Total No. of printed pages = 11

CT-303/SOM/3rd Sem/2017/N

STRENGTH OF MATERIALS

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Note : (i) Answer all the questions.

(ii) Section-1 (Q1-Q25) contains MCQ's and carries 1 mark each.

(iii) Section-2 (Q26-Q30). marks are indicated along side the questions.

SECTION – 1

1. According to Lami's theorem

(a) Three forces acting at a point will be in equilibrium.

(b) Three forces acting at a point can be represented by a triangle, each side being proportional to force.

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(c) If three forces acting upon a particle are represented in magnitude and direction by the sides of a triangle, taken in order, they will be in equilibrium.

(d) If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two.

2. A number of forces acting at a point will be in equilibrium if

(a) Their total sum is zero

(b) Two resolved parts in two directions at right angles are equal

(c) Sum of resolved parts in any two perpendicular directions are both zero

(d) All of them are inclined equally

3. Pick up the correct statement from the following :

(a) The point through which the resultant of the shear stresses passes is known as shear centre.

(b) In the standard rolled channels, the shear centre is on the horizontal line passing through and away from the C.G beyond web.

(c) In equal angles, the shear centre is on the horizontal plane and away from the C.G, outside of the leg projection.

(d) All of the above.

4. A beam is said to be of uniform strength, if

(a) B.M is same throughout the beam

(b) Deflection is same throughout the beam

(c) Bending stress is same throughout the beam

(d) Shear stress is same throughout the beam.

5. If a three hinged parabolic arch carries a uniformly distributed load on its entire span, every section of the arch resists

(a) Compressive force

(b) Tensile force

(c) Shear force

(d) Bending moment.

6. Which of the under mentioned type is a simple strain ?

(a) Tensile strain

(b) Compressive strain

(c) Shear strain

(d) All of the above.

7. In a solid arch, shear force acts

(a) Vertically upwards

(b) Along the axis of the arch

(c) Perpendicular to the axis of arch

(d) Tangentially to the arch.

8. An arch with three hinges, is a structure

(a) Statically determinate

(b) Statically indeterminate

(c) Geometrically unstable

(d) Structurally sound but indeterminate.

9. Beams of uniform strength are preferred to those of uniform section because these are economical for

(a) Large spans

(b) Heavy weights

(c) Light weights

(d) Short spans.

10. The tensile force required to cause an elongation of 0.045 mm in a steel rod of 1000 mm length and 12 mm diameter, is (where $E = 2 \times 10^6$ kg/cm^2)

(a) 166 kg

(b) 102 kg

(c) 204 kg

(d) 74 kg

11. A long vertical member, subjected to an axial compressive load, is called

(a) A column

(b) A strut

(c) A tie

(d) A stanchion

12. The property of a material by which it can be drawn to a smaller section, due to tension, is called

(a) Plasticity

(b) Ductility

(c) Elasticity

(d) Malleability

13. The unit of force in S.I units is

(a) Kilogram

(b) Newton

(c) Watt

(d) Dyne

14. A bending moment may be defined as :

(a) Arithmetic sum of the moments of all the forces on either side of the section

(b) Arithmetic sum of the forces on either side of the section

(c) Algebraic sum of the moments of all the forces on either side of the section

(d) None of these

15. Which of the following is a vector quantity ?

(a) Energy

(b) Mass

(c) Momentum

(d) Angle

16. Choose the incorrect statement.

(a) The cross-sectional area of the welded member is effective.

(b) A welded joint develops strength of its parent metal.

(c) Welded joints provide rigidity.

(d) Welding takes more time than riveting.

17. In a three hinged arch, the shear force is usually

(a) Maximum at crown

(b) Maximum at springing

(c) Maximum at quarter points

(d) Varies with slope.

18. If Z and I are the section modulus and moment of inertia of the section, the shear force F and bending moment M at a section are related by

(a) $F = My/I$

(b) $F = M/Z$

(c) $F = dM/dx$

(d) $F = Mdx$

19. The shear force on a simply supported beam is proportional to

(a) Displacement of the neutral axis

(b) Sum of the forces

(c) Sum of the transverse forces

(d) Algebraic sum of the transverse forces of the section.

20. The value of Poisson's ratio always remains

(a) Greater than one

(b) Less than one

(c) Equal to one

(d) None of these.

21. A beam is said to be of uniform strength, if

(a) B.M is same throughout the beam

(b) Shear stress is same throughout the beam

(c) Deflection is same throughout the beam

(d) Bending stress is same at every section along its longitudinal axis.

22. The maximum bending moment due to a moving load on a simply supported beam, occurs

(a) At the mid span

(b) At the supports

(c) Under the load

(d) Anywhere on the beam

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

(a) Shear stress

(b) Compressive stress

(c) Tensile stress

(d) Transverse stress

24. Pick up the correct statement from the following :

(a) The rate of change of bending moment is equal to rate of shear force.

(b) The rate of change of shear force is equal to rate of loading.

(c) Neither (a) nor (b)

(d) Both (a) and (b)

25. In a loaded beam, the point of contraflexure occurs at a section where

(a) Bending moment is minimum

(b) Bending moment is zero or changes sign

(c) Bending moment is maximum

(d) Shearing force is maximum.

SECTION – 2

26. (a) A steel bar 2m long, 40 mm wide and 20 mm thick is subjected to an axial pull of 160 kN in the direction of its length. Find the changes in its length, width and thickness of the bar. Take E= 200 Gpa and Poisson's ratio = 0.8. 6

(b) Explain in brief that for every direct stress, it is always accompanied by a strain in its own direction and an opposite kind of strain in every direction at right angle to it. 3

27. For the volumetric strain of a rectangular body subjected to an axial force, derive that $\delta V/V = e\left(1-\frac{2}{m}\right)$, where symbols have their usual meaning. 9

28. A simply supported beam of 4m span is carrying loads as shown in fig.13.19. Draw the shear force and bending moment diagrams for the beam. Show all the calculations. 9

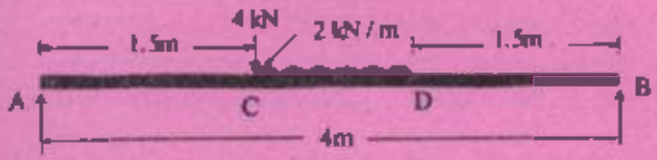

Fig. 13.19

29. (a) In case of simple bending, derive that $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$, where symbols have their usual meaning. 7

(b) List out the assumptions made in the theory of simple bending. 2

30. The stresses at a point in a component are 100 Mpa (tensile) and 50 Mpa (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 20° with the tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. 9