
   (b) Shearing stage only
   (c) Both consolidation and shearing stages
   (d) Loading stage

46. In a Mohr’s diagram, a point above Mohr’s envelope indicates
   (a) Imaginary condition
   (b) Safe condition
   (c) Imminent failure condition
   (d) Condition of maximum obliquity

47. Which one of the following soil types is most likely to be subjected to liquefaction under seismic forces?
   (a) Soft saturated clays
   (b) Loose saturated sands
   (c) Murum
   (d) Fractured rocky strata

48. Laboratory vane shear test can also be used to determine
   (a) Shear parameters of silty sand
   (b) Shear parameters of sandy clay
   (c) Liquid limit of silty clay
   (d) Plastic limit of clayey silt

49. As the state of strain of an element of dense sand changes from plain strain to triaxial strain condition, the effective angle of internal friction:
   (a) Increases
   (b) Decreases
   (c) Remains constant
   (d) First increase then remains constant
50. Which one of the following different types of submerged soils is susceptible to liquefaction under earthquake shocks?
   (a) Dense sand  (b) Soft clay
   (c) Loose silt  (d) Fissured clay

51. What does the confining pressure used in triaxial compression tests on an undisturbed soil sample represent?
   (a) The in-situ total normal stress (b) The in-situ total lateral stress
   (c) The in-situ effective average principal stress (d) The in-situ shear stress

52. Considerable loss of shear strength due to shock or disturbance is exhibited by
   (a) Under-consolidated clays (b) Normally consolidated clays
   (c) Over-consolidated clays (d) Organic soil

53. Liquefaction of foundation soil during an earthquake shall not be the reason for cracking of
   (a) only floors in the building (b) walls and roof in the building
   (c) beams and columns in the building (d) only balcony in the building

54. For the determination of shear strength parameters, c and $\phi$, of soil in the laboratory, the test to be conducted will be
   (a) Triaxial compression test (b) Sieve analysis
   (c) Compaction test (d) Relative density test

55. Given that for a soil deposit.
   $K_o = \text{earth pressure coefficient at rest,}$
   $K_a = \text{active earth pressure coefficient,}$
   $K_p = \text{passive earth pressure coefficient and}$
   $\nu = \text{Poisson's ratio,}$ the value of $(1-\mu)/\mu$ is given by
   (a) $K_o/K_p$  (b) $K_0/K_a$
   (c) $K_a/K_o$  (d) $1/K_0$

56. The nature of earth pressure above dredge line behind a cantilever sheet pile wall is
   (a) Active  (b) Passive
   (c) At rest  (d) Active and passive

57. The wall friction of the retaining wall:
   (a) decreases active earth pressure but increases passive earth pressure
(b) decreases passive earth pressure but increases active earth pressure
(c) decreases both active and passive earth pressures
(d) increases both active and passive earth pressures

58. Why are weep holes provided at the back of retaining walls?
(a) To reduce the active earth pressure on the walls
(b) To reduce the build-up of hydrostatic pressure
(c) To provide better compaction
(d) To increase the passive earth pressure

59. Rafts resting on sands can be allowed double of the allowable soil pressure when
(a) Permissible settlement is doubled
(b) Length is doubled
(c) Depth factor is increased
(d) Water table is lowered

60. Influence factor for immediate settlement of footing depends on its
(a) Size and shape
(b) Rigidity alone
(c) Location and size
(d) Size, shape, rigidity and location

61. The contact pressure distribution under a rigid footing on a cohesionless soil would be
(a) Uniform throughout
(b) Zero at centre and maximum at edges
(c) Zero at edges and maximum at centre
(d) Maximum at edges and minimum at centre

62. In case of footing on the surface or shallow depth is very dense sand, which one of the following types of failure is likely to occur?
(a) Punching shear failure
(b) Local shear failure
(c) General shear failure
(d) Any of the above three

63. The bearing capacity factors $N_c$, $N_q$ and $N_γ$ are functions of
(a) Width and depth of footing
(b) Density of soil
(c) Cohesion of soil
(d) Angle of internal friction of soil

64. In a plate test, how is the ultimate load estimated from the load settlement curve on a log-log graph?
(a) Directly
(b) By drawing tangents to the curve at the initial and final points.
(c) By the secant method.
(d) At 0.2 percent of the maximum settlement.
65. Which one of the following is the correct statement?
The contact pressure distribution below rigid footing on the surface of a clayey soil is
(a) uniform for the full width
(b) maximum at the centre and minimum at the edges.
(c) maximum at the edges and minimum at the centre.
(d) of an irregular shape.

66. The net ultimate bearing capacity of a purely cohesive soil
(a) depends on the width of the footing and is independent of the depth of the footing.
(b) depends on the width as well as the depth of the footing
(c) depends on the depth, but is independent of the width of the footing
(d) is independent of both the width and the depth of the footing

67. If water table is encountered in the standard pit while conducting plate load test
(a) The load test should be abandoned
(b) The pit is considered unsafe
(c) Test should be conducted with complete dewatering continuously throughout the test duration
(d) The bearing capacity of soil cannot be determined in this condition

68. Efficiency of a pile group is defined as:
(a) \( \frac{\text{Load carried by the largest pile in the group}}{\text{Load carried by the smallest pile in the group}} \)
(b) \( \frac{\text{Maximum load carried by a pile in the group}}{\text{Minimum load carried by a pile in the group}} \)
(c) \( \frac{\text{Minimum load carried by a pile in the group}}{\text{Maximum load carried by a pile in the group}} \)
(d) \( \frac{\text{Average load carried by a pile in the group}}{\text{Load carried by a single pile}} \)

69. In case of well foundation, grip length is defined as the
(a) length below the top of the well cap to the cutting edge.
(b) length between the bottom of the well cap to the cutting edge.
(c) depth of the bottom of the well below the minimum scour level.
(d) depth of the bottom of the well below the maximum scour level.

70. Ratio of bearing capacity of double Under Reamed (U.R.) pile to that of single U.R. pile is nearly
(a) 2
(b) 1.5
(c) 1.2
(d) 1.7

71. In the Engineering News Record formula for determining the safe load carrying capacity of a pile, the factor of safety used is
(a) 2.5
(b) 3
72. In under-reamed pile construction, the ratio of shaft diameter to diameter is
   (a) 1/1.5  (b) ½  
   (c) ½.5   (d) ¼  
   [IES-2001]

73. A static cone penetration test is usually conducted when the structure is likely to be founded on which of the following?
   (a) Shallow foundations  
   (b) Pile foundations  
   (c) Drier foundations  
   (d) Improved ground  
   [IES-2001]

74. Which of the following of piles is likely to have the highest load capacity in compression?
   (a) Driven pre-cast concrete pile  
   (b) Pre-cast pile placed in a pre-drilled bore  
   (c) Driven steel pipe pile  
   (d) Steel pipe pile placed in a pre-drilled bore  
   [IES-2007]

75. A wet, cohesive subgrade is most effectively stabilized by the addition of
   (a) Cement  (b) Fly ash  
   (c) Bitumen   (d) Lime  
   [IES-2000]

ANSWER KEY

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Surveying
1. A scale of 1 inch=50 ft. is mentioned on an old map. What is the corresponding equivalent scale?
(a) 1 cm = 5 m  (b) 1 cm = 6 m
(c) 1 cm = 10 m  (d) 1 cm = 12 m
[IES-2008]

2. Offsets are
(a) lateral measurements made with respect to main survey lines
(b) perpendiculars erected from chain lines
(c) taken to avoid unnecessary walking between stations
(d) Measurements which are not made at right angles to the chain line
[IES-1995]

(c) 10. What is the angle between two plane mirrors of an optical square?
(a) 30°  (b) 60°
© 45°  (d) 90°
[IES-2006]

3. If \( L \) is the length of the chain, \( W \) is the weight of the chain and \( T \) is the tension, the sag correction for the chain line is
(a) \( W^2L^2/24T^3 \)  (b) \( W^2L/24T^2 \)
(c) \( W^2L^2/24T^2 \)  (d) \( W^2L^2/24T^2 \)
[IES-2012]

4. In an inclined terrain, if the elevation difference between the two ends of a line is \( h \) and the inclined length of the line is \( L \), the correction for slope is
(a) \( h^2/L^2 \)  (b) \( h^2/2L^2 \)
(c) \( 2h^2/L^2 \)  (d) \( h^2/2L^2 \)
[IES-2012]

5. The direction of the magnetic meridian is established at each traverse station and the direction of the line is determined with reference to the magnetic meridian. This method of traversing is called.
(a) Fast needle method
(b) Loose needle method
(c) Bearing method
(d) Fixed needle method
[IES-1998]

6. The magnetic needle in a prismatic compass is placed
(a) At the bottom of the graduated aluminium ring
(b) Above the graduated aluminum ring
(c) Below the brass box
(d) Below the needle lifter, but above the bottom inside the compass
[IES-2003]

7. Diurnal variation is greater
(a) In water than in summer
(b) At smaller latitudes than at higher latitudes
(c) At magnetic equator points
(d) In summer than in winter
[IES-2006]

8. Which one of the following statements is not correct?
(a) A surveyor's compass has two sight vanes
(b) A prismatic compass has an object vane and an eye vane
(c) A trough compass is an accessory to a plane table
(d) In a prismatic compass the graduations on the aluminium disc rotate and the index remains stationary

[IES-2011]

9. The needle of a magnetic compass is generally supported on a
(a) Bush bearing  (b) Ball bearing
(c) Needle bearing  (d) Jewel bearing

[IES-2012]

10. A plane, which is perpendicular to the plumb line through a point and is tangential to the level surface at that point is called a
(a) Tangential plane  (b) Vertical plane
(c) Level plane  (d) Horizontal plane

[IES-2014]

11. Which one of the following is carried out by two theodolite method?
(a) Circular curve ranging  (b) Tacheometric survey
(c) Geodetic survey  (d) Astronomical survey

[IES-2008]

12. In a transit theodolite, error due to eccentricity of verniers is eliminated by reading
(a) both verniers  (b) both right swing and left swing
(c) right and left faces  (d) different parts of main scale

[IES-2010]

13. In a transit theodolite, any incidental error due to eccentricity of verniers is primarily counteracted by
(a) Reading both the verniers  (b) Reading different part of main scale
(c) Reading right and left faces  (d) Taking both right swing readings

[IES-2014]

14. For minor adjustments of horizontal angles measured using a theodolite, the tangential screw is adjusted after
(a) both the plates are unclamped  (b) the lower plate is clamped and the upper plate is unclamped
(c) the upper plate is clamped and the lower plate is unclamped  (d) both the plates are clamped

[IES-2015]

15. Triangulation station selected close to the main station for avoiding intervening obstruction is called
(a) eccentric station  (b) Pivot station
(c) Satellite station  (d) Tie station

[IES-2000]
16. On which one of the following are the third generation electro-optical instruments based?
   (a) Microwave  (b) Infrared
   (c) UV light    (d) He-Laser light  [IES-2004]

17. If $L$ is the perimeter of a closed traverse, $\Delta D$ is the closing error in departure, the correction for the
    departure of a traverse side of length $L$, according to Bowditch rule, is
   (a) $\Delta D \frac{L}{l}$   (b) $\Delta D \frac{l^2}{L}$
   (c) $\frac{l}{\Delta D}$    (d) $\Delta D \frac{l}{L}$  [IES-2010]

18. The arithmetical check for the computation of R.L. by “rise and fall” method is given by
   (a) $\sum F.S. - \sum B.S. = R.L. \text{ of last station point} - R.L. \text{ of first station point}$
   (b) $\sum B.S. - \sum F.S. = R.L. \text{ of first station point} - R.L. \text{ of last station point}$
   (c) $\sum B.S. - \sum F.S. = R.L. \text{ of last station point} - R.L. \text{ of first station point}$
   (d) $\sum B.S. - \sum F.S. = R.L. \text{ of first station point} - R.L. \text{ of last station point}$  [IES-2000]

19. The sensivingness of a bubble tube in a level would decrease if
   (a) The radius of the curvature of the internal surface of the tube is increased
   (b) The diameter of the tube is increased
   (c) The length of the vapour bubble is increased
   (d) The viscosity of the liquid is increased  [IES-2001]

20. Which one of the following surveys is employed for collecting sufficient data in connection with
    sewage disposal and water supply works?
   (a) Topographic survey  (b) Cadastral survey
   (c) Geodetic survey    (d) Cross-sectioning and profile leveling  [IES-2002]

21. Which one of the following methods of leveling eliminates the error due to curvature and
    refraction?
   (a) Fly leveling
   (b) Levelling by equalizing the distances of backsight and foresight
   (c) Check leveling
   (d) Precise leveling  [IES-2003]

22. Which of the following sights will be applicable for a change point?
   (a) Back sight
   (b) Intermediate sight and fore sight
   (c) Fore sight
   (d) Back sight and fore sight  [IES-2009]

23. In case of leveling, backsight is
   (a) A fixed point of known elevation
(b) The last staff reading taken before shifting the instrument
(c) The first staff reading taken after setting the instrument
(d) Any staff reading taken on a point of unknown elevation

24. Refraction error is the least in case of
(a) Stadia tacheometry
(b) Tangential tacheometry
(c) Subtense bar tacheometry
(d) Omnimeters

25. The subtense tacheometry method is adopted when the ground is
(a) Flat   (b) Inclined
(c) Undulating
(d) A waterbody

26. Error due to inclination of line of collimation in leveling across a river can be eliminated by
(a) Reversion
(b) Reciprocal ranging
(c) Reciprocal leveling
(d) Keeping level in middle

27. Setting off the proper principal distance in the projectors of projection stereoplotters is a procedure for which one of the following?
(a) Finding the focal length of the camera used
(b) Evaluating the digital terrain model
(c) Carrying out the interior orientation
(d) Filling the quotation for the purchase of A, stereoplotters

28. For sir borne application and materialization of GPS receiver and easy construction, which is the most frequently used antenna?
(a) Microstrip  (b) Micropole
(c) Spiral helix  (d) Choke ring

29. Which of the following can be used as a map substitute?
(a) Terrestrial photographs
(b) Vertical aerial photographs
(c) Oblique aerial photographs
(d) Vertical aerial photo-mosaics

30. Which one of the following is not strictly a method of remote sensing?
(a) Thermal and multi spectral scanning
(b) Microwave sensing
(c) Earth resource satellite
(d) Stereoscopy

31. When H is the flight height, R is the appropriate radial measure and d is the relief displacement, the vertical height of an object appearing on an aerial photograph is
32. The observations made over the same area on different dates to monitor ground features like crop growth is called
(a) Temporal resolution
(b) Radiometric resolution
(c) Spatial resolution
(d) Spectral resolution

33. Theory of errors and adjustments deals with minimizing the effects of
(a) Instrumental errors
(b) Mistakes
(c) Systematic errors
(d) Personal and accidental errors

34. From the probability it is found that the most probable values of series of errors arising out of the observations of equal weightage are those for which the sum of their squares is
(a) zero   (b) Infinity
(c) Minimum   (d) Maximum

35. Which one of the following surveys is required in observations of stars?
(a) Astronomical survey
(b) Cadastral survey
(c) Aerial survey
(d) Photogrammetric survey

36. At a given place of observation, the declination of a circumpolar star is
(a) Greater than the latitude
(b) Equal to the latitude
(c) Less than the co-latitude
(d) Greater than the co-latitude

37. Which one of the following is the angular distance between the observer's meridian and the vertical circle passing through a star measured along the celestial horizon?
(a) Right ascension   (b) Azimuth
(c) Declination   (d) Hour angle

38. Flamsteed gave numbers to stars observed by him in each constellation according to their
(a) Brilliance   (b) Altitudes
(c) Co-declinations   (d) Right ascensions

39. Which of the following coordinate system is the most convenient way to specify the position of the star on celestial sphere?
(a) Latitude and longitude
(b) Altitude and azimuth
c. Declination and right ascension

d. Declination and hour angle

[IES-2009]

40. Which one of the following linear methods of setting out a circular curve needs reference of the
centre of the curve?

(a) Offset from chord produced
(b) Radial offset
(c) Perpendicular offset
(d) Successive bisection of arcs

[IES-2009]

41. The difference between the apparent solar time and mean solar time is known as

(a) Real time (b) Average time
(c) Equation of time
(d) Sidereal time

[IES-2010]

42. When compared with the co-latitude of the place of observation, the declination of a
circumpolar star is always,

(a) lesser (b) Greater
(c) Equal
(d) Either lesser or equal

[IES-2012]

43. Which one of the following methods estimates best the area of an irregular and curved
boundary?

(a) Trapezoidal method
(b) Simpson’s method
(c) Average ordinate method
(d) Mid-ordinate method

[IES-1998]

44. Which one of the following is measure by the area between the balancing line and the mass-
haul curve?

(a) Haul between the balancing points
(b) Earthwork accumulated upto that point
(c) Excess of excavation
(d) Excess of filling

[IES-2004]

45. Which one of the following methods of computing area assumes that the short lengths of the
boundary between the ordinates are parabolic arcs?

(a) Average ordinate rule
(b) Middle ordinate rule
(c) Simpson’s rule
(d) Trapezoidal rule

[IES-2009]

46. It is required to produce a small-scale map of an area in a magnetic zone by directly plotting and
checking the work in the field itself. Which one of the following surveys will be most appropriate
for this purpose?

(a) Chain (b) Theodolite
(c) Plane Table (d) Compass

[IES-1995]
47. For locating an inaccessible point with the help of only a Plane table, one should use
(a) traversing   (b) resection
(c) radiation   (d) intersection   [IES-1995]

48. The method of plane tabling commonly used for establishing the instrument station is a method of
(a) radiation   (b) intersection
(c) resection   (d) traversing   [IES-1996]

49. The process of determining the location of the station (on the map) occupied by the plane table is called as
(a) Intersection   (b) Three-point problem
(c) Traversing   (d) Resection   [IES-2002]

50. Which one of the following surveys employs alidade?
(a) Contour survey   (b) Archaeological survey
(c) Plane table survey   (d) Reconnaissance survey   [IES-2008]

51. Which one of the following errors is more severe in plane table surveying?
(a) Defective sighting   (b) Defective orientation
(c) Movement of board between sights   (d) Non-horizontality of board when points sighted are at large differences of their elevation.   [IES-2009]

52. In a solution of the three-point problem in plane table surveying, the converging of error is attained through:
(a) Concyclic concept   (b) Bessel’s method
(c) Triangle of error   (d) Tracing paper method   [IES-2011]

53. Regarding plane-table survey, which of the following statements does not hold?
(a) All the plotting work including contouring can be done in the field
(b) It is quite suitable for small scale surveys
(c) Less number of control points are required
(d) It can be done in all seasons   [IES-2012]

54. In a plane-table survey, the process of determining the plotted position of a station occupied by the plane-table by means of sights taken towards known points, the locations of which have already been plotted, is known as
(a) Radiation   (b) Resection
(c) Intersection   (d) Traversing   [IES-2012]
55. The plotting of inaccessible points in a plane-table survey can be done by the method of
(a) Interpolation (b) Radiation
(b) Intersection (d) Traversing
[IES-2012]

56. Altimetry may be depicted most accurately by
(a) Hachures (b) Relief shading
(c) Layer tinting (d) Contour lines
[IES-2010]

57. A contour may be defined as an imaginary line passing through
(a) Points on the longitudinal section
(b) Points of equal elevation
(c) Point of equal local ground slope
(d) Point of transverse section surveys
[IES-2012]

58. A closed contour line with two or more higher contours inside it will represent a
(a) Depression (b) Hill
(c) Cave (d) Well
[IES-2012]

ANSWER KEY

<p>| | | | | | |</p>
<table>
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SOM
Strength Of Material
1. Consider the following statements:

1. If a beam has two axes of symmetry even then shear centre does not coincide with the centroid.
2. For a section having one axis of symmetry, the shear centre does not coincide with the centroid but lies on the axis of symmetry.
3. If a load passes through the shear centre, then there will be only bending in the cross-section and no twisting.

Which of these statements are correct?
(a) 1, 2 and 3
(b) 1 and 2
(c) 2 and 3
(d) 1 and 3 [IES-1995]

2. A ratio of moment carrying capacity of a circular beam of diameter D and square beam of size 'D' is

(a) $\pi/4$
(b) $3\pi/8$
(c) $\pi/3$
(d) $3\pi/16$ [IES-1995]

3. Match List-I with List-II and select the correct answer using the codes given below the lists:

<table>
<thead>
<tr>
<th>List-I</th>
<th>List-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Moment of inertia</td>
<td>1. Tensile stress</td>
</tr>
<tr>
<td>B. Elongation</td>
<td>2. Modulus of rupture</td>
</tr>
<tr>
<td>C. Neutral axis</td>
<td>3. Zero shear stress</td>
</tr>
<tr>
<td>D. Top fibre stress</td>
<td>4. Zero longitudinal stress</td>
</tr>
</tbody>
</table>

Codes:

(a) 2 1 3 4
(b) 1 2 4 3
(c) 3 4 1 2
(d) 2 1 4 3 [IES-1997]

4. The simply supported beam of constant width and varying depth and uniform strength is subjected to a central concentrated load. The depth of the beam $d_x$ at a distance $x$ from one of the supports is proportional to

(a) $x^{1/2}$
(b) $x^{1/3}$
(c) $x$
(d) $x^2$ [IES-1999]
5. A cantilever beam of T cross-section carries uniformly distributed load. Where does the maximum magnitude of the bending stress occur?

(a) At the top of cross-section  
(b) At the junction of flange and web  
(c) At the mid-depth point  
(d) At the bottom of the section

6. A beam is made of two identical metal flats soldered together. What is the ratio of stiffness of this beam to the stiffness of a beam in which the two flats are not soldered and which acts independently?

(a) 2  
(b) 4  
(c) 6  
(d) 8  

7. A steel beam is replaced by a corresponding aluminium beam of same cross-sectional shape and dimensions, and is subjected to same loading. The maximum bending stress will

(a) be unaltered  
(b) increase  
(c) decrease  
(d) vary in proportion to their modulus of elasticity

8. Consider the following statements for a beam of rectangular cross-section and uniform flexural rigidity EI subjected to pure bending:

1. The bending stresses have the maximum magnitude at the top and bottom of the cross-section.
2. The bending stresses vary linearly through the depth of the cross-section.
3. The bending stresses vary parabolically through the depth of the cross-section.

Which of the above statements is/are correct?

(a) 1, 2 and 3  
(b) 1 only  
(c) 2 only  
(d) 1 and 2 only

9. Out of the two beams of the same material and same cross-sectional area, one is of circular cross-section and the other is of square cross-section. If each of these is subjected to bending moment of the same magnitude, then

(a) both sections would be equally strong  
(b) both sections would be equally economical  
(c) square section would be more economical than circular section  
(d) square section would be less economical than circular section
10. Given that for an element in a body of homogeneous isotropic material subjected to plane stress, \( \varepsilon_x , \varepsilon_y \) and \( \varepsilon_z \) are normal strains in \( x, y, z \), directions respectively and \( \mu \) is the Poisson’s ratio, the magnitude of unit volume change of the element is given by
   (a) \( \varepsilon_x + \varepsilon_y + \varepsilon_z \)  
   (b) \( \varepsilon_x - \mu (\varepsilon_y + \varepsilon_z) \)  
   (c) \( \mu (\varepsilon_x + \varepsilon_y + \varepsilon_z) \)  
   (d) \( \frac{1}{\varepsilon_x} + \frac{1}{\varepsilon_y} + \frac{1}{\varepsilon_z} \)  
   [IES-1995]

11. A solid metal bar of uniform diameter \( D \) and length \( L \) is hung vertically from a ceiling. If the density of the material of the bar is \( \rho \) and the modulus of elasticity is \( E \), then the total elongation of the bar due to its own weight is
   (a) \( \rho \frac{L}{2E} \)  
   (b) \( \rho \frac{L^2}{2E} \)  
   (c) \( \rho \frac{E}{2L} \)  
   (d) \( \rho \frac{E}{2L^2} \)  
   [IES-1995]

12. In terms of bulk modulus (\( K \)) and modulus of rigidity (\( G \)), the Poisson’s ratio can be expressed as
   (a) \( \frac{3K - 4G}{6K + 4G} \)  
   (b) \( \frac{3K + 4G}{6K - 4G} \)  
   (c) \( \frac{3K - 2G}{6K + 2G} \)  
   (d) \( \frac{3K + 2G}{6K - 4G} \)  
   [IES-1995]

13. The stress level, below which a material has a high probability of not failing under reversal of stress, is known as
   (a) elastic limit  
   (b) endurance limit  
   (c) proportional limit  
   (d) tolerance limit  
   [IES-1995]

14. If all dimensions of a prismatic bar of square cross-section suspended freely from the ceiling of a roof are doubled then the total elongation produced by its own weight will increase
   (a) eight times  
   (b) four times  
   (c) three times  
   (d) two times  
   [IES-1996]

15. The stress at which a material fractures under large number of reversals of stress is called.
   (a) endurance limit  
   (b) creep  
   (c) ultimate strength  
   (d) residual stress  
   [IES-1996]

16. A given material has Young’s modulus \( E \), modulus of rigidity \( G \) and Poisson’s ratio 0.25 the ratio of Young’s modulus to modulus of rigidity of this material is
   (a) 3.75  
   (b) 3  
   (c) 2.5  
   (d) 1.5  
   [IES-1997]

17. If ‘\( A \)’ be the area of cross-section of a bar, the gauge length for the measurement of ductility will be
   (a) \( 5.65 \times A^{1/2} \)  
   (b) \( 5.65 \times A \)  
   (c) \( 6.56 \times A^{1/2} \)  
   (d) \( 6.56 \times A \)  
   [IES-1998]

18. For a linear, elastic, isotropic material, the number of independent constant is
   (a) 1  
   (b) 2  
   (c) 3  
   (d) 4  
   [IES-2000]

19. Creep is the gradual increase of
   (a) Plastic strain with time at constant load  
   (b) Elastic strain with time at constant load  
   (c) Plastic strain with time at varying load  
   (d) Elastic strain with time at varying load  
   [IES-2001]

20. Resilience is
   (a) Maximum strain energy  
   (b) recoverable strain energy  
   (c) total potential energy  
   (d) shear strain energy (Beyond Hooke’s Law)  
   [IES-2002]
21. A member having length L, cross-section area A and modulus of elasticity E is subjected to an axial load W. The strain energy stored in this member is
   (a) \( \frac{WL^2}{AE} \)  
   (b) \( \frac{WL^2}{2AE} \)  
   (c) \( \frac{W^2L}{2AE} \)  
   (d) \( \frac{W^2L}{AE} \) \[IES-2003\]

22. Elastic limit is the point
   (a) Up to which stress is proportional to strain
   (b) At which elongation takes place without application of additional load
   (c) Up to which if the load is removed, original volume and shape are regained
   (d) At which the toughness is maximum \[IES-2003\]

23. The material in which large deformation is possible before the absolute failure or rupture is termed as
   (a) Brittle  
   (b) Elastic  
   (c) Ductile  
   (d) Plastic \[IES-2003\]

24. As per the elastic theory of design, the factor of safety is the ratio of
   (a) Working stress to stress at the limit of proportionality
   (b) Yield stress to working stress
   (c) Ultimate stress to working stress
   (d) Ultimate load to load at yield \[IES-2003\]

25. If G is the modulus of rigidity, E the modulus of elasticity and \( \mu \) the Poisson’s ratio for a material, then what is expression for G?
   (a) \( G = \frac{3E}{2(1+2\mu)} \)  
   (b) \( G = \frac{5E}{(1+\mu)^2} \)  
   (c) \( G = \frac{E}{2(1+\mu)} \)  
   (d) \( G = \frac{E}{(1+2\mu)} \) \[IES-2006\]

26. What is the correct sequence of the following metals in the decreasing order of their Poisson’s ratio?
   1. Aluminium  
   2. Cast iron  
   3. Steel
   Select the correct answer using the code given below:
   (a) 1 - 2 - 3  
   (b) 2 - 1 - 3  
   (c) 1 - 3 - 2  
   (d) 3 - 1 - 2 \[IES-2007\]

27. What is the nature of stress in a ceiling fan rod?
   (a) Bending  
   (b) Tensile  
   (c) Compressive  
   (d) Shear \[IES-2008\]

28. Some structural members subjected to long time sustained loads deform progressively with time especially at elevated temperatures. What is such a phenomenon called?
   (a) Fatigue  
   (b) Creep  
   (c) creep relaxation  
   (d) Fracture \[IES-2008\]

29. A circular rod of diameter 30 mm and length 200 mm is subjected to a tensile force. The extension in rod is 0.09 mm and change in diameter is 0.0045 mm. What is the Poisson’s ratio of the material of the rod?
   (a) 0.30  
   (b) 0.32  
   (c) 0.33  
   (d) 0.35 \[IES-2009\]
30. Poisson’s ratio is defined as the ratio of
   (a) Longitudinal stress and longitudinal strain
   (b) Lateral strain and longitudinal strain
   (c) Longitudinal stress and lateral stress
   (d) Lateral stress and longitudinal stress

31. The symmetry of the stress tensor at a point in a body when at equilibrium is obtained from
   (a) conservation of mass
   (b) force equilibrium equations
   (c) moment equilibrium equations
   (d) conservation of energy

32. If the crushing in the material of a mild steel column is 3300 kg/cm²,
   Euler’s formula for crippling load is applicable for slenderness ratio equal to/grater than
   (a) 40
   (b) 50
   (c) 60
   (d) 80

33. A hollow circular column of internal diameter ‘d’ & external diameter 1.5d is subjected to a
    compressive load. The maximum distance of a point of application of load from the centre for no tension is
    (a) d/8
    (b) 13d/48
    (c) d/4
    (d) 13d/96

34. if the eccentricity of total self weight ‘W’ of a masonry dam at its base is equal to one – fourth of the base width ‘B’ then the maximum pressure at the base is given by
    (a) 2W/3B
    (b) 4W/3B
    (c) 5W/2B
    (d) 8W/3B

35. A column base is subjected to moment. If the intensity of bearing pressure due to axial load is equal to stress due to the moment, then the bearing pressure between the base and the concrete is
    (a) Uniform compression throughout
    (b) Zero at one end and compression at the other end
    (c) Tension at one end and compression at the other end
    (d) Uniform tension throughout

36. The slenderness ratio of a compression member in the context of Rankine’s formula is defined as
    \( \frac{\text{length}}{\text{least lateral dimension}} \)
(b) Effective length
least radius of gyration

(c) Effective length
least lateral dimension

(d) Length
least radius of gyration

37. For a masonry dam of base width $b$, at which location w.r.t. the central line, should the resultant loading intersect the sections to avoid tension in any horizontal section?

(a) Outside of $b/6$  (b) Within $b/6$

(c) Within $b/8$  (d) At the central line  

[IES-2007]

38. A circular column of external diameter $D$, and internal diameter $d$, carries an eccentric load such that tension is developed nowhere. What shall be the diameter of the core?

(a) $(D^2+d^2)/8d$  (b) $(D^2-d^2)/8d$

(c) $(D^2+d^2)/4d$  (d) $(D^2-d^2)/4d$

[IES-2009]

39. The base of a column is subjected to moment. If the intensity of bearing pressure due to axial load is equal to stress due to moment, then the bearing pressure between the base and the concrete is

(a) Uniform compression throughout

(b) Zero at one end and compression at the other end

(c) Tension at one end and compression at the other end

(d) Compression, varying as a parabolic profile  

[IES-2011]

40. According to maximum shear stress failure criterion, yielding in material occurs when

(a) Maximum shear stress = $1/2 \times$ yield stress

(b) Maximum shear stress = $\sqrt{2} \times$ yield stress

(c) Maximum shear stress = $\sqrt{2/3} \times$ yield stress

(d) Maximum shear stress = $2 \times$ yield stress  

[IES-1995]

41. A shaft is subjected to a bending moment $M$ and a torque $T$. The equivalent bending moment $M_{eq}$ on the shaft is given by
A circular shaft is subjected to a twisting moment \( T \) and bending moment \( M \). The ratio of maximum bending stress to shear stress is given by

\[
\begin{align*}
(a) \quad & \frac{2M}{T} \\
(b) \quad & \frac{M}{T} \\
(c) \quad & \frac{2T}{M} \\
(d) \quad & \frac{M}{2T}
\end{align*}
\]

[IES-1996]
49. A beam simply-supported at both the ends, of length ‘L’ carries two equal unlike couples M at two ends. If the flexural rigidity EI=constant, then the central deflection of beam is given by
(a) ML²/4EI (b) ML²/16EI (c) ML²/64EI (d) ML²/8EI  [IES-1995]

50. The maximum deflection of a fixed beam carrying a central load W is equal to
(a) WL³/48EI (b) WL³/96EI (c) WL³/192EI (d) WL³/384EI [IES-1996]

51. 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 moments will
(a) Increase (b) Decrease (c) Remain constant (d) Change their directions  [IES-1997]

52. A simply supported rectangular beam of span ‘L’ and depth ‘d’ carries a central load ‘W’
The ratio of maximum deflection to maximum bending stress is
(a) L²/6Ed (b) L²/8Ed (c) L²/48Ed (d) L²/12Ed

53. In a cantilever of span ‘L’, subjected to a concentrated load of ‘W’ acting at a distance of 1/3 L from the free end, the deflection under load will be
(a) WL³/3 EI (b) WL³/81 EI (c) 14WL³/81 EI (d) 8WL³/81 EI

54. The maximum deflection of simply supported beam occurs at zero
(a) Bending moment location (b) Shear force location (c) Slope location (d) Shear force location and also zero bending moment location  [IES-2001]

55. The strain energy in a member is proportional to
(a) Total strain multiplied by the volume of the member (b) Product of stress and the corresponding strain (c) Product of strain and Young’s modulus of the material (d) The maximum strain multiplied by the length of the member

56. A mild steel bar of uniform cross-section ‘A’ and length L is subjected to an axial load ‘W’. The Strain Energy stored in the bar would be
(a) WL / 2 AE (b) W² L / 4 AE (c) WL / 4 AE (d) W² L / 2 AE  [IES-2001]
57. The compatibility conditions in terms of strains in a two-dimensional problem are associated with
   (a) Stresses
   (b) Forces
   (c) Properties of material
   (d) Deformations                              [IES-2011]

58. The total deflection of a structure when subjected simultaneously to different sets of loading is equal to the sum of the deflections under each such set of loads as if acting separately on the structure. Which one of the following justifies this statement?
   (a) Elastic limit is not exceeded
   (b) Elastic limit including buckling is not exceeded
   (c) Limit state is not exceeded
   (d) Proportional limit without buckling is not exceeded

59. Clockwise moments are applied to both the ends of a uniform simply supported beam. If the ratio of the rotation of two ends is 2, then the ratio of the applied moments will be
   (a) 5/4     (b) 7/5
   (c) 5/3     (d) 3/2

60. The distance of centroids of areas above and below the equal area axis in a solid circular section from its center (R is the radius of circular section) is

   (a) \(\frac{4R}{3\pi}\)                        (b) \(\frac{4\pi}{3R}\)

   (c) \(\frac{3R}{4\pi}\)                               (d) \(\frac{3\pi}{4R}\)      [IES-2001]

61. The polar moment of inertia of the cross-section of the member if required to assess the strength of the member in

   (a) bending                                     (b) torsion
   (c) axial force                                 (d) shear               [IES-2015]

62. The polar modulus of a circular shaft of diameter d is

   (a) \(\frac{\pi}{16} \cdot d^3\)                    (b) \(\frac{\pi}{32} \cdot d^3\)

   (c) \(\frac{\pi}{64} \cdot d^3\)                    (d) \(\frac{\pi}{32} \cdot d^2\)       [IES-2015]

63. What is the polar modulus of a solid circular metal shaft of diameter 8 cm?

   (a) 64\pi \text{ cm}^3                         (b) 32\pi \text{ cm}^3
   (c) 16\pi \text{ cm}^3                         (d) 8\pi \text{ cm}^3        [IES-2015]
64. Which one of the following statement is correct?
(a) Shear force is the first derivative of bending moment
(b) Shear force is the first derivative of intensity of load
(c) Load intensity on a beam is the first derivative of bending moment.
(d) Bending moment is the first derivative of shear force.  \[\text{IES-1995}\]

65. Assertion (A) : The maximum bending moment occurs where the shear force is either zero or changes sign
Reason (R) : If the shear force diagram line between the two points is horizontal, the BM diagram line is inclined. But if the SF diagram is inclined, the BM diagram is a parabola of second degree. \[\text{IES-1996}\]

66. A beam has a triangular cross- section, having base ‘b’ & altitude ‘h’. if a section of the beam is subjected to a shear force F, the shear stress at the level of neutral axis in the cross- section is given by

(a) $4F/3bh$  
(b) $3F/4bh$  
(c) $8F/3bh$  
(d) $8F/3bh$  \[\text{IES-1995}\]

67. Shear centre of a semi – circular arc strip pf radius ‘R’ will be at a distance ‘x’ from the centre of , arc ‘x’ is equal to

(a) $\frac{\pi R}{2}$  
(b) $\frac{2R}{\pi}$  
(c) $\frac{4R}{\pi}$  
(d) $\frac{\pi R}{4}$  \[\text{IES-1998}\]

68. A symmetrical I section is subjected to shear force. The shear force induced across the section is maximum at which section?

(a) Extreme fibers
(b) At the bottom of flanges in flanges
(c) At the bottom of flanges in web portion
(d) At the neutral axis

69. A rectangular beam of width 100 mm is subjected to a maximum shear force of 60 kN. The corresponding maximum shear stress in the cross- section is 4 N/mm². The depth of the beam should be?

(a) 200mm  
(b) 150mm  
(c) 100mm  
(d) 225mm  \[\text{IES-2012}\]
70. Two planks of each of 50mm x 50 mm section are glued together along the length to form a section 50mm x 100 mm; and used as a beam. If the shear force at a section is 1000N, what is the maximum shear stress on the glue?

(a) 0.15 MPa  
(b) 0.3 MPa

(c) 0.6 MPa  
(d) 2.4 MPa [IES-2015]

71. A beam of square cross-section is placed such that its neutral axis coincides with its diagonal, & it is subjected to a shear force F. what is the ratio of the maximum shear stress to the shear stress at the neutral axis?

(a) 9/8  
(b) 8/9

(c) 7/8  
(d) 8/7 [IES-2015]

72. If two springs of stiffness $K_1$ and $K_2$ are connected in series, the stiffness of the combined spring is

(a) $\frac{K_1 K_2}{K_1 + K_2}$  
(b) $\frac{K_1 + K_2}{K_1 K_2}$

(c) $K_1 + K_2$  
(d) $K_1 K_2$ [IES-1995]

73. close-coiled helical spring with n coils, mean radius R and diameter d is subjected to an axial load W. what is the compression in the spring?

(a) $\frac{64 W R^3 n}{C d^3}$  
(b) $\frac{64 W R^3 n}{C d^4}$

(c) $\frac{32 W R^3 n}{C d^3}$  
(d) $\frac{32 W R^3 n}{C d^4}$ [IES-2007]

74. Two closely coiled helical springs A and B are equal in all respects but for the number of turns, with A having just half the number of turns of that of B. what is the ratio of deflection in terms of spring A to spring B?

(a) 1/8  
(b) 1/4

(c) 1/2  
(d) 2/1 [IES-2015]

75. Consider the following statements in respect of a thick cylinder subjected to internal pressure:
1. The stress on an element on the outer wall is unidirectional.
2. The stresses on an element on the innerwall are principal stresses.
3. The constants of the Lame’s equation are positive.
Which of these statements are correct?
76. For the analysis of thick cylinders, the theory applicable is
(a) Lame’s theory
(b) Rankine’s theory
(c) Poisson’s theory
(d) Courbon’s theory

IES-1999

77. A thin hollow cylinder of diameter d, length ℓ and thickness t is subjected to an internal pressure p. The hoop stress in the cylinder is
(a) pd / 8t
(b) pd / 4t
(c) pd / 2t
(d) pd / t

IES-2003

78. A thin cylinder of unit length, thickness ‘t’ and radius ‘r’ is subjected to internal pressure ‘p’. What is the circumferential stress?
(a) \( \frac{pr}{2Et} \)
(b) \( \frac{pr}{2r} \)
(c) \( \frac{pr}{t} \)
(d) \( \frac{2pr}{t} \)

IES-2008

79. A solid shaft of circular cross-section is subjected to torque T, which produce a maximum shear stress \( f_s \) in the shaft the diameter of the shaft should be
(a) \( \sqrt{\frac{PF}{16T}} \)
(b) \( \sqrt{\frac{PF}{16T}} \)
(c) \( \frac{1}{16T}/\pi f \)
(d) \( \sqrt{\frac{PF}{16T}} \)

IES-1997

80. Two shaft of solid circular cross-section are identical except for their diameter \( d_1 \) & \( d_2 \). They are subjected to same torque T. The ratio of the strain energies stored \( U_1/U_2 \) will be
(a) \( (d_1/d_2)^4 \)
(b) \( (d_1/d_2)^2 \)
(c) \( (d_2/d_1)^2 \)
(d) \( (d_2/d_1)^4 \)

IES-1999

81. Consider the following statement:
1. The weight of the hollow shaft will be less than that of solid shaft.
2. The external diameter of hollow shaft will be greater than that of solid shaft
3. The stiffness of hollow shaft will be equal to that of the solid shaft
Of the statements
(a) 1, 2 & 3 are correct
(b) 2 & 3 are correct
(c) 1 alone is correct
(d) 1 & 2 are correct

IES-1999

82. The ratio of the torsional moment of resistance of solid circular shaft of diameter \( D \), & hollow circular shaft having external diameter \( d \) is given by
(a) \( \frac{D^4}{D^4 - d^4} \)
(b) \( \frac{D^4 - d^4}{D^4} \)
(c) \( \frac{D^3 - d^3}{D^3} \)
(d) \( \frac{D^3}{D^3 - d^3} \)

IES-2002
83. Two shaft having same length & material are joined in series & subjected to a torque of 10 kNm.

If the ratio of their diameters is 2:1, then the ratio of their angle of twist is

(a) 16:1                       (b) 2:1
(c) 1:2                        (d) 1:16  [IES-2003]

84. A solid circular shaft of diameter d is subjected to a twisting moment T. The maximum shear stress in the shaft is proportional to.

(a) \(d^2\)          (b) d
(c) \(1/d^2\)        (d) \(1/d^3\)  [IES-2003]

85. When a cantilever shaft of brittle material is subjected to a clockwise twisting moment at the free end, the possible crack propagation will be

(a) 45° clockwise with respect to the axis of the shaft.
(b) 45° anticlockwise with respect to the axis of the shaft.
(c) Perpendicular to the axis
(d) Parallel to the axis  [IES-2004]

86. The failure surface of a standard cast iron torsion specimen, subjected to a torque is along

(a) the surface helicoidal is 45° to the axis of the specimen.
(b) the curved surface at the grip
(c) the plan surface perpendicular to the axis of the specimen
(d) the curved surface perpendicular to the axis of the specimen  [IES-2006]

87. In a shaft is turning at N rpm. & the mean torque to which the shaft is subjected is T N–m the power transmitted by the shaft in kW WOULD BE

(a) \(\frac{2\pi NT}{45000}\)                      (b) \(\frac{2\pi NT}{60000}\)
(c) \(\frac{2\pi NT}{30000}\)                     (d) \(\frac{2\pi NT}{33000}\)  [IES-2012]

88. In a rectangular element subjected to like principal tensile stresses \(p_1\) and \(p_2\) in two mutually perpendicular directions x and y, the maximum shear stress would occur along the

(a) plane normal to x-axis
(b) plane normal to y-axis
(c) plane at 45° to y-direction
89. Consider the following statements:

1. In a member subjected to uniaxial tensile force the maximum normal stress is the external load divided by the maximum cross-sectional area.

2. When the structural member is subjected to uniaxial loading, the shear stress is zero on a plane where the normal stress is maximum.

3. In a member subjected to uniaxial loading, the normal stress on the planes of maximum shear stress is less than the maximum.

Which of these statements are correct?

(a) 1 and 2  
(b) 1 and 3  
(c) 2 and 3  
(d) 1, 2 and 3  

[IES-1996]

90. In a plane stress problem there are normal tensile stresses $\sigma_x$ and $\sigma_y$ accompanied by shear stress $t_{xy}$ at a point along orthogonal Cartesian co-ordinates $x$ and $y$ respectively. If it is observed that the minimum principal stress on a certain plane is zero then

(a) $t_{xy} = \sqrt{\sigma_x + \sigma_y}$  
(b) $t_{xy} = \sqrt{\sigma_x - \sigma_y}$  
(c) $t_{xy} = \sqrt{\sigma_x \cdot \sigma_y}$  
(d) $t_{xy} = \sqrt{\sigma_x / \sigma_y}$  

[IES-1998]

91. The radius of Mohr’s circle is zero when the state of stress is such that

(a) Shear stress is zero  
(b) There is pure shear  
(c) There is no shear stress but identical direct stresses  
(d) There is no shear stress but equal direct stresses, opposite in nature, in two mutually perpendicular directions  

[IES-2003]

92. In the Mohr’s circle for strains, radius of Mohr’s circle gives the

(a) Minimum value of normal strain  
(b) Maximum value of normal strain  
(c) Maximum value of shear strain  
(d) Half of maximum value of shear strain  

93. In a body carries two unlike principle stress, what is the maximum shear stress?

(a) Half the difference of magnitude of the principal stresses  
(b) Half the sum of the magnitude of principal stresses  
(c) Difference of the magnitude of principal stresses  
(d) Sum of the magnitude of principal stresses  

94. Which one of the following statements is correct?

(a) Principal stress is defined as the shear stresses on planes on which the normal stress is maximum or minimum.
(b) The centre of Mohr’s circle for a two-dimensional stress system always lies in the y-axis (adopting conventional axes notation),
(c) The plane of maximum shear stress is inclined to the plane of principal stress at an angle of 45°,
(d) In case of biaxial state of normal stresses, the normal stress on 45° plane is equal to the sum of normal stresses. [IES-2011]

95. In a two-dimensional stress system, the radius of the mohr’s circle represents
(a) maximum normal stress
(b) minimum normal stress
(c) minimum shear stress
(d) maximum shear stress  [IES-2012]

96. Consider the following statements:
If the planes at right angles carry only shear stress of magnitude q in a certain instance, then the
1. Diameter of Mohr’s circle would be equal to 2q.
2. Centre of Mohr’s circle would lie at the origin
3. Principal stresses are unlike and are of magnitude q each
4. Angle between the principal plane and the plane of maximum shear would be 45°
Which of the above statements are correct?
(a) 1, 2 and 3 only  (b) 1, 2 and 4 only
(c) 3 and 4 only  (d) 1, 2, 3 and 4  [IES-2014]

97. Which of the following stresses is measured on inclined surface in Mohr’s Circle Method?
(a) Principal stress  (b) Normal stress
(c) Tangential stress  (d) Maximum stress
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DSS
Design of
Steel
Structure
1. The permissible stress in axial tension $\sigma_{Ax}$ in steel member on the net effective area of the section shall not exceed ($f_y$ is the yield stress)
   
   (a) $0.80 \ f_y$  
   (b) $0.75f_y$  
   (c) $0.60 \ f_y$  
   (d) $0.50 \ f_y$ [GATE-2005]

2. Factor of safety adopted by IS: 800 – 1984 while arriving at the permissible stress in axial compression is
   
   (a) 2.00  
   (b) 1.00  
   (c) 1.67  
   (d) 1.50 [GATE-1997]

3. The permissible bending tensile stress in concrete for the vertical wall of an R.C. water tank made of M 25 concrete is
   
   (a) 8.5 N/mm²  
   (b) 6.0 N/mm²  
   (c) 2.5 N/mm²  
   (d) 1.8 N/mm². [GATE-1997]

4. Generally the maximum deflection/span ratio of a steel member should not exceed
   
   (a) 1/750  
   (b) 1/500  
   (c) 1/325  
   (d) 1/25 [GATE-1996]

5. Which one of the following methods of design is not suitable for structures subjected to impact and fatigue?
   
   (a) Simple  
   (b) Semi – rigid design  
   (c) Rigid design  
   (d) Plastic design [IES-1996]

6. In the case of structural steel sections, the MINIMUM ratio of thickness of elements in compression, in the terms of their outstanding length is specified to prevent
   
   (a) Bending failure  
   (b) Shear failure  
   (c) Local bucking  
   (d) Tension failure [IES-1998]

7. The order of elongation which a specimen of mild steel undergoes before fracture is
8. For steel structure proportional using plastic design, the working load (dead load + imposed load) should be multiplied by which one of the following minimum load factor?

(a) 1.3  (b) 1.5  
(c) 1.7  (d) 2.0  [IES-2004]

9. Some steels do not show yield plateau and show continuous curve. For such steel, how is the yield strength obtained?

(a) By drawing 0.2% offset of the strain  
(b) By drawing 0.5% offset of the strain  
(c) By drawing initial tangent  
(d) By drawing initial secant modulus  [IES-2004]

10. Which one of the following stresses is independent of yield stress as a permissible stress for steel members ?

(a) Axial tensile stress  
(b) Maximum shear stress  
(c) Bearing stress  
(d) Stress in slab base  [IES-2005]

11. In a situation where torsion is dominant, which one of the following is desirable section?

(a) Angle section  
(b) Channel section  
(c) I-section  
(d) Box type section  [IES-2005]

12. What is the allowable direct tensile stress in structural steel (approximately) ?

(a) 0.45 $f_y$  
(b) 0.6 $f_y$
where $f_Y$ is the yield stress or proof stress. [IES-2008]

13. Which one of the following is correct?

Steel structures are ideally suitable for impact loads because they have high

(a) Toughness value  (b) Elastic modulus
(c) Design stress  (d) Plastic modulus  [IES-2008]

14. Which of the following steel sections should preferably be used at places where torsion occurs?

(a) Box-type section  (b) Channel section
(c) Angel section  (d) Any of the above  [IES-2011]

15. Prying Forces are:

(a) Shearing forces on the bolts because of the joints
(b) Tensile forces due to the flexibility of connected ports.
(c) Bending forces on the bolts because of the joints.
(d) Forces due the friction between connected

[GATE-2015 SET-II]

16. In a steel plate with bolted connections, the rupture of the net section is a mode of failure under

(a) Tension  (b) Compression
(c) Flexure  (d) Shear

[GATE-2012]

17. Generally (fatigue life of welded steel structure-fatigue life of riveted steel structure) ratio is
(a) smaller than 1  (b) equal to 1
(c) greater than 1  (d) greater than 2.1

18. As per IS: 800-1984, the minimum pitch of rivers in a row is recommended as the diameter of the rivet times

(a) 2.0  (b) 2.5
(c) 3.0  (d) 4.0

19. Maximum size of a fillet weld for a plate of square edge is

(a) 1.5 mm less than the thickness of the plate
(b) one half of the thickness of the plate
(c) thickness of the plate itself
(d) 1.5 mm more than the thickness of the plate

20. The common assumption that all rivets share equally a non-eccentric load is valid at a load

(a) Below the working load
(b) Equal to the working load
(c) Above the working load
(d) Equal to the failure load

21. In a fillet weld the weakest section is the

(a) smaller side of the fillet
(b) throat of the fillet

(C) side perpendicular to force

(d) side parallel to force

22. In the design of framed connections, the rivets or bolts connecting the web of the beam with the connecting angles are subject to

(a) Single shearing and bearing on the web
(b) Double shearing and bearing on the web
(c) Double shearing and no bearing on the web
(d) No shearing but only bearing on the web [IES-1997]

23. The effective length of the fillet weld is

(a) Total length – 2 × throat size
(b) Total length – 2 × weld size
(c) 0.7 × total length
(d) Total length – weld size / √2

24. The permissible stresses in rivets wind load conditions as per IS. 800 can be exceeded by about

(a) 15 %
(b) 25 %
(c) 33 %
(d) 50 % [IES-2000]

25. A plate used for connecting two or more structural members intersecting each other is termed as

(a) Template
(b) Base plate
(c) Gusset plate
(d) Shoe plate [IES-2003]

26. In a riveted joint, failure will occur due to which one of the following?

(a) Shear failure of rivet
(b) Bearing failure of rivet
27. How are structural members composed of two angles back to back, connected throughout their length?

(a) By looking rivets  (b) By spacing rivets
(c) By gripping rivets  (d) By tacking rivets

28. Which one of the following is correct? The permissible stresses in a weld are usually taken as

(a) less than those of the parent body
(b) equal to those of the parent body
(c) more than those of the parent body
(d) any desired value

29. For field rivets, the permissible stresses are reduced by what percentage?

(a) 10%  (b) 15%
(c) 25%  (d) 33\(\frac{1}{3}\)%

30. A bolt designated as Hex bolt M 16\(\times\)70 NL will have

(a) Diameter of 16 mm
(b) Diameter of 70 mm
(c) Length of 16 mm
(d) Cross-sectional area of 16\(\times\)70 cm\(^2\)

31. The maximum longitudinal pitch allowed in bolted joints of tension members is

(a) 16 times the diameter of the bolt
(b) 32 times the diameter of the bolt
(c) 16 times the thickness of the plate
32. When the effect of wind or earthquake load is taken into account in the design of a riveted connection, the permissible stresses in rivets may be exceeded by

(a) 16.66 %  
(b) 33.33 %

(c) 25 %  
(d) 50 %

[IES-2012]

33. A. The effective throat thickness of a fillet weld depends upon

(a) angle between fusion faces

(b) length of weld

(c) permissible shear stress

(d) type of weld

[IES-2012]

34. When the load the line coincides with the centroid of the rivet group, the rivets are subjected to

(a) shear only

(b) tension only

(c) bending only

(d) shear as well as tension

[IES-2012]

35. The effective length of a fillet weld is taken as the actual length

(a) plus twice the size of the weld

(b) minus twice the size of the weld

(c) plus the size of the weld

(d) minus the size of the weld

36. The net effective cross section area calculated in the steel angle tension member design accounts for

(a) The tensile force and bolt holes

(b) The eccentricity of the end connections and the bolt holes

(c) The effectiveness of the tack connection along the length

(d) The effectiveness of the end connection

[GATE-1995]
37. The slenderness ratio in tension member as per BIS code where reversal of stress is due to loads other than wind of seismic shall not exceed

(a) 350  
(b) 180  
(c) 100  
(d) 60  

[IES-2001]

38. The working stress for structural steel in tension is of the order of

(a) 15 N/mm²  
(b) 75 N/mm²  
(c) 150 N/mm²  
(d) 750 N/mm²  

[IES-2003]

39. The centre to centre maximum distance between rivets in tension member of thickness 10 mm is

(a) 200 mm  
(b) 160 mm  
(c) 120 mm  
(d) 100 mm  

[IES-2003]

40. Which one of the following statements is correct?

Lug angles

(a) are necessarily unequal angles  
(b) are always equal angles  
(c) increase the shear resistance of joint  
(d) reduce the length of joint  

[IES-2005]

41. For a pair of identical steel channel sections, tack-welded as a tension element, what is the net area of cross-section for design purposes?

(a) Net area of the webs only  
(b) Net area of the flanges only  
(c) Net area of the webs and flanges  
(d) Web area plus a portion of the area of the flanges  

[IES-2007]

42. The best-suited rolled steel section for a tension member is
43. The square root of the ratio of moment of inertia of the cross-section to its cross-section area is called
   (a) Second moment of area
   (b) Slenderness ratio
   (c) Section modulus
   (d) Radius of gyration

44. In the design of lacing system for a built-up steel column, the maximum allowable slenderness ratio of lacing bar is
   (a) 120
   (b) 145
   (c) 180
   (d) 250

45. The effective length of a circular electric pole of length L and constant diameter erected on ground is,
   (a) 0.80 L
   (b) 1.20 L
   (c) 1.50 L
   (d) 2.00 L

46. In IS :800 (1984), the permissible compressive stress in column is based on
   (a) Euler formula
   (b) secant formula
   (c) Rankine – Gordan formula
47. The maximum allowable compressive stress corresponding to lateral buckling in a discretely laterally supported symmetrical I beam does not depend upon

(a) The modulus of elasticity  
(b) The radius of gyration about the minor axis  
(c) The spin/length of the beam  
(d) The ratio of overall depth to thickness of the flange

[GATE-1995]

48. As per IS:800 - 1984, the maximum allowable slenderness ratio of compression members carrying forces resulting from dead load and superimposed load is

(a) 180  
(b) 250  
(c) 300  
(d) 400

[GATE-1995]

49. In the case of an axially loaded column machined for full bearing the fastening connecting the column to the base plates in gusseted base are designed for

(a) 100% of the column load  
(b) 50% of the column load  
(c) 25% of the column load  
(d) Erection conditions only

[IES-1999]

50. Which one of the following is the most critical set of considerations in the design of roller steel columns carrying axial loads?

(a) Percent elongation at yield and the end cross-sectional area  
(b) Critical bending strength and axial yield strength of the material  
(c) Buckling strength based on the net area of the section and percent elongation at ultimate load
(d) Compressive strength based on slenderness ratio and gross cross-sectional area of the member [IES-1999]

51. The elements that are normally subjected to combined bending and axial forces are

(a) struts in reinforced concrete members

(b) the members in long span bridges

(c) columns in framed structures

(d) space truss members [IES-2002]

52. An electric pole 5m high is fixed into the foundation. It carries a wire at the top and is free to move sideways. The effective length of the pole is:

(a) 3.25 m
(b) 4.0 m
(c) 5.0 m
(d) 10.0 m [IES-2003]

53. The type of stress induced in the foundation bolts fixing a column to its footing is

(a) Pure compression
(b) Bearing

(c) Pure tension
(d) Bending [IES-2003]

54. For a compression member having the same effective length about any cross-sectional axis, the most preferred section from the point of view of strength is

(a) A box
(b) An I-section

(c) A circular tube
(d) A single angle [IES-2003]

55. What is the maximum slenderness ratio for a steel member carrying compressive loads resulting from dead load and imposed loads?

(a) 180
(b) 250

(c) 350
(d) 400 [IES-2004]

56. Where should splices in the columns be provided?
(a) At the floor levels

(b) At the mid height of columns

(c) At the beam-column joints

(d) At one-fourth height of columns

57. Why are tie plates provided in laced columns?

(a) To check the buckling of column as whole

(b) To check the buckling of the lacing flats

(c) To check the buckling of the component columns

(d) To check the distortion of the end cross sections

58. What is the permissible tensile stress in bolts used for column bases?

(a) $120 \text{ N/mm}^2$

(b) $150 \text{ N/mm}^2$

(c) $0.6f_y$

(d) $0.4f_y$

59. The slenderness ratio of lacing bars should not exceed:

(a) 100

(b) 200

(c) 145

(d) 180

60. Which one of the following is a compression member?

(a) Purlin

(b) Boom

(c) Girt

(d) Tie

61. What is the maximum permissible slenderness ratio of a major compression member which undergoes reversal of stress due to wind load?

(a) 180

(b) 250
62. Which one among the following is the correct ratio of effective length to actual of a discontinuous angle strut, if ends are welded?

(a) 0.65 (b) 0.85

(c) 1.0 (d) 1.2

[IES-2006]

63. What is the maximum permissible slenderness ratio for steel ties likely to be subjected to compression?

(a) 400 (b) 350

(c) 250 (d) 180

[IES-2008]

64. Which one of the following forces is used for the design of battens of a built up column?

(a) Axial load (b) Twisting moment

(c) Vertical shear (d) Transverse shear

[IES-2008]

65. The batten plates used to connect the components of a built-up column are designed to resist

(a) Longitudinal shear only

(b) Transverse shear only

(c) Longitudinal shear and moment arising from transverse shear

(d) Vertical shear only

[IES-2010]

66. The most critical consideration in the design of a rolled steel column carrying axial loads is the

(a) Percentage elongation at yield and the net cross-sectional area

(b) Critical bending strength and axial yield strength of material

(c) Buckling strength based on the net area of the section and percentage elongation at ultimate load
(d) Compressive strength based on slenderness ratio and gross cross-sectional area

[IES-2011]

67. A column member of length ‘l’ which cannot sway has a rigid foundation at its bottom. Its top is held with heavy beams. The effective length of the column is

(a) 1.5 l
(b) 1.0 l
(c) 0.8 l
(d) 0.65 l

[IES-2012]

68. In laced columns, end tie-plates are provided to

(a) check the buckling of column
(b) keep the column components in position
(c) check the distortion of column sections at ends because of unbalanced horizontal force from lacings
(d) prevent rotation of elements

[IES-2012]

69. A column is effectively held in position and restrained in direction at one end but is free at the other end. If the actual length is L, the effective length is

(a) 0.67 L
(b) L
(c) 1.5L
(d) 2L

[IES-2012]

70. The effective width of outstand in compound steel column for design purposes is equal to

(a) half the flange width
(b) distance of the free edge from the rivet line
(c) distance of the free edge from the stiffeners
(d) distance of the free edge to the nearest row of rivets.

[IES-2013]
71. For a steel built-up column subjected to an axial force of 1200 kN, the lacing system is to be designed for resisting transverse shear of

(a) 15 kN  
(b) 20 kN  
(c) 25 kN  
(d) 30 kN  

[IES-2013]

72. The effective length of a battened strut of actual length L, effectively held in position at both ends but not restrained in direction, is taken as

(a) L  
(b) 1.1L  
(c) 1.5L  
(d) 1.8L  

[IES-2014]

73. The slenderness ratio (as per IS :800) of a member, carrying compressive loads arising from combined dead loads and imposed loads, should not exceed

(a) 180  
(b) 250  
(c) 350  
(d) 380  

[IES-2014]

74. Lacing of compound steel columns

(a) increases the load-carrying capacity  
(b) decreases the chances of local buckling  
(c) decreases overall buckling of the column  
(d) assures unified behaviour  

[IES-2014]

75. For a compression member with double angle section, which of the following sections will give larger value of minimum radius of gyration?

(a) Equal angles back-to-back  
(b) Unequal angles with long legs back-to-back  
(c) Unequal angles with short legs back-to-back  
(d) None of the above  

[IES-2014]
76. Battens provided for a compression member shall be designed to carry a transverse shear equal to

(a) 2.5% of axial force in the member

(b) 5% of axial force in the member

(c) 10% of axial force in the member

(d) 20% of axial force in the member [IES-2014]

77. The problems of lateral buckling can arise only in those steel beams which have

(a) moment of inertia about the bending axis larger than the other

(b) moment of inertia about the bending axis smaller than the other

(c) fully supported compression flange

(d) None of the above [IES-2014]

78. In the case of an axially loaded column, machined for full bearing the fastenings connecting the column to the base plates through gussets are to be designed for

(a) 100% of the load on the column

(b) 50% of the load on the column

(c) 25% of the load on the column

(d) Respective erection conditions only [IES-2015]

79. When designing steel structures, one must ensure that local buckling in webs does not take place. This check may not be very critical when using rolled sections because

(a) Quality control at the time of manufacture of rolled sections is very good

(b) Web depths available are small

(c) Web stiffeners are in-built in rolled sections
(d) Depth to thickness ratios (of the web) are appropriately adjusted

[Gate-2002]

80. An ISMB 500 is used as beam in a multi-storey construction. From the viewpoint of structural design, it can be considered to be ‘laterally restrained’ when,

(a) The tension flange is ‘laterally restrained’
(b) The compression flange is ‘laterally restrained’
(c) The web is adequately stiffened
(d) The conditions in (a) and (c) are met

[Gate-2002]

81. A steel beam supporting loads from the floors slab as well as from wall is termed as

(a) Stringer beam
(b) Lintel beam
(c) Spandrel beam
(d) Header beam

82. The height at which wind force acts on a moving vehicle on a bridge deck is

(a) 1.2 m
(b) 1.5 m
(c) 1.7 m
(d) 2.0 m

[IES-1998]

83. Racking force on a steel railway bridge is due to

(a) Tractive effect of the driving wheel
(b) Braking effect
(c) Resistance offered by the bearing to the movement at the roller end
(d) Lateral movement of the train when moving on a straight track

[IES-1998]

84. How are the most commonly produced and used structural elements in frames, floor beams, etc with high moment of inertia about x-axis, are designated?
85. A cantilever arm is to be attached to a column. Which one among the following is the best connection?

(a) Framed connection  
(b) Seated connection  
(c) Stiffened seated connection  
(d) End plate connection  

86. A steel beam is connected to a steel column by means of two angles placed on the two sides of the web of the beam. What is it called?

(a) Stiffened seat connection  
(b) Unstiffened seat connection  
(c) Framed connection  
(d) Rigid connection  

87. Intermediate vertical stiffeners are provided in plate girders to

(a) eliminate web buckling  
(b) eliminate local buckling  
(c) transfer concentrated loads  
(d) prevent excessive deflection  

88. The thickness of web for unstiffened plate girder with clear distance $d$ between the flanges shall not be less than

(a) $\frac{d}{200}$  
(b) $\frac{1}{85}d$
89. In a plate girder bridge the thickness of web is less than \( \frac{d'}{200} \) where \( d' \) is the unsupported depth of web. The web plate should be provided with

(a) vertical stiffeners

(b) Horizontal stiffeners

(c) End stiffness

(d) Both vertical and horizontal stiffness

[IES-2001]

90. In the design of steel bridges if wind or seismic forces are also considered, the allowable stresses as per BIS may be increased by

(a) 10\%

(b) \( 16\frac{2}{3}\% \)

(c) 25\%

(d) \( 33\frac{1}{3}\% \)

[IES-2001]

91. The effective flange area in tension of a plate girder is equal to

(a) \( A_f \)

(b) \( A_f + \frac{A_w}{2} \)

(c) \( A_f + \frac{A_w}{8} \)

(d) \( A_f + \frac{A_w}{6} \)

Where \( A_f \) is the area of each flange and \( A_w \) is the web area.

[IES-2001]

92. \( A_f \) is the area of flanges and \( A_w \) is the area of web. What is the effective flange area in the design of a plate girder?

(a) \( A_f + \frac{A_w}{8} \)

(b) \( A_f + \frac{A_w}{6} \)

(c) \( A_f - \frac{A_w}{8} \)

(d) \( A_f - \frac{A_w}{6} \)

[IES-2004]

93. For a vertical stiffened web of a plate girder, the lesser clear dimension of the panel should not exceed:

(a) 85 t

(b) 180 t
94. Why are intermediate vertical stiffeners provided in plate girders?

(a) To eliminate web buckling
(b) To eliminate local buckling
(c) To transfer concentrated loads
(d) To prevent excessive deflection

95. Horizontal stiffeners are needed in plate girders if the thickness of web is

(a) < 6 mm  
(b) < \( \frac{d}{200} \)
(c) < \( \frac{L}{500} \)
(d) nearly equal to flange thickness

Where \( d \) = distance between the flanges and
\( L \) = span

96. The allowable shear stress in the web of mild steel beams decreases with

(a) Decrease in \( h/t \) ratio
(b) Increase in \( h/t \) ratio
(c) Decrease in thickness
(d) Increase in height

Where \( h \) is the height and \( t \) is the thickness

97. The allowable shear stress in stiffened webs of mild steel beams decreases with

(a) Decrease in the spacing of the stiffeners
(b) Increase in the spacing of the stiffeners
98. The thickness of web for unstiffened plate girder with clear distance ‘d’ between the flanges shall be not less than

(a) \(\frac{d}{200}\)  
(b) \(\frac{d}{85}\)  
(c) \(\frac{d}{100}\)  
(d) \(\frac{d}{160}\)  

99. Bearing stiffeners in plate girders are provided to

(a) decrease the effective depth of web  
(b) transfer the load from the top flange to the bottom flange  
(c) prevent buckling of web  
(d) increase the bearing capacity of the flange.

100. Localized bearing stress caused by the transmission of compression from the wide flange to the narrow web causes a failure called

(a) web buckling  
(b) web shear flow  
(c) web bearing  
(d) web crippling

101. In a plate girder, the web is primarily designed to resist

(a) torsional moment  
(b) shear force  
(c) bending moment  
(d) diagonal buckling

102. When designing steel structures, one must ensure that local buckling in webs does not take place. This check may not be critical when using rolled steel sections because

(a) quality control at the time of manufacture of rolled sections is very good  
(b) web depths available are small
(c) web stiffness is built-in in rolled sections

(d) depth to thickness ratio of the web is always appropriately adjusted [IES-2014]

103. Horizontal stiffener in a plate girder is provided to safeguard against web buckling due to

(a) shear
(b) compressive force in bending
(c) tensile force in bending
(d) heavy concentrated load [IES-2014]

104. In which of the following cases is the compression flange most susceptible to buckle laterally?

(a) An I-section supporting a roof slab with shear connection
(b) Purlin of a roof supporting dead and live loads
(c) Encased beam
(d) A steel I-section supporting a point load when acting as a cantilever [IES-2014]

105. The serviceability criterion for a plate girder design is based upon

(a) width of flange
(b) depth of web
(c) minimum thickness of web
(d) stiffness of web [IES-2014]

106. Web buckling occurs in a beam due to excessive

(a) Direct tensile stress in the web
(b) Bending tensile stress in the web
(c) Torsional shear stress in the web
107. As per IS 800:2007, the cross-section in which the extreme fibre can reach the yield stress, but cannot develop the plastic moment of resistance due to failure by local buckling is classified as

(a) Plastic section  
(b) compact section

(c) semi-compact section  
(d) slender section

108. In the theory of plastic bending of beams, the ratio of plastic moment to yield moment is called

(a) Shape factor  
(b) Plastic section modulus

(c) Modulus of resilience  
(d) Rigidity modulus

109. The shape of the cross-section, which has the largest shape factor, is

(a) Rectangular  
(b) I-section

(c) diamond  
(d) solid circular

110. For a fixed beam with span L, having plastic moment capacity of $M_p$, the ultimate central concentrated load will be

(a) $4MP/L$  
(b) $MP/8L$

(c) $6MP/L$  
(d) $8MP/L$
111. Which one of the following conditions, both elastic and plastic methods of analysis of indeterminate structures have to satisfy?

(a) yield condition

(b) mechanism condition

(c) equilibrium

(d) compatibility of deformation

[GATE-1995]

112. A cantilever beam of length \(L\), width \(b\) and depth of is loaded with a concentrated vertical load at the tip. If yielding starts at a load \(P\), the collapse load shall be

(a) 2.0 \(P\)  
(b) 1.5 \(P\)  
(c) 1.2 \(P\)  
(d) \(P\)

[GATE-2005]

113. The shape factor of a rectangular section is

(a) 1.00  
(b) 1.50  
(c) 2.00  
(d) 2.50

[GATE-1994]

114. At the location of plastic hinge

(a) radius of curvature is infinite

(b) curvature is infinite

(c) moment is infinite

(d) flexural stress is infinite

[IES-1995]

115. A ductile structure is defined as one for which the plastic deformation before fracture

(a) is smaller than the elastic deformation
(b) vanishes

(c) is equal to the elastic deformation

(d) is much larger than the elastic deformation [IES-1996]

116. Upper yield point in the stress-strain curve in structural steel can be avoided by

(a) Cold working
(b) Hot working
(c) Guenching
(d) Galvanising [IES-1997]

117. To transform an intermediate frame with a degree of indeterminacy ‘r’ into a determinate one, the number of plastic hinges required is

(a) \( r + 2 \)  
(b) \( r + 1 \)
(c) \( r \)  
(d) \( r - 1 \) [IES-1998]

118. A propped cantilever of span ‘L’ is subjected to a concentrated load at mid-span. If \( M_p \) is plastic moment capacity of the beam, then the value of the collapse load will be

(a) \( 12 M_p/L \)  
(b) \( 8M_p/L \)
(c) \( 6 M_p/L \)  
(d) \( 4 M_p/L \) [IES-1999]

119. Which one of the following modes of failure is taken care of in plastic design of a steel beam?

(a) Plastic material deformation throughout the beam
(b) Lateral buckling of the beam
(c) Elastic buckling of the compression flange
(d) Hinge formation in the beam due to yielding of steel [IES-1999]

120. The collapse load of a simply supported beam of span L and fully plastic moment \( M_p \) subjected to central concentrated load is given by

(a) \( 4 M_p/L \)  
(b) \( 6M_p/L \)
121. A propped cantilever beam of span ‘L’ and constant plastic moment capacity $M_p$ carries a concentrated load at midspan, then the load at collapse will be

(a) $8M_p/L$  
(b) $6M_p/L$  
(c) $4M_p/L$  
(d) $2M_p/L$  

122. In the context of the ultimate load theory for steel, the stress-strain curve for steel is idealized as

(a) A single straight line  
(b) Bi-linear  
(c) A quadratic parabola  
(d) A circular arc

123. A structure has two degrees of indeterminacy. The number of plastic hinges that would be formed at complete collapse is

(a) 0  
(b) 1  
(c) 2  
(d) 3

124. A beam of rectangular section having simply supported span $L$, is subject to a concentrated load at its mid-span. What is the length of elasto-plastic of the plastic hinge?

(a) $L/3$  
(b) $L/4$  
(c) $L/5$  
(c) $L/7$

125. In a plastic analysis of structures, the segment between any two successive plastic hinges is assumed to deform as:

(a) A plastic material  
(b) A rigid material
(c) An elastic material

(d) An inelastic material [IES-2005]

126. What is the number of plastic hinges formed if an indeterminate beam with redundancy R is to become determinate?

(a) R – 1  (b) R

(c) R + 1  (d) R + 2 [IES-2008]

127. Plastic analysis of structures is applicable to the structures made of which one of the following?

(a) Ductile and brittle materials

(b) Any structural material

(c) Brittle material only

(d) Ductile material only [IES-2008]

128. What value of the shape factor is taken for a rectangular section in plastic design?

(a) 1.0  (b) 1.5

(c) 2.0  (d) 2.5 [IES-2008]

129. A prismatic beam (shape factor, S) fixed at both ends carries UDL through the span. What is the ratio of collapse load to yield load?

(a) 4/3 S  (b) 3/4 S

(c) 5/3 S  (d) 3/5 S [IES-2009]

130 At the location of plastic hinge

(a) radius of curvature is infinite

(b) curvature is infinite

(c) moment is infinite
131. Which of the following conditions is to be satisfied both in elastic and plastic analysis?

(a) Equilibrium condition
(b) Yield condition
(c) Plastic moment condition
(d) Mechanism condition

132. If the shape factor of a section is 1.5 and the factor of safety to be adopted is 2, then the load factor will be

(a) 3   (b) 4
(c) 1.5   (d) 2

133. The number of plastic hinges required in a structure of indeterminate status for a ‘mechanism’ to develop is

(a) i   (b) i +1
(c) i + 2   (d) i - 1

Where i is the degree of indeterminacy.

134. The shape factors of a triangle section and a diamond section are respectively

(a) 2.343 and 2.0   (b) 2.0 and 2.343
(c) 1.343 and 2.0   (d) 2.0 and 1.343

135. The economic spacing of a roof truss depends upon the

(a) Cost of purlins and cost of roof covering
(b) Cost of roof covering and dead loads
(c) Dead loads and live loads
(d) Live loads and cost of purlins
In a gabled industrial building in order to minimize the wind forces on the roof, the roof slope should be kept close to

(a) $5^\circ$        (b) $15^\circ$

(c) $30^\circ$    (d) $45^\circ$

What is the maximum slenderness ratio permitted as per IS 800-1984 for design of a tie member subjected to reversal of stress due to earthquake?

(a) 180          (b) 250

(c) 300    (d) 350

A welded plate girder has a web plate $1500 \times 6$ mm. Which one of the following is correct about stiffening the web?

(a) The web is left unstiffened

(b) The web is provided with vertical stiffeners

(c) The web is provided with vertical stiffeners and a horizontal stiffener at $0.4 \, d$ from the top flange

(d) The web is provided with vertical stiffener and two rows of horizontal stiffeners, one at $0.4 \, d$ from the top flange and another at the mid-height of the web

At what value (nearly) is the maximum spacing of purlins for standard asbestos roofing sheets kept?

(a) 1.0 m         (b) 1.4 m

(c) 1.8 m        (d) 2.0 m

The effective length of an angle member in a riveted truss is equal to which one of the following?

(a) $\square$            (b) 0.85 $\square$
141. A building with a gabled roof will experience pressure on its leeward slope which is

(a) Always positive
(b) Always negative
(c) Sometimes positive and other negative
(d) Zero

142. The live load for a sloping roof with slope 15° where access is not provided to the roof, is taken as

(a) 0.65 kN/m²
(b) 0.75 kN/m²
(c) 1.35 kN/m²
(d) 1.50 kN/m²

143. The purlins in roof trusses are placed at the panel points essentially avoid

(a) Axial force in rafter
(b) shear force in rafter
(c) Deflection in rafter
(d) Bending moment in rafter

144. In a roof truss, if pitch is ½ and slope is 1, the angle of inclination with the horizontal would be

(a) 30°
(b) 45°
(c) 60°
(d) 75°

145. For heavy vibrating loads in industrial buildings, the roof trusses are provided with

(a) diagonal bracing in the plane of lower chord members
(b) diagonal bracing in the plane of lower chord members
146. Which of the following elements of a pitched roof industrial steel building primarily resists lateral load parallel to the ridge?

(a) Bracing (b) Purlin (c) Truss (d) Column

147. Intermediate vertical stiffeners are provided in plate girders to

(a) eliminate web buckling (b) eliminate local buckling
(c) transfer concentrated loads (d) prevent excessive deflection

148. The thickness of web for unstiffened plate girder with clear distance \( d \) between the flanges shall not be less than

\[
\begin{align*}
(a) & \quad \frac{d}{200} \\
(b) & \quad \frac{1}{85}d \\
(c) & \quad \frac{d}{100} \\
(d) & \quad \frac{d}{160}
\end{align*}
\]

[IES-1996]

149. In a plate girder bridge, the thickness of web is less than \( d'/200 \) where \( d' \) is the unsupported depth of web. The web plate should be provided with

(a) vertical stiffeners
(b) horizontal stiffeners
(c) end stiffness
(d) both vertical and horizontal stiffness

[IES-2001]

150. In the design of steel bridges if wind or seismic forces are also considered, the allowable stresses as per BIS may be increased by
151. The effective flange area in tension of a plate girder is equal to

(a) $A_f$  
(b) $A_f + A_w/2$

(c) $A_f + A_w/8$  
(d) $A_f + A_w/6$

Where $A_f$ is the area of each flange and $A_w$ is the web area. \[\text{IES-2001}\]

152. $A_f$ is the area of flanges and $A_w$ is the area of web. What is the effective flange area in the design of a plate girder?

(a) $A_f + A_w /8$  
(b) $A_f + A_w /6$

(c) $A_f - A_w /8$  
(d) $A_f - A_w /6$ \[\text{IES-2004}\]

153. For a vertical stiffened web of a plate girder, the lesser clear dimension of the panel should not exceed:

(a) 85 t  
(b) 180 t

(c) 200 t  
(d) 250 t \[\text{IES-2005}\]

154. Why are intermediate vertical stiffeners provided in plate girders?

(a) To eliminate web buckling

(b) To eliminate local bucking

(c) To transfer concentrated loads

(d) To prevent excessive deflection \[\text{IES-2007}\]

155. Horizontal stiffeners are needed in plate girders if the thickness of web is

(a) $< 6$ mm  
(b) $< d/200$

(c) $< L/500$
(d) nearly equal to flange thickness

Where \( d \) = distance between the flanges and

\[ L = \text{span} \] [IES-2007]

156. The allowable shear stress in the web of mild steel beams decreases with

(a) Decrease in \( h/t \) ratio

(b) Increase in \( h/t \) ratio

(c) Decrease in thickness

(d) Increase in height

Where \( h \) is the height and \( t \) is the thickness [IES-2011]

157. The allowable shear stress in stiffened webs of mild steel beams decreases with

(a) Decrease in the spacing of the stiffeners

(b) Increase in the spacing of the stiffeners

(c) Decrease in the effective depth

(d) Decrease in the effective depth [IES-2011]

158. The thickness of web for unstiffened plate girder with clear distance \( 'd' \) between the flanges shall be not less than

(a) \( \frac{d}{200} \)

(b) \( \frac{d}{85} \)

(c) \( \frac{d}{100} \)

(d) \( \frac{d}{160} \) [IES-2011]

159. Bearing stiffeners in plate girders are provided to

(a) decrease the effective depth of web

(b) transfer the load from the top flange to the bottom flange
160. Localized bearing stress caused by the transmission of compression from the wide flange to the narrow web causes a failure called

(a) web buckling  
(b) web shear flow

(c) web bearing  
(d) web crippling  [IES-2014]

161. In a plate girder, the web is primarily designed to resist

(a) torsional moment  
(b) shear force

(c) bending moment  
(d) diagonal buckling  [IES-2014]

162. When designing steel structures, one must ensure that local buckling in webs does not take place. This check may not be critical when using rolled steel sections because

(a) quality control at the time of manufacture of rolled sections is very good

(b) web depths available are small

(c) web stiffness is built-in in rolled sections

(d) depth to thickness ratio of the web is always appropriately adjusted  [IES-2014]

163. Horizontal stiffener in a plate girder is provided to safeguard against web buckling due to

(a) shear

(b) compressive force in bending

(c) tensile force in bending

(d) heavy concentrated load  [IES-2014]

164. In which of the following cases is the compression flange most susceptible to buckle laterally?
165. The serviceability criterion for a plate girder design is based upon

(a) width of flange
(b) depth of web
(c) minimum thickness of web
(d) stiffness of web [IES-2014]
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