132. Torsional formula is

(*a*) $\frac{T}{J} = N\ \theta = \frac{R}{\tau_{max}}$ (*b*) $\frac{T}{J} = \frac{N\theta}{t} = \frac{R}{\tau_{max}}$

(*c*) $\frac{T}{J} = \frac{l}{N\theta} = \frac{R}{\tau_{max}}$ (*d*) $\frac{T}{J} = \frac{N\theta}{l} = \frac{R}{\tau_{max}}$

133. The hoop stress for a thick cylinder at any point at radius r from centre is given by Lame's equation, is

(*a*) $a + br$ (*b*) $a + b/2$

(*c*) $a + (2b)/r$ (*d*) none of these

134. In a thin spherical shell of diameter d, the total force normal to a diameter plane due to an internal fluid pressure p, is given by

(*a*) $\frac{\pi p d^2}{4}$ (*b*) $\frac{pd}{2}$

(*c*) $\frac{pd}{4t}$ (*d*) $\frac{pd}{t}$

135. Beam of uniform strength can be obtained by

(*a*) keeping depth constant throughout the length and varying in the width suitably

(*b*) keeping the width constant throughout the length and varying the depth suitably

(*c*) varying both the depth and width suitably

(*d*) any of the above.

136. Value of shear stress induced in the shaft due to applied couple varies

(*a*) from maximum at the centre to zero at the circumference

(*b*) from zero at the centre to maximum at the circumference

(*c*) from maximum at the centre to minimum at the curcumference

(*d*) from minimum at the centre to maximum at the circumference

137. The mid span moments in a fixed beam due to uniformly distributed load w, throughout the span is

(*a*) $\frac{wL^2}{8}$ (*b*) $\frac{wL^2}{12}$

(*c*) $\frac{wL^2}{16}$ (*d*) $\frac{wL^2}{24}$

138. Steel bars in a concrete beam are embedded

(*a*) uniformly (*b*) near bottom section

(*c*) in the centre (*d*) near top section

139. Radius of curvature of a stressed beam and modulus of elasticity

(*a*) are directly proportional

(*b*) are inversely proportional

(*c*) are inversely related

(*d*) have unpredictable relationship

140. Stress in a beam and the second modulus

(*a*) are directly proportional

(*b*) are inversely proportional

(*c*) are inversely related

(*d*) have unpredictable relationship

141. Neutral plane of a beam

(*a*) is in the middle

(*b*) passes through the *e.g.*

(*c*) is one whose length remains unchanged during the deformation

(*d*) lies at bottom most fibre

142. The point of contra-flexure occurs only in

(*a*) cantilever beams

(*b*) overhanging beams

(*c*) simply supported beams

(*d*) continuous beams

143. Design of thin cylindrical shells is based on

(*a*) hoop stress

(*b*) longitudinal stress

(*c*) volumetric stress

(*d*) average of hoop and longitudinal stresses.

144. Rupture stress is

(*a*) breaking stress

(*b*) maximum load/original cross-sectional area

(*c*) load at breaking point/original C.S. area

(*d*) load at breaking point/neck area

145. Elasticity of various materials is controlled by its

(*a*) ultimate tensile stress

(*b*) proof stress

(*c*) stress at yield point

(*d*) stress at elastic limit

146. Ratio of lateral strain to linear strain within elastic limit, is known as

(*a*) Young's modulus (*b*) bulk modulus

(*c*) modulus of rigidity (*d*) Poisson's ratio

147. Maximum shear stress in Mohr's circle is equal to

(*a*) radius of circle

(*b*) diameter of circle

(*c*) centre of circle from y-axis

(*d*) chord of circle

148. In thick cylinders, the stress can be uniformly distributed over the thickness by the method of pre-stressing as

(*a*) self-hooping

(*b*) constructing laminated cylinders

(*c*) shrinking hollow cylinder over main cylinder

(*d*) any of the above

149. In a tensile test, near the elastic limit zone,

(*a*) tensile strain increases more quickly

(*b*) tensile strain decreases more quickly

(*c*) tensile strain increases in proportion to the stress

(*d*) tensile strain decreases in proportion to the stress

150. The property of a material by virtue of which it can be beaten or rolled into plates is called

(*a*) malleability (*b*) ductility

(*c*) plasticity (*d*) elasticity

151. The stress developed in a material at breaking point in extension is called

(*a*) breaking stress (*b*) fracture stress

(*c*) yield point stress (*d*) ultimate tensilet stress

152. Stresses at any point in the thick cylinder are

(*a*) tensile (*b*) compressive

(*c*) shear (*d*) principal

153. When a rectangular beam is loaded longitudinally, shear develops on

(*a*) top fibre (*b*) middle fibre

(*c*) bottom fibre (*d*) every horizontal plane

154. In a prismatic member made of two materials so joined that they deform equally under axial stress, the unit stresses in two materials are

(*a*) equal

(*b*) proportional to their respective moduli of elasticity

(*c*) inversely proportional to their moduli of elasticity

(*d*) average of the sum of mouduli of elasticity

155. Ratio of shear modulus to 'modulus of elasticity if Poisson's ratio is 0.25 will be

(*a*) 0.4 (*b*) 0.25

(*c*) 4 (*d*) 0.5

156. The safe twisting moment for a compound shaft is equal to the

(*a*) maximum calculated value

(*b*) minimum calculated value

(*c*) mean value

(*d*) extreme value

157. Torsional rigidity of shaft is expressed by

(*a*) maximum torque it can transmit

(*b*) number of cycles it undergoes before failure

(*c*) elastic limit upto which it resists torsion, shear and bending stresses

(*d*) torque required to produce a twist of one radian per unit length of shaft

158. Strain energy stored in a hollow shaft of outer and inner diameters D and d subjected to shear stress s_a and having modulus of rigidity C is equal to

(*a*) $\frac{s_s^2}{4C}\left(\frac{D^2-d^2}{D}\right) \times$ volume

(*b*) $\frac{s_s^2}{2C}\left(\frac{D^2-d^2}{D}\right) \times$ volume

(*c*) $\frac{s_s}{4C}\left(\frac{D^2-d^2}{D}\right) \times$ volume

(*d*) $\frac{s_s^2}{2C}\left(\frac{D^2-d^2}{D}\right) \times$ volume

159. Ratio of circumferential to longitudinal stress developed in a thin shell under internal pressure p is

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

160. Resilience of a material is considered when it is subjected to

(*a*) frequent heat treatment

(*b*) fatigue

(*c*) creep

(*d*) shock loading

161. Maximum strain energy that can be stored in a body is known as

(*a*) impact energy (*b*) resilience

(*c*) proof resilience (*d*) modulus of resilience

162. The value of Poisson's ratio for cast iron is

(*a*) 0.1 to 0.2 (*b*) 0.23 to 0.27

(*c*) 0.25 to 0.33 (*d*) 0.4 to 0.6

163. The property of a material which allows it to be drawn into a smaller section is called

(*a*) plasticity (*b*) ductility

(*c*) elasticity (*d*) malleability

164. Which one of the following materials is highly elastic ?

(*a*) Rubber (*b*) Brass

(*c*) Steel (*d*) Glass

165. Which one of the following favours brittle fracture in a ductile material ?

(*a*) Elevated temperature

(*b*) Slow rate of straining

(*c*) Presence of notch

(*d*) Circular cross-section

166. The use of elastic modulus is the same as these of

(*a*) stress, shear modulus and pressure

(*b*) strain, shear modulus and force .

(*c*) mean modulus, stress and force

(*d*) stress strain and pressure

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

List-I

A. Inelastic

B. Rigid plastic material

C. Ductile material

D. Visco-elastic

List-II

1. Strain is zero upto a stress level and then stress remains constant

2. Has no plastic zone

3. Strain not recovered after unloading

4. Has large plastic zone material

5. Has a time dependent stress-strain relation

Codes:

Codes :

	A	**B**	**C**	**D**
(*a*)	3	1	4	5
(*b*)	2	1	4	5
(*c*)	4	5	1	3
(*d*)	3	2	5	1

168. The bolts in a rigid flanged coupling connecting two shafts transmitting power are subjected to

(*a*) shear force and bending moment

(*b*) axial force

(*c*) torsion

(*d*) torsion and bending moment.

169. The value of Poisson's ratio for any material cannot exceed

(*a*) 2.0

(*b*) 1.414

(*c*) 1.0

(*d*) 0.5

170. A ductile material is one which was

(*a*) A small strain upto rupture

(*b*) A relatively large tensile strain upto the point of rupture

(*c*) No change in volumetric strain

(*d*) A large strain upto yield point.

171. For most brittle materials generally ultimate strength in compression is much larger than the ultimate strength in tension because

(*a*) of flaws such as microscopic cracks or cavities.

(*b*) compression failure is due to normal stress and failure in tension is due to shear stress.

(*c*) yield point does not occur in compression.

(*d*) of inherent properties of materials.

172. An elastic body is subjected to a direct compressive stress P_x in the longitudinal direction. If the lateral strains in the other two directions are prevented by applying P_y and P_x in those directions then $P_y = P_x$ is equal to (μ is the Poisson's ratio)

(*a*) $\dfrac{P_x}{(\mu-1)}$ (*b*) μP_x

(*c*) $\dfrac{P_x}{[(\mu-1)\mu]}$ (*d*) $\dfrac{\mu P_x}{(1-\mu)}$

173. The maximum energy stored at elastic limit of a material is called

(*a*) resilience

(*b*) proof resilience

(*c*) modulus of resilience

(*d*) bulk resilience

174. The cross-section of a bar is subjected to a uniaxial tensile stress p. The tangential stress on a plane inclined at q to the cross-section of the bar would be

(*a*) $\dfrac{p\sin 2\theta}{2}$ (*b*) $p \sin 2q$

(*c*) $\dfrac{p\cos 2\theta}{2}$ (*d*) $p \cos 2q$

175. During tensile-testing of a specimen using a Universal Testing Machine, the parameters actually measured include

(*a*) true stress and true strain .

(*b*) Poisson's ratio and Young's modulus

(*c*) engineering stress and engineering strain

(*d*) load and elongation.

176. 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

177. 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.

178. 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.

179. High yield deformed bars have a

(*a*) definite yield value

(*b*) chemical composition different from mild steel

(*c*) percentage elongation less than that of mild steel

(*d*) percentage elongation more than that of mild steel.

180. 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*) $6.56 \times A$

181. Castellated beams are used for

(*a*) light construction

(*b*) resisting bending moment only

(*c*) loads not passing through the shear centre

(*d*) sections subjected to alternate compressive and shear stress.

182. A cantilever beam curved in plan and subjected to lateral loads will develop at any section

(*a*) bending moment and shearing force

(*b*) bending moment and twisting moment

(*c*) bending moment and shearing force

(*d*) bending moment, twisting moment & shearing force

EXERCISE - II

(Questions From Previous SSC CPWD Exams)

2008

1. The relation between Young's modulus (E) and modulus of rigidity (N) is given as:

(*a*) $E = 2N\left(1+\frac{1}{m}\right)$ (*b*) $E = 2N\left(1-\frac{1}{m}\right)$

(*c*) $E = \frac{2N}{\left(1+\frac{1}{m}\right)}$ (*d*) $E = \frac{1}{2N\left(1+\frac{1}{m}\right)}$

2. A cantilever of span 'l' has a load P acting at the free end. The bending moment at the free end will be

(*a*) 0 (*b*) PL

(*c*) –PL (*d*) $\frac{PL}{2}$

3. The bending moment (M) is constant over a length of a segment (I) of a beam, the shearing force will also be a constant over this length and is given by

(*a*) $\frac{M}{l}$

(*b*) $\frac{M}{2l}$

(*c*) $\frac{M}{4l}$

(*d*) None of the above

4. A closed coil helical spring is subjected to a torque about it axis. The spring wire would experience a

(*a*) Bending stress

(*b*) Direct tensile stress of uniform intensity at its cross section

(*c*) Direct shear stress

(*d*) Torsional shearing stress

5. Column may be made of plain concrete if their unsupported length does not exceed their least lateral diameter by

(*a*) Two times (*b*) Three times

(*c*) Four times (*d*) Five times

2009

6. A plate load test is used to determine:

(*a*) Bearing capacity of foundations.

(*b*) Settlement of foundations.

(*c*) Both (*a*) and (*b*)

(*d*) None of the above.

7. An open ended thin cylindrical shall, subject to uniform internal pressure will be subjected to

(*a*) Hoop stress only

(*b*) Longitudinal stress only

(*c*) Both hoop stress and longitudinal strain

(*d*) None of the above

8. Moment of inertia is a concept applicable in case of:

(*a*) A rotating body.

(*b*) A body moving in straight line.

(*c*) A body at rest.

(*d*) Both (*a*) and (*b*).

9. The relation between E (modulus of elasticity) and N (shear modulus) is given by:

(*a*) $E = N(1 - 2\mu)$ (*b*) $E = 2N(1 + \mu)$

(*c*) $E = 3N(1 - 2\mu)$ (*d*) None of the above.

10. The % of elongation of the piece under tension indicates its:

(*a*) Brittleness. (*b*) Malleability.

(*c*) Stiffness. (*d*) Ductility.

11. In a cantilever beam with u.d.l the shear force varies following.

(*a*) Linear law (*b*) Parabolic law

(*c*) Both (*a*) and (*b*) (*d*) None of the above

12. The bending equation is written as:

(*a*) $\frac{M}{I} = \frac{\sigma_b}{Y} = \frac{E}{R}$ (*b*) $\frac{I}{M} = \frac{\sigma_b}{Y} = \frac{E}{R}$

(*c*) $\frac{M}{I} = \frac{\sigma_b}{Y} = \frac{R}{E}$ (*d*) $\frac{M}{I} = \frac{Y}{\sigma_b} = \frac{E}{R}$

13. The permissible bending stress in steel is

(*a*) 1500 kg/cm^2 (*b*) 1890 kg/cm^2

(*c*) 1900 kg/cm^2 (*d*) 1300 kg/cm^2

14. In a beam the diagonal tension is inclined at an angle of _____ with horizontal.

(*a*) 30° (*b*) 45°

(*c*) 90° (*d*) 135°

15. The economical spacing of trusses varies from:

(*a*) L/3toL/4 (*b*) L/4 to L/5

(*c*) L/4 to L/6 (*d*) None of the above.

16. The compressive strength of ordinary Portland cement after 3 days should not be less than:

(*a*) 50 kg/cm^2

(*b*) 100 kg/cm^2

(*c*) 115 kg/cm^2

(*d*) 150 kg/cm^2

17. If a beam fails ih bond, then its bond strength can be increased most economically by

(*a*) Increasing the depth of beam

(*b*) Using thinner bars but more in number

(*c*) Using thicker bars but less in number

(*d*) None of the above

2010

18. Tension bars in a cantilever beam must be enclosed in the support up to :

(*a*) L_d (*b*) $\frac{L_d}{3}$

(*c*) 12 (*d*) *d*

19. For determining the ultimate bearing capacity of soil the recommended size of square bearing plate used in plate load test is 30-75 cm with a minimum thickness of:

(*a*) 20 mm (*b*) 5 mm

(*c*) 50 mm (*d*) None of the above.

20. Section modulus for a rectangular section is given as

(*a*) $bd^2/36$ (*b*) $bd^3/6$

(*c*) $bd^2/6$ (*d*) $bd^3/12$

21. In a cantilever retaining wall, the stem design moment is:

(*a*) $\frac{1}{2}K_a\gamma h^2$ (*b*) $K_a\gamma h$

(*c*) $\frac{1}{6}K_a\gamma h^3$ (*d*) $\frac{1}{12}K_a\gamma h^3$

22. Shear reinforcement is provided in the form of

(*a*) Vertical bars

(*b*) Inclined bars

(*c*) Combination of vertical & inclined bars

(*d*) Any one of the above

23. The shear stress distribution over a beam of solid circular section is such that

(*a*) $q_{max} = 2\,q_{mean}$ (*b*) $q_{max} = 1.5\,q_{mean}$

(*c*) $q_{max} = 1.33\,q_{mean}$ (*d*) $q_{max} = 1.25\,q_{mean}$

24. A column is a compression member, the effective length of which exceeds three times of its least lateral dimension. This is applicable to

(*a*) Rectangular and circular sections

(*b*) I section and circular sections

(*c*) Rectangular, circular and I section sections

(*d*) All the shapes of sections

25. $EI(d^3y/dx^3)$ for a beam represent:

(*a*) Deflection. (*b*) Slope.

(*c*) Moment. (*d*) Shear.

26. For a fixed support in a plane structure, total number of reactions is:

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

27. Standard loads are given in

(*a*) IS 885 (*b*) IS 1375

(*c*) IS 675 (*d*) IS 875

28. 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*) 4

(*c*) 3 (*d*) 2

29. For a beam, the term M/EI is

(*a*) Stress (*b*) Rigidity

(*c*) Curvature (*d*) Shear force

30. If lines of action of forces in a system of force meet at a point then these forces are called as:

(*a*) Parallel forces.

(*b*) Non-concurrent forces.

(*c*) Concurrent forces.

(*d*) Resultant forces.

31. Tension bars in a cantilever beam must be enclosed in the support up to

(*a*) L_d (*b*) $L_d/3$

(*c*) 12ϕ (*d*) d

32. strain energy stored in a solid is given as:

(*a*) $\sigma \times \varepsilon \times$ volume

(*b*) $\sigma \times \varepsilon \times$ area of cross section

(*c*) $0.5 \times \sigma \times \varepsilon \times I$

(*d*) $0.5 \times \sigma \times \varepsilon \times$ volume.

33. Relation between Young's modulus (E) and modulus of rigidity (N) is given as:

(*a*) $E = 3N(1 + \mu)$ (*b*) $E = 2N(1 - \mu)$

(*c*) $E = 2N(1 + \mu)$ (*d*) $E = 3N(1 - 2\mu)$

34. The characteristic strength of concrete in the actual structure is taken as:

(*a*) f_{ck} (*b*) $0.85\ f_{ck}$

(*c*) $0.67\ f_{ck}$ (*d*) $0.447\ f_{ck}$

2011

35. The ratio of normal stress to volumetric strain is defined as

(*a*) Young's modulus (*b*) Bulk modulus

(*c*) Rigidity modulus (*d*) Tangent modulus

36. The ratio of flexural rigidity of a beam (b × d) to another one (b × 2d) of similar material will be

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{4}$

(*c*) $\frac{1}{8}$ (*d*) $\frac{1}{18}$

37. A material is called ductile if it

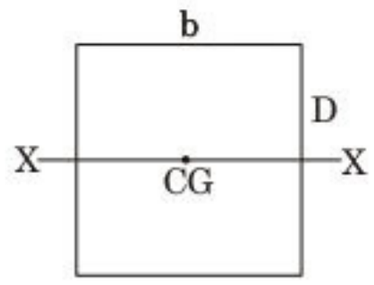
(*a*) has little plastic elongation range

(*b*) has long plastic elongation range

(*c*) could be hammered into a very thin sheet

(*d*) shows large elastic strain

38. The moment of inertia of the cross-section about X - X axis is



(*a*) $D^3b/3$ (*b*) $D^3b/12$

(*c*) $Db^3/3$ (*d*) $Db^3/12$

39. Poisson's ratio is defined as

(*a*) longitudinal strain / lateral strain

(*b*) lateral strain / longitudinal strain

(*c*) lateral strain × longitudinal strain

(*d*) $\frac{1}{2}$ (lateral strain) × longitudinal strain)

40. Modulus of rigidity is expressed as

(*a*) compressive stress / compressive strain

(*b*) tensile stress / tensile strain

(*c*) shear stress / shear strain

(*d*) stress / volumetric strain

41. For a rectangular beam, the maximum shear stress is related to average shear stress, τ_{av}, by

(*a*) τ_{av} (*b*) $1.25\ \tau_{av}$

(*c*) $1.50\ \tau_{av}$ (*d*) $1.75\ \tau_{av}$

42. The standard consistency test is done in a

(*a*) Blaine's apparatus

(*b*) Le-Chatelier's apparatus

(*c*) Vane apparatus

(*d*) Vicat's apparatus

2012

43. For a given shear force across a symmetrical 'I' section the intensity of shear stress is maximum at the

(*a*) At the junction of the flange and the web, but on the web

(*b*) At the junction of the flange and the web, but on the flange

(*c*) Extreme fibres

(*d*) Centroid of the section

44. The predominant effect of an axial tensile force on a helical spring is

(*a*) Compression (*b*) Twisting

(*c*) Bending (*d*) Tension

45. Slope at the supports of a simply supported beam of effective span L with a central point load W is given by

(*a*) $WL^2/16EI$ (*b*) $WL^2/24EI$

(*c*) $WL^2/8EI$ (*d*) $WL^2/12EI$

46. If a circular shaft is subjected to a torque T and bending moment M, the ratio of maximum bending stress and maximum shear stress is given by

(*a*) $\frac{M}{T}$ (*b*) $\frac{2T}{M}$

(*c*) $\frac{2M}{T}$ (*d*) $\frac{M}{2T}$

47. The point of contraflexure is a point where

(*a*) Shear force is maximum

(*b*) Bending moment is maximum

(*c*) Shear force changes sign

(*d*) Bending moment changes sign

48. A rectangular log of wood is floating in water with a load of 100 N at its centre. The maximum shear force in the wooden log is

(*a*) 100 N at the centre (*b*) Zero shear all through

(*c*) 50 N at each end (*d*) 50 N at the centre

49. IN a beam at a section carrying a shear force F, the shear stress is maximum at

(*a*) Bottommost fibre (*b*) Mid depth

(*c*) Neutral surface (*d*) Topmost fibre

50. Strain energy per unit volume of a solid circular shaft ϕ under axial tension is

(*a*) $\frac{\sigma^2}{8E}$ (*b*) $\frac{\sigma^2}{16E}$

(*c*) $\frac{\sigma^2}{2E}$ (*d*) $\frac{\sigma^2}{4E}$

51. For a cantilever beam of length L carrying a triangular load of intensity 'w' at the support and zero at the free end, the slope of the free end is given by

(*a*) $\frac{WL^3}{24EI}$ (*b*) $\frac{WL^3}{48EI}$

(*c*) $\frac{WL^3}{8EI}$ (*d*) $\frac{WL^3}{12EI}$

52. For a beam carrying a uniformly distributed load, the strain energy will be maximum in case the beam is

(*a*) Propped cantilever (*b*) Fixed at both ends

(*c*) Cantilever (*d*) Simply supported

2013

53. In a Mohr's circle of $\sigma - \tau$ plane (σ = normal stress, τ = shear stress), the vertical diameter represents

(*a*) Maximum shear stress

(*b*) Maximum normal stress

(*c*) Principal stress

(*d*) Minimum normal stress

54. The shear diagram for a cantilever beam subjected to a concentrated load at the free end is given by a/an.

(*a*) Triangle (*b*) Rectangle

(*c*) Parabola (*d*) Ellipse

55. Deflection of the free end of a cantilever beam having a concentrated load W at mid span is given by

(*a*) $WL^3/3\ EI$ (*b*) $5\ WL^3/24\ EI$

(*c*) $5\ WL^3/48\ EI$ (*d*) $WL^3/48\ EI$

56. A concentrated load W acts at the centre of a simply supported beam of length L. If the load is changed to a uniformly distributed load over the entire span, then the ratio of maximum deflection uder concentrated load will be

(*a*) 1.2 (*b*) 1.3

(*c*) 1/4 (*d*) 8/5

57. Poisson's ratio μ is defined as the ratio of

(*a*) axial strain to transverse strain

(*b*) axial strain to shear strain

(*c*) transverse strain to axial strain

(*d*) shear strain to axial strain

58. A cantilever retaining wall should ***not*** be used for heights more than

(*a*) 4 m (*b*) 6 m

(*c*) 8 m (*d*) 10 m

2014

59. Which one of the following has least bearing capacity?

(*a*) Loose gravel

(*b*) Hard rocks

(*c*) Soft rocks

(*d*) Compact gravel

60. The property of a material by which it gets permanent deformation under a load which is not recovered after removal of load is called

(*a*) elasticity (*b*) brittleness

(*c*) ductility (*d*) plasticity

61. The concrete having a slump of 6.5 cm,is said to be:

(*a*) plastic (*b*) dry

(*c*) earthmoist (*d*) semi-plastic

62. Strain energy due to sudden axial load is given by :

σ : resultant stress

P : Axial load

Δ : detornator

$\in$: strain

E : modulous of elasticity

(*a*) $\frac{1}{2}P\Delta$ (*b*) $\sigma.\in$

(*c*) $P\Delta$ (*d*) $\frac{\sigma^2}{2E}$

63. The maximum permissible stress for hand driven river in axial tension is :

(*a*) 250N/mm^2 (*b*) 80N/mm^2

(*c*) 90 N/mm^2 (*d*) 100 N/mm^2

64. Spacing of stirrups in a rectangular beam is :

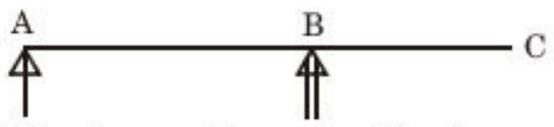
(*a*) increased at the ends

(*b*) kept constant throughout the length

(*c*) decreased towards the centre of the beam

(*d*) increased at the centre of the beam

65.



The beam shown in Fig. is :

(*a*) Free cantilever beam

(*b*) Single overhanging beam

(*c*) Doubel overhanging beam

(*d*) Proper cantilever beam

66. The increase in the strength of concrete with time is :

(*a*) Linear (*b*) Non-linear

(*c*) Asymptotic (*d*) All of the above

67. Generally concrete cubes are tested measure concrete's

(*a*) Compressive strength

(*b*) Tensile strength

(*c*) Twisting strength

(*d*) None of the above

68. Which of the following is a dimensionless quantity?

(*a*) Shear force (*b*) Stress

(*c*) Strain (*d*) Modulus of elasticity

69. The ratio of normal stress to normal strain within elastic limits is called :

(*a*) Young's Modulus (*b*) Shear Modulus

(*c*) Poisson's Ratio (*d*) Bulk Modulus

70. The shape of Bending Moment Diagram in a beam subjected to only Uniformly Distributed Load (UDL) is :

(*a*) Constant (*b*) Cubic parabola

(*c*) Parabola (*d*) Triangular

71. In single laced column construction, the thickness of the flat lacing bars shall not be less than :

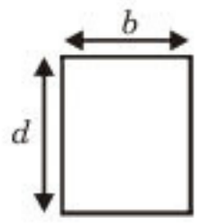
(*a*) $\frac{1}{15}$ th of the width of the lacing bar

(*b*) $\frac{1}{30}$ th of the effective length of single lacing

(*c*) $\frac{1}{40}$ th of the effective length of single lacing

(*d*) $\frac{1}{10}$ th of the width of the lacing bar

72.



Moment of Inertia of rectangular section shown in Fig. about its base is :

(*a*) $\frac{bd^2}{3}$ (*b*) $\frac{bd^3}{12}$

(*c*) $\frac{bd^3}{3}$ (*d*) $\frac{bd^2}{12}$

73. The maximum shear force in a simply supported beam of span L, subjected to a central point load, W is given by the following expression :

(*a*) $\frac{W}{2}$ (*b*) WL

(*c*) $WL^2/2$ (*d*) $WL^2/4$

74. "Poisson's ratio" is defined as the ratio of

(*a*) lateral strain to linear strain

(*b*) linear strain to lateral strain

(*c*) lateral stress to linear stress

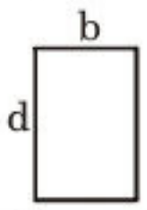
(*d*) linear stress to lateral stress

75. In a cantilever beam subjected to general loading, the maximum bending moment is at

(*a*) fixed end (*b*) free end

(*c*) mid-span (*d*) quarter-span

76.



Moment of inertia of rectangular section shown in Fig. about its horizontal centroidal axis is

(*a*) $db^3/12$ (*b*) $db^3/3$

(*c*) $bd^3/12$ (*d*) $bd^3/3$

77. Ratio of length of column to the minimum radius of gyration of the cross-sectional area of the column is known as

(*a*) Slenderness ratio (*b*) Buckling ratio

(*c*) Crippling ratio (*d*) Compressive ratio

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78. The construction joints in cement concrete

(*a*) should not be provided at the corners

(*b*) should be spaced at a distance of 3 m apart in case of huge structures

(*c*) should be located where shear force is large

(*d*) should be located where bending moment is large

79. The Indian standard mix design for fly ash and cement concrete recommends water content

(*a*) to increase by 3% to 5%

(*b*) to reduce by 15%

(*c*) to increase by 15%

(*d*) to reduce by 3% to 5%

80. The thickness of the flange of a tee beam of a ribbed slab is assumed as

(*a*) half the thickness of the rib

(*b*) thickness of the concrete topping

(*c*) depth of the rib

(*d*) width of the rib

81. Co-efficient of wind resistance of a circular surface is

(*a*) $\frac{2}{3}$ (*b*) $\frac{3}{2}$

(*c*) $\frac{1}{3}$ (*d*) $\frac{1}{2}$

82. Total number of elastic constants of an isotropic material are

(*a*) 2 (*b*) 3

(*c*) 4 (*d*) 5

83. A propped cantilever is indeterminate externally of

(*a*) second degree (*b*) fourth degree

(*c*) first degree (*d*) third degree

84. Which of the following is a relatively ductile material?

(*a*) High carbon steel (*b*) Bronze

(*c*) Mild steel (*d*) Cast iron

85. A beam is supported over three rollers lying in the same plane. The beam is stable for

(*a*) loading with no component perpendicular to the direction of beam

(*b*) only when no load except self weight acts

(*c*) loading with no component in the direction of the beam

(*d*) any general loading

86. The total length of a cranked bar through a distance (d) at 45° in case of a beam of effective length L, and depth (d) is

(*a*) L + 0.42 d (*b*) L + 2 × 0.42 d

(*c*) L – 0.42 d (*d*) L – 2 × 0.42 d

87. Aggregate impact value indicates which of the following properties of aggregates?

(*a*) Durability (*b*) Toughness

(*c*) Hardness (*d*) Strength

88. The shape of the STOP sign according to IRC : 67-2001 is

(*a*) Circular (*b*) Triangular

(*c*) Rectangular (*d*) Octogonal

89. If the depth of the section of an upper column is much smaller than the lower column

(*a*) bearing plates are provided with column splice

(*b*) filler and bearing plates are provided with column splice

(*c*) filler plates are provided with column

(*d*) neither filler nor bearing plates are provided with column splice

90. Web crippling in beams generally occurs at the points where

(*a*) concentrated loads act

(*b*) bending moment is maximum

(*c*) shear force is maximum

(*d*) deflection is maximum

91. Total depreciation during first five years of a cement concrete structure is

(*a*) zero per cent (*b*) 0.5 per cent

(*c*) 1 per cent (*d*) 2 per cent

ANSWERS

EXERCISE - I

1. (*b*)	**2.** (*b*)	**3.** (*c*)	**4.** (*b*)	**5.** (*c*)	**6.** (*a*)	**7.** (*b*)	**8.** (*c*)	**9.** (*d*)	**10.** (*d*)
11. (*b*)	**12.** (*d*)	**13.** (*c*)	**14.** (*b*)	**15.** (*c*)	**16.** (*d*)	**17.** (*a*)	**18.** (*c*)	**19.** (*c*)	**20.** (*d*)
21. (*d*)	**22.** (*a*)	**23.** (*b*)	**24.** (*b*)	**25.** (*a*)	**26.** (*c*)	**27.** (*a*)	**28.** (*c*)	**29.** (*d*)	**30.** (*d*)
31. (*c*)	**32.** (*c*)	**33.** (*a*)	**34.** (*d*)	**35.** (*d*)	**36.** (*d*)	**37.** (*b*)	**38.** (*c*)	**39.** (*c*)	**40.** (*b*)
41. (*d*)	**42.** (*b*)	**43.** (*b*)	**44.** (*b*)	**45.** (*a*)	**46.** (*a*)	**47.** (*c*)	**48.** (*c*)	**49.** (*b*)	**50.** (*a*)
51. (*d*)	**52.** (*b*)	**53.** (*d*)	**54.** (*b*)	**55.** (*a*)	**56.** (*b*)	**57.** (*c*)	**58.** (*c*)	**59.** (*d*)	**60.** (*b*)
61. (*c*)	**62.** (*d*)	**63.** (*d*)	**64.** (*d*)	**65.** (*b*)	**66.** (*c*)	**67.** (*a*)	**68.** (*a*)	**69.** (*b*)	**70.** (*d*)
71. (*c*)	**72.** (*d*)	**73.** (*b*)	**74.** (*a*)	**75.** (*c*)	**76.** (*b*)	**77.** (*c*)	**78.** (*b*)	**79.** (*d*)	**80.** (*c*)
81. (*a*)	**82.** (*a*)	**83.** (*c*)	**84.** (*c*)	**85.** (*b*)	**86.** (*a*)	**87.** (*d*)	**88.** (*b*)	**89.** (*a*)	**90.** (*b*)
91. (*c*)	**92.** (*d*)	**93.** (*d*)	**94.** (*b*)	**95.** (*a*)	**96.** (*c*)	**97.** (*b*)	**98.** (*d*)	**99.** (*b*)	**100.** (*c*)
101. (*c*)	**102.** (*a*)	**103.** (*a*)	**104.** (*b*)	**105.** (*d*)	**106.** (*d*)	**107.** (*c*)	**108.** (*a*)	**109.** (*a*)	**110.** (*d*)
111. (*d*)	**112.** (*b*)	**113.** (*d*)	**114.** (*c*)	**115.** (*d*)	**116.** (*a*)	**117.** (*d*)	**118.** (*b*)	**119.** (*b*)	**120.** (*d*)
121. (*b*)	**122.** (*c*)	**123.** (*c*)	**124.** (*d*)	**125.** (*b*)	**126.** (*d*)	**127.** (*a*)	**128.** (*a*)	**129.** (*a*)	**130.** (*b*)
131. (*b*)	**132.** (*b*)	**133.** (*b*)	**134.** (*d*)	**135.** (*d*)	**136.** (*b*)	**137.** (*d*)	**138.** (*b*)	**139.** (*d*)	**140.** (*b*)
141. (*c*)	**142.** (*b*)	**143.** (*a*)	**144.** (*d*)	**145.** (*d*)	**146.** (*d*)	**147.** (*a*)	**148.** (*d*)	**149.** (*a*)	**150.** (*a*)
151. (*a*)	**152.** (*d*)	**153.** (*d*)	**154.** (*b*)	**155.** (*a*)	**156.** (*b*)	**157.** (*d*)	**158.** (*a*)	**159.** (*b*)	**160.** (*d*)
161. (*c*)	**162.** (*b*)	**163.** (*b*)	**164.** (*c*)	**165.** (*c*)	**166.** (*a*)	**167.** (*a*)	**168.** (*a*)	**169.** (*d*)	**170.** (*c*)
171. (*a*)	**172.** (*d*)	**173.** (*b*)	**174.** (*a*)	**175.** (*d*)	**176.** (*a*)	**177.** (*d*)	**178.** (*c*)	**179.** (*c*)	**180.** (*a*)
181. (*a*)	**182.** (*b*)								

EXERCISE - II

1. (*a*)	**2.** (*a*)	**3.** (*a*)	**4.** (*d*)	**5.** (*c*)	**6.** (*c*)	**7.** (*c*)	**8.** (*a*)	**9.** (*b*)	**10.** (*d*)
11. (*a*)	**12.** (*a*)	**13.** (*b*)	**14.** (*b*)	**15.** (*b*)	**16.** (*d*)	**17.** (*b*)	**18.** (d)	**19.** (*d*)	**20.** (*c*)
21. (*c*)	**22.** (*d*)	**23.** (*c*)	**24.** (*a*)	**25.** (*d*)	**26.** (*c*)	**27.** (*d*)	**28.** (*d*)	**29.** (*c*)	**30.** (*c*)
31. (*a*)	**32.** (*d*)	**33.** (*c*)	**34.** (*c*)	**35.** (*b*)	**36.** (*c*)	**37.** (*b*)	**38.** (*b*)	**39.** (*b*)	**40.** (*c*)
41. (*c*)	**42.** (*d*)	**43.** (*d*)	**44.** (*b*)	**45.** (*a*)	**46.** (*c*)	**47.** (*d*)	**48.** (*d*)	**49.** (*c*)	**50.** (*c*)
51. (*a*)	**52.** (*c*)	**53.** (*a*)	**54.** (*b*)	**55.** (*c*)	**56.** (*d*)	**57.** (*c*)	**58.** (*b*)	**59.** (*a*)	**60.** (*d*)
61. (*a*)	**62.** (*c*)	**63.** (*b*)	**64.** (*d*)	**65.** (*b*)	**66.** (*b*)	**67.** (*c*)	**68.** (*c*)	**69.** (*a*)	**70.** (*c*)
71. (*c*)	**72.** (*c*)	**73.** (*a*)	**74.** (*a*)	**75.** (*a*)	**76.** (*c*)	**77.** (*a*)	**78.** (*a*)	**79.** (*d*)	**80.** (*b*)
81. (*)	**82.** (*a*)	**83.** (*c*)	**84.** (*c*)	**85.** (*c*)	**86.** (*b*)	**87.** (*b*)	**88.** (*d*)	**89.** (*c*)	**90.** (*a*)
91. (*)									

EXPLANATIONS

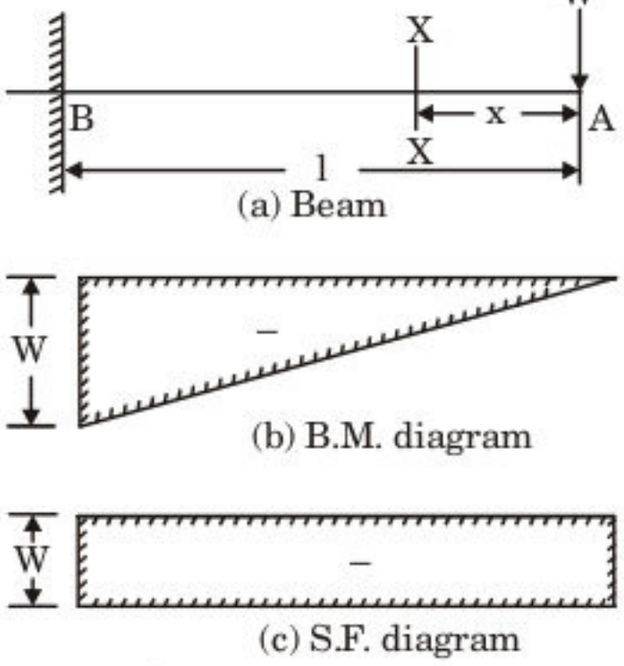
EXERCISE - II

1. $E = 2N(1 + \mu)$

Now, $\mu = \frac{1}{m}$

$\therefore$ $E = 2N\left(1 + \frac{1}{m}\right)$

2. Consider a section XX at a Distance x from the free end A



S.F. at X = $S_x = -W$

B.M. at X = $M_x = -Wx$

Now, Bending moment at the free end A

$M_A = -W \times 0 = 0$

3. The bending moment (M) is constant over a length of a segment (l) of a beam, the shearing force will also be a constant over this length by $\frac{M}{l}$

4. A closed coil helical spring is subjected to a torque about it axis. The spring wire would experience a Torsional shearing stress.

5. Column may be made of plain concrete if their unsupported length does not exceed their least lateral diameter by 4 times.

6. Plate Load Test

- It is used to determine the ultimate bearing capacity of soil as well as the probable settlement of the soil for a given loading and for a given depth.
- It is a field test, which is generally performed on uniform sandy soil.

7. An open ended thin cylindrical shall, subject to uniform internal pressure will be subjected to both hoop stress and longitudinal strain.

8. Moment of inertia is a physical property that combines the mass and distribution of the particles around the rotation axis.

10. Ductility is a solid material's ability to deform under tensile stress; this is often characterized by the material's ability to be stretched into a wire.

12. Bending equation

$$\frac{M}{I} = \frac{\sigma_b}{Y} = \frac{E}{R}$$

13. The permissible bending stress in steel (for slab plates and all steels.

15. For economical spacing of trusses, the cost of trusses should be equal to twice the cost of purlins plus the cost of roof covering,

i.e. $t = 2p + r$

Where, t = cost of trusses

p = cost of purlins

r = cost of roof covering

As a guide, the spacing of the roof trusses can be kept 1/4 of the span for up to 15 m, and 1/5 of span from 15-30 m spans of roof trusses.

16. The compressive strength of ordinary Portland cement after 3 days should not be less than 16.0 N/mm^2 or 150 kg/cm^2

Table: Minimum Specified Strength in N/mm^2

Type/Days	1 Day	3 Days	7 Days	28 Days
OPC	–	16.0	22.0	31.0
PPC	–	–	22.0	31.0
Low Heat Portland cement	16.0	27.5	–	–
Rapid hardening cement	–	–	22.0	31.0
High alumina cement	30.0	35.0	–	–

17. Beam fails in bond then its bond strength can be increased most economically by using thinner bars but more in number.

19. In plate load test, the rigid bearing plate to be used is square in section, of minimum size 30cm × 30cm, and maximum size 75cm × 75cm. The plate thickness should be sufficient to withstand effectively the bending stresses likely to be caused by the maximum anticipated load. It should generally **not be less than 1 cm (10 mm).**

20. Let rectangular section of width b and depth d then.

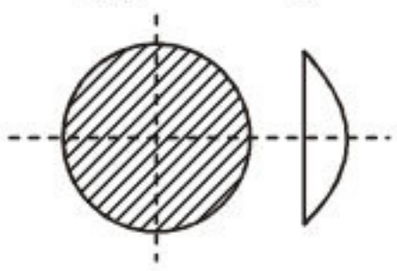
Section modulus, $Z = \frac{I}{y_{max}}$

where $I = \frac{bd^3}{12}$ & $y_{max} = \frac{d}{2}$.

Now $Z = \frac{\left(\frac{bd^3}{12}\right)}{\left(\frac{d}{2}\right)} = \frac{bd^2}{6}$

23. Maximum shear stress is 1.33 times to average shear stress for circular beam. i.e.

$q_{max} = 1.33\, q_{av}$



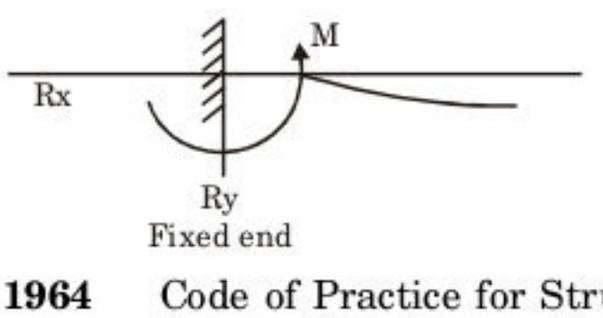
Solid circle

24. Column is a compression member, the effective length of which exceeds three times the least lateral dimension. Compression member whose length do not exceed three times their least lateral dimension are classified as a pedestals.

25. $EI.\frac{dy}{dx}$ = slope; $EI.\frac{d^2y}{dx^2}$ = moment

$EI.\frac{d^3y}{dx^3}$ = shear

26. Fixed support in a plane structure, total number of reactions is three.



27. **IS 875 : 1964** Code of Practice for Structural Safety of Buildings ; **Loading Standards**

29. The curvature of a beam at a section is M/EI

30. In a concurrent force system, all forces pass through a common point.

32. Strain energy stored in a solid

$$U = \frac{1}{2}\text{stress} \times \text{strain} \times \text{volume}$$

$$= 0.5 \times \sigma \times \varepsilon \times \text{volume}.$$

34. For design purposes, the compressive strength of concrete in the structure shall be assumed to be 0.67 times the characteristic strength. The partial safety factor = 1.5 shall be applied in addition to this.

36. Ratio of flexural rigidity $= \frac{E_1I_1}{E_2I_2}$

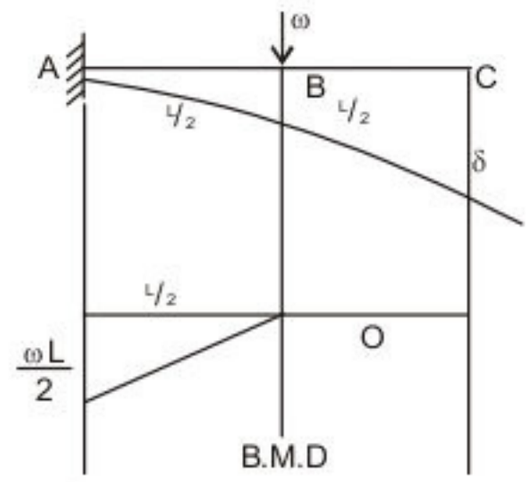
For same materials $E_1 = E_2 = E$

$\because$ Ratio $= \frac{EI_1}{EI_2} = \frac{\frac{bd^3}{12}}{\frac{b(2d)^3}{12}}$

Ratio of flexural rigidity $= \frac{1}{8}$

53. Maximum shear stress.

55. By area moment theorem



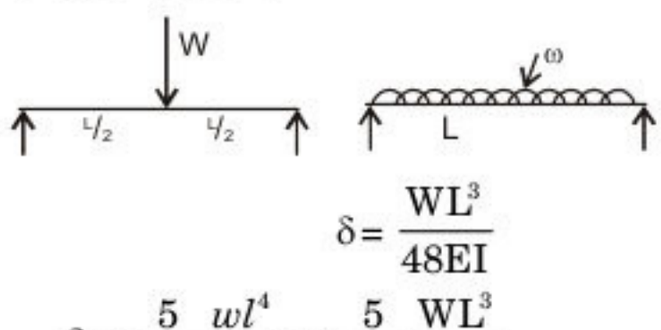
$$\delta_C^A \Rightarrow \sum \frac{A \cdot \bar{x}}{EI}$$

$$\Rightarrow \frac{1}{EI}\frac{1}{2} \times \frac{L}{2} \times \frac{WL}{2} \times \left[\frac{1}{2} + \frac{2}{3} \times \frac{1}{2}\right]$$

$$\Rightarrow \frac{WL^2}{8EI} \times \left[\frac{3L + 2L}{6}\right]$$

$$\Rightarrow \frac{5WL^3}{48EI}$$

56. According to question



$$\delta = \frac{WL^3}{48EI}$$

$$\delta = \frac{5}{384}\frac{wl^4}{EI} \Rightarrow \frac{5}{384}\frac{WL^3}{EI}$$

The Ratio of $\Rightarrow$

$$\frac{\text{Maximum deflection under concentrated load}}{\text{Maximum deflection under U.D.L}}$$

$$\Rightarrow \frac{\frac{WL^3}{48EI}}{\frac{5}{384} \times \frac{WL^3}{EI}} \Rightarrow \frac{WL^3}{48EI} \times \frac{384EI}{5WL^3}$$

$$\Rightarrow \frac{8}{5}$$

57. Poisson's Ratio μ

$$\Rightarrow \frac{\text{Lateral strain}}{\text{Longitudinal strain}} \text{ or } \Rightarrow \frac{\text{Transverse strain}}{\text{Axial strain}}$$

58. 6 m

59. Loose gravel has least bearing capacity among Hard rocks, Soft rocks and Compact gravel.

60. The property of a material by which it gets permanent deformation under a load which is not recovered after removal of load is called Plasticity.

61. The concrete having a slump of 6.5 cm, is said to be plastic.

62. Strain energy due to gradually applied axial load is given by

$$U = \frac{1}{2} P\Delta$$

Now axial deformation due to sudden applied axial load is **twice** the axial deformation due to gradually applied axial load.

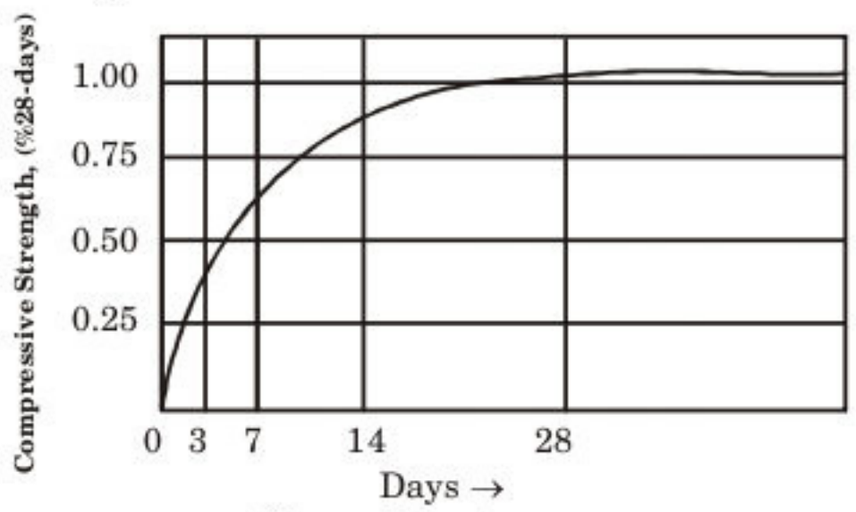
Hence, Strain energy due to suddenly applied axial load will be

$$U = \frac{1}{2} P(2\Delta) = P\Delta$$

64. Spacing of stirrup in a rectangular beam increased at the centre of the beam.

65. An overhanging beam is one in which the supports are not situated at ends i.e. one or both the ends project beyond the supports. Thus it is single overhanging beam.

66. As the graph of indicates that the increase in the strength of concrete with time is non-linear.



Strength-gain curve.

67. Generally concrete cubes are tested to measure concrete's characteristic compressive strength of 150 mm cube after 28 days.

68. Strain is dimensionless quantity, i.e.

$$\varepsilon = \frac{\Delta L}{L} \Rightarrow \frac{m}{m} \text{ i.e. } [M^0L^0T^0]$$

69. The ratio of normal stress to normal strain within elastic limits is called Young's Modulus.

The ratio of direct stress to volumetric strain within elastic limits is called Bulk Modulus.

The Ratio of shear stress to shear strain within elastic limits is called Modulus of Rigidity.

The ratio of lateral strain to linear strain is called Poisson's ratio.

71. The minimum thickness of the flat lacing bars shall not be less than-

- $\frac{1}{40}$ th of the effective length of single 40 lacing.
- $\frac{1}{60}$ th of the effective length of double 60 lacing.

72. Moment of inertia of the cross-section given rectangular section about its base -

By parallel axis theorem

About its base

$$I_{base} = I_{x-x} + Ah^2$$

Now $I_{x-x} = \frac{bD^3}{12}$

$\therefore$ $I_{base} = \frac{bD^3}{12} + (bd)\left(\frac{d}{2}\right)^2 = \frac{bd^3}{3}$

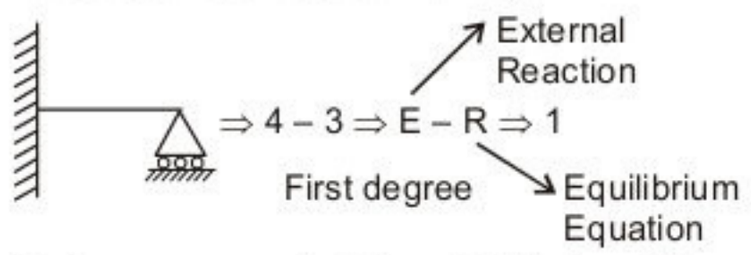
78. Constructor joint should be provided whenever the construction works stop temporarily. The joint could be either along transverse or longitudinal direction.

79. The flyash is replacement of cement with about 20-30% and also reduce the water demand of 10-15% with low heat of hydration.

80. Thickness of flange (d_f). This is equal to the overall depth of the slab forming the flange of the T-Beam.

82. Two elastic constant E and μ.

83.



84. Carbon content is 0.2 – 0.35% in mild steels.

85.  → Movement in x-direction.

86. $L + 2 \times 0.42d$

$L \Rightarrow$ effective length = clear distance.

90. When web is crippling use bearing stiffness these are used on support and where point paint.

■■