SANT LONGOWAL INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Question Bank

Subject: Strength of Material

Subject Code: PCME-523

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For UG Program

QUESTION BANK OF STRENGTH OF MATERIAL (PCME-523) for UG

This question bank contains the following type of questions

1. **80 MCQ**
2. **30 short answer questions**
3. **20 Long answer questions**

1. Strain is defined as the ratio of
(a) change in volume to original volume
(b) change in length to original length
(c) change in cross-sectional area to original cross-sectional area
(d) any one of the above
(e) none of the above.

2. Hooke's law holds good up to
(a) yield point
(b) limit of proportionality
(c) breaking point
(d) elastic limit
(e) plastic limit.

3. Young's modulus is defined as the ratio of
(a) volumetric stress and volumetric strain
(b) lateral stress and lateral strain
(c) longitudinal stress and longitudinal strain
(d) shear stress to shear strain
(e) longitudinal stress and lateral strain.

4. The unit of Young's modulus is
(a) m/mm
(b) kg/cm
(c) kg
(d) g/cm2
(e) kgcm2.

5. Deformation per unit length in the direction of force is known as
(a) strain
(b) lateral train
(c) linear strain
(d) linear stress
(e) unit strain.

6. It equal and opposite forces applied to a body tend to elongate it, the stress so produced is called

(a) internal resistance
(b) tensile stress
(c) transverse tress
(d) compressive tress
(e) working stress.

7. The materials having same elastic properties in all directions are called

(a) ideal materials
(b) uniform materials
(c) isotropic materials
(d) practical materials
(e) elastic materials.

8. A thin mild steel wire is loaded by adding loads in equal increments till it breaks. The extensions noted with increasing loads will behave as under

(a) uniform throughout
(b) increase uniformly
(c) first increase and then decrease
(d) increase uniformly first and then increase rapidly
(e) increase rapidly first and then uniformly.

9. Modulus of rigidity is defined as the ratio of (a) longitudinal stress and longitudinal strain
(b) volumetric stress and volumetric strain
(c) lateral stress and lateral strain
(d) shear stress and shear strain
(e) linear stress and lateral strain.

10. If the radius of wire stretched by a load is doubled, then its Young's modulus will be

(a) doubled
(b) halved
(c) become four times
(d) become one-fourth
(e) remain unaffected.

11. The ultimate tensile stress of mild steel compared to ultimate compressive stress is

(a) same
(b) more
(c) less
(d) more or less depending on other factors
(e) unpredictable.

12. Tensile strength of a material is obtained by dividing the maximum load during the test by the

(a) area at the time of fracture
(b) original cross-sectional area
(c) average of (a) and (b)
(d) minimum area after fracture
(e) none of the above.

13. The impact strength of a material is an index of its

(a) toughness
(b) tensile strength
(c) capability of being cold worked
(d) hardness
(e) fatigue strength.

14. The Young's modulus of a wire is defined as the stress which will increase the length of wire compared to its original length

(a) half
(b) same amount
(c) double
(d) one-fourth
(e) four times.

15. Percentage reduction of area in performing tensile test on cast iron may be of the order of

(a) 50%
(b) 25%
(c) 0%
(d) 15%
(e) 60%.

16. The intensity of stress which causes unit strain is called

(a) unit stress
(b) bulk modulus
(c) modulus of rigidity
(d) modulus of elasticity
(e) principal stress.

17. True stress-strain curve for materials is plotted between

(a) load/original cross-sectional area and change in length/original length
(b) load/instantaneous cross-sectional area original area and log.
(c) load/instantaneous cross-sectional area and change in length/original length
(d) load/instantaneous area and instantaneous area/original area
(e) none of the above.

18. During a tensile test on a specimen of 1 cm cross-section, maximum load observed was 8 tons and area of cross- section at neck was 0.5 cm2. Ultimate tensile strength of specimen is
(a) 4 tons/cm2
(b) 8 tons/cm2
(c) 16 tons/cm2
(d) 22 tons/cm^2
(e) none of the above.

19. For steel, the ultimate strength in shear as compared to in tension is nearly
(a) same
(b) half
(c) one-third
(d) two-third
(e) one-fourth.

20. Which of the following has no unit
(a) kinematic viscosity
(b) surface tension
(c) bulk
modulus (d)
strain
(e) elasticity.

21. Which is the false statement about true stress-strain method
(a) It does not exist
(b) It is more sensitive to changes in both metallurgical and mechanical conditions
(c) It gives, a more accurate picture of the ductility
(d) It can be correlated with stress-strain values in other tests like torsion, impact, combined stress tests etc.
(e) It can be used for compression tests as well.

22. In a tensile test on mild steel specimen, the breaking stress as compared to ultimate tensile stress is
(a) more
(b) less (c)
same
(d) more/less depending on composition
(e) may have any value.

23. If a part is constrained to move and heated, it will develop
(a) principal stress
(b) tensile stress
(c) compressive stress
(d) shear stress
(e) no stress.

24. Which of the following materials is most elastic
(a) rubber
(b) plastic
(c) brass
(d) steel (e)
glass.

25. The value of modulus of elasticity for mild steel is of the order of
(a) 2.1xl05 kg/cm2 (b)
2.1 X 106 kg/cm2
(c) 2.1 x 107 kg/cm2
(d) 0.1 xlO6 kg/cm2
(e) 3.8 x 106 kg/cm2.

26. The value of Poisson's ratio for steel is between
(a) 0.01 to 0.1
(b) 0.23 to 0.27
(c) 0.25 to 0.33
(d) 0.4 to 0.6
(e) 3 to 4.

27. The buckling load for a given material depends on
(a) slenderness ratio and area of cross-section
(b) Poisson's ratio and modulus of elasticity
(c) slenderness ratio and modulus of elasticity
(d) slenderness ratio, area of cross-section and modulus of elasticity
(e) Poisson's ratio and slenderness ratio.

28. The total elongation produced in a bar of uniform section hanging vertically downwards due to its own weight is equal to that produced by a weight
(a) of same magnitude as that of bar and applied at the lower end
(b) half the weight of bar applied at lower end
(c) half of the square of weight of bar applied at lower end
(d) one-fourth of weight of bar applied at lower end
(e) none of the above.

29. The property of a material by virtue of which a body returns to its original, shape after removal of the load is called
(a) plasticity
(b) elasticity
(c) ductility
(d) malleability
(e) resilience.

30. The materials which exhibit the same elastic properties in all directions are called
(a) homogeneous

(b) inelastic
(c) isotropic
(d) isentropic
(e) visco-elastic.

31. 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
(e) 3 to 4.

32. 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
(e) drawability.

33. Poisson's ratio is defined as the
ratio of
(a) longitudinal stress and longitudinal strain
(b) longitudinal stress and lateral stress
(c) lateral stress and longitudinal stress
(d) lateral stress and lateral strain
(e) none of the above.

34. For which material the Poisson's ratio is more than unity
(a) steel
(b) copper
(c) aluminium
(d) cast iron
(e) none of the above.

35. 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
(e) reliability.

36. The change in the unit volume of a material under tension with
increase in its Poisson's ratio will,
(a) increase
(b) decrease
(c) remain same

(d) increase initially and then decrease
(e) unpredictable.

37. The percentage reduction in area of a cast iron specimen during tensile test would be of the order of
(a) more than 0%
(b) 25—50%
(c) 10—25%
(d) 5—10%
(e) negligible.

38. If a material expands freely due to heating it will develop
(a) thermal stresses
(b) tensile stress
(c) bending
(d) compressive stress
(e) no stress.

39. In a tensile test, near the elastic limit zone, the
(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
(e) tensile strain remains constant.

40. The stress necessary to initiate yielding is
(a) considerably greater than that necessary to continue it
(b) considerably lesser than that necessary to continue it
(c) greater than that necessary to stop it
(d) lesser than that necessary to stop it
(e) equal to that necessary to stop it.

41. In the tensile test, the phenomenon of slow extension of the material, i. e. stress increasing with the time at a constant load is called
(a) creeping
(b) yielding
(c) breaking
(d) plasticity
(e) none of the above.

42. 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 tensile stress
(e) proof stress.

43. Rupture stress is
(a) breaking stress
(b) maximum load/original cross-sectional area
(c) load at breaking point/A
(d) load at breaking point/neck area
(e) maximum stress.

44. The 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
(e) tensile stress.

45. The ratio of lateral strain to the linear strain within elastic limit is known as
(a) Young's modulus
(b) bulk modulus
(c) modulus of rigidity
(d) modulus of elasticity
(e) Poisson's ratio.

46. The ratio of direct stress to volumetric strain in case of a body subjected to three mutually perpendicular stresses of equal intensity, is equal to
(a) Young's modulus
(b) bulk modulus
(c) modulus of rigidity
(d) modulus of elasticity
(e) Poisson's ratio.

47. The stress at which extension of the material takes place more quickly as compared to the increase in load is called
(a) elastic point of the material
(b) plastic point of the material
(c) breaking point of the material
(d) yielding point of the material
(e) ultimate point of the material.

48. In question 56, the internal reaction in bottom 80 cm length will be
(a) same in both cases
(b) zero in first case
(c) different in both cases
(d) data are not sufficient to determine same
(e) none of the above.

49. Flow stress corresponds to
(a) fluids in motion

(b) breaking point
(c) plastic deformation of solids
(d) rupture stress
(e) none of the above.

50. When it is indicated that a member is elastic, it means that when force is applied, it will
(a) not deform
(b) be safest
(c) stretch
(d) not stretch
(e) none of the above.

51. The energy absorbed in a body, when it is strained within the elastic limits, is known as
(a) strain energy
(b) resilience
(c) proof resilience
(d) modulus of resilience
(e) toughness.

52. Resilience of a material is considered when it is subjected to
(a) frequent heat treatment
(b) fatigue
(c) creep
(d) shock loading
(e) resonant condition.

53. The 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
(e) toughness.

54. The total strain energy stored in a body is termed as
(a) resilience
(b) proof resilience
(c) modulus of resilience
(d) toughness
(e) impact energy.

55. Proof resilience per material is known as
(a) resilience
(b) proof resilience
(c) modulus of resilience
(d) toughness
(e) impact energy.

56. The stress induced in a body due to suddenly applied load compared to when it is applied gradually is
(a) same
(b) half
(c) two times
(d) four times
(e) none of the above.

57. The strain energy stored in a body due to suddenly applied load compared to when it is applied gradually is
(a) same
(b) twice
(c) four times
(d) eight times
(e) half.

58. A material capable of absorbing large amount of energy before fracture is known as
(a) ductility
(b) toughness
(c) resilience
(d) shock proof
(e) plasticity.

59. Coaxing is the method of increasing
(a) strength by reversible cycling
(b) corrosion resistance by spraying
(c) hardness by surface treatment
(d) fatigue resistance by over-stressing the metal by successively increasing loadings
(e) creep by head treatment.

60. A beam is loaded as cantilever. If the load at the end is increased, the failure will occur
(a) in the middle
(b) at the tip below the load
(c) at the support
(d) anywhere
(e) none of the above.

61. A non-yielding support implies that the
(a) support is frictionless
(b) support can take any amount of reaction
(c) support holds member firmly
(d) slope of the beam at the support is zero
(e) none of the above.

62. The ratio of elongation in a prismatic bar due to its own weight (W) as compared to another similar bar carrying an additional weight (W) will be
(a) 1:2

(b) 1 : 3
(c) 1 : 4
(d) 1 :2.5
(e) 1 : 2.25.

63. 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 moduli of elasticity
(e) none of the above.

64. In riveted boiler joints, all stresses, shearing, bearing and tensile are based on the
(a) size of rivet
(b) size of the drilled or reamed hole
(c) average of size of rivet and hole
(d) smaller of the two
(e) any one of the above.

65. The distance between the centres of the rivets in adjacent rows of zig-zag riveted joint is known as
(a) pitch
(b) back pitch
(c) diagonal pitch
(d) diametral pitch
(e) lap.

66. Efficiency of a riveted joint is the ratio of its strength (max. load it can resist without failure) to the strength of the unpunched plate in
(a) tension
(b) compression
(c) bearing
(d) any one of the above
(e) none of the above.

67. When two plates are butt together and riveted with cover plates with two rows of rivets, the joi;it is known as
(a) lap point
(b) butt joint
(c) single riveted single cover butt joint
(d) double riveted double cover butt joint

(e) single riveted double cover
butt joint.

68. A riveted joint in which every rivet of a row is opposite to other rivet of the outer row, is known as
(a) chain riveted joint
(b) diamond riveted
joint
(c) criss-cross riveted
joint
(d) zig-zag riveted
joint
(e) none of the above.

69. A riveted joint in which the number of rivets decrease from innermost to outer most row is called
(a) chain riveted joint
(b) diamond riveted
joint
(c) criss-cross riveted
joint
(d) zig-zag riveted
joint
(e) none of the above.

70. If the rivets in adjacent rows are staggered and the outermost row has only one rivet, the arrangement of the rivets is called
(a) chain riveting
(b) zig zag riveting
(c) diamond riveting
(d) criss-cross riveting
(e) none of the above.

71. Diamond riveted joint can be adopted in the case of following type of joint
(a) butt joint
(b) lap joint
(c) double riveted lap joints
(d) all types of joints
(e) none of the above.

72. Rivets are made of following type of material
(a) tough
(b) hard
(c) resilient
(d)
ductile
(e) malleable.

73. The weakest section of a diamond riveting is the section which passes through
(a) the first row
(b) the second row
(c) the central row
(d) one rivet hole of the end row
(e) none of the above.

74. The deformation of a bar under its own weight compared to the deformation of same body subjected to a direct load equal to weight of the body is
(a) same
(b) double
(c) half
(d) four times
(e) one-fourth.

75. The force acting along the circumference will cause stress in the walls in a direction normal to the longitudinal axis of cylinder; this stress is called
(a) longitudinal stress
(b) hoop stress
(c) yeiled stress
(d) ultimate
stress
(e) none of the above.

76. A boiler shell 200 cm diameter and plate thickness 1.5 cm is subjected to internal pressure of 1.5 MN/m , then the hoop stress will be

(a) 30 MN/m^2

(b) 50 MN/m^2

(c) 100 MN/m^2

(d) 200 MN/m^2

(e) 300 MN/m^2

77. A cylindrical section having no joint is known as
(a) jointless section
(b) homogeneous section
(c) perfect section
(d) manufactured section
(e) seamless section.

78. Longitudinal stress in a thin cylinder is
(a) equal to the hoop stress
(b) twice the hoop stress
(c) half of the hoop stress
(d) one-fourth of hoop stress
(e) four times the hoop stress.

79. 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
(e) none of the above.

80. The torsional rigidity of a shaft is expressed by the
(a) maximum torque it can transmit
(b) number of cycles it undergoes before failure
(c) elastic limit up to which it resists torsion, shear and bending stresses
(d) torque required to produce a twist of one radian per unit length of shaft
(e) maximum power it can transmit at highest possible speed.

Short answer type question (30)

1. What is an isotropic material?
2. What is a temperature stress?
3. What is Poisson's ratio.
4. If the radius of wire stretched by a load is doubled, then its young's modulus will be……
5. If a one end of the column is fixed and other is free what will be its equivalent length……
6. Write Rankine formula for columns.
7. Write the equivalent stiffness for two similar springs with stiffness (k) connected in series.
8. What is point of contraflexure?
9. Define torsional rigidity
10. Define compressive stress and compressive strain?
11. Define shear stress and shear strain?
12. What is a composite bar?
13. Write the relationship between modulus of elasticity, modulus of rigidity and Poisson's ratio?
14. What is state Hooke's law?
15. Define stress and strain?
16. Define modulus of rigidity?
17. Define modulus of elasticity?
18. Define bulk modulus?

19. Define longitudinal strain and lateral strain?

20. How deformation in a uniform cross-section bar due to self-weight is half of the deformation due to external force equal to the weight of the body?

21. What are Mechanical Properties of Material? Define stress and strength?

22. What do you mean by strength of materials? What are the uses of strength of materials?

23. What are the different types of stresses and strains? Write its formula and unit?

24. A mild steel rod 2m long &3cm diameter is subjected to an axial pull of 10 kN. E for Youngs modulus for steel is 2 x 105 N/mm^2. Find the stress, strain.

25. A steel bar 900mm long its 2ends are 40mm &30mm in diameters &the length of each rod is 200mm. The middle portion of the bar is 15mm in diameters & 500mm in long if the bar is subjected an axial tensile load of 15 KN. Determine the stress in each section &total extension. Take E=200 $103N/mm^2$.

26. Define Bulk modulus. Write its formula and units.

27. What are types of loads on beams? Explain with figures.

28. What is Stress-Strain Curve? Explain

29. What is the relation between stress and strain?

30. What does center of gravity depends on?

Long answer Type questions (20)

1. The following are the results of a tensile on test on a molested rod is 16 mm gauge length is 50 mm, load at proportionality limit is 48.5 kN. Extension at the proportionally limit is 0.05 mm. Load at yield point is 50.3 KN ultimate loads is 90 KN. Final length between gauges points is 64mm, diameter of the neck at fracture is 13.7 mm. Determine the e you Stress, % of elongation& % of reduction in area.

2. A wire 2 m long and 2 mm in diameter, when stretched by weight of 8 kg has its length increased by 0.24 mm. Find stress, strain and young's modulus of material of the wire. $g=9.8m/sec^2$.

3. A mild steel wire of radius 0.5 mm and length 3m is stretched by a force of 49 N. Calculate (a) Longitudinal Stress (b) Longitudinal Strain (c) Elongation produced in the body if Y for steel 2.0x1011 N/m^2.

4. A wire of length 2 m and cross-sectional area 10-4 m^2 is stretched by a load 102 kg. The wire is stretched by 0.1 cm. Calculate longitudinal stress, longitudinal strain and young's modulus of the material of wire. g= 9.8 m/sec^2.

5. A bar of 20 mm diameter is tested in tension it is observed that when a lead of 40KN is applied the extension measured over a gauge length of 200 mm,0.12 mm & contraction in diameter is 0.0036 mm. Find Poisson's ratio, young's modulus.

6. What is theory of simple bending? Write bending stress formula?

7. What is the bending equation? Write the meaning of symbols used in equation.

8. What are assumptions are made in the theory of the simple bending?

9. Derive the bending equation.

10. A cantilever beam of length 2m fails when a load of 2KN is applied at the free end. If the section is 40mmx60mm, find the stress at the failure.

11. A rectangular beam 200mm deep and 300mm wide is simply supported over the span of 8m. What uniformly distributed load per meter the beam may carry, if the bending stress is not exceeding 120N/mm^2.

12. A beam is simply supported and carries a uniformly distributed load of 40KN/m run over the whole span. The section of the beam is rectangular having depth as 500mm.If the maximum stress in the material of the beam is 120N/mm^2 and moment of inertia of the section is 7x108 mm^4, find the span of the beam.

13. Calculate the maximum stress induced in a cast iron pipe of external diameter 40 mm,of internal diameter 20 mm and length 4m when the pipe is supported at its ends and carries a point load of 80N at its center.

14. A rectangular beam 300mm deep is simply supported over a span of 4m. Determine the uniformly distributed load per meter which the beam may carry, if the bending stress should not exceed 120N/mm2.Take I=8x106 mm4.

15. A square beam 20mmx20mm in section and 2m long is supported at the ends. The beam fails when a point load of 400N is applied at the centre of the beam. What uniformly distributed load per meter length will break a cantilever of the same material 40mm wide,60 mm deep and 3m long?

16. A timber beam of rectangular section is to support a load of 20KN uniformly distributed over a span of 3.6m when beam is simply supported. If the depth is to be twice the breadth, and the stress in timber is not exceed 7N/mm^2, find the dimensions of the cross section. How could you modify the dimensions with 20KN of concentrated load is present at centre with same breadth and depth ratio.

17. A circular shaft has to transmit 550 KW power at 115 RPM. Allowable shear stress=78MPa. Find i) The required diameter of solid shaft ii) The diameters of hollow section such that internal diameter=0.75 x external diameter.

18. A hollow shaft diameter ratio 3/5 is required to transmit 450 Kw at 120 rpm, the shearing stress in the shaft must not exceed 60N/mm^2 and the twist in a length of 2.5m is not to exceed 10. Calculate the minimum external diameter of the shaft. Take, G=8.0 KN/mm^2.

19. What must be the length of a 5mm diameter aluminium wire so that it can be twisted through 1 complete revolution without exceeding a shear of 42N/mm2? Take, G=27 GPa.

20. A solid steel shaft has to transmit 75KW power at 200 rpm. Taking allowable shear stress 70MPa. Find suitable dia. of shaft with the maximum torque transmitted on each revolution exceeds by 1.3 times mean.