

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – MATHEMATICS

FIFTH SEMESTER – NOVEMBER 2018

MT 5510– STATICS

Date: 02-11-2018
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

PART – A

Answer ALL the questions:

(10x2=20 Marks)

1. Define composition and resolution forces.
2. State triangle of forces.
3. Define unlike parallel forces with an example.
4. Define moment of a force F about a point O .
5. Define centre of gravity.
6. Define centre of mass.
7. State Hooke's law.
8. When does a body at rest is said to be in unstable equilibrium?
9. Define catenary.
10. Give the intrinsic equation of the catenary and Cartesian equation of the catenary.

PART – B

Answer any FIVE questions:

(5x8=40 Marks)

11. Two forces of magnitudes P and Q ($P > Q$) act on a particle and the angle between the forces is α . If the magnitudes are interchanged, show that the resultant turns through the angle

$$2 \tan^{-1} \left(\left(\frac{P-Q}{P+Q} \right) \tan \frac{\alpha}{2} \right).$$

12. State and prove Lami's theorem.
13. Derive the resultant of two like parallel forces.
14. Find the centre of gravity of a uniform solid right circular cone.
15. A piece of uniform wire is bent in the shape of an isosceles triangle whose sides are a and b . show that the distance of the centre of gravity from the base of the triangle is $\frac{a}{2} \sqrt{\frac{2a-b}{2a+b}}$.
16. State and prove the principle of virtual work for a system of coplanar forces acting on a rigid body.
17. Describe the parabolic catenary.
18. A string of length $2l$ hangs over two small smooth pegs in the same horizontal level. Show that, if h is the sag in the middle, the length of either part of the string that hangs vertically is $h+l-2\sqrt{hl}$.

PART – C

Answer any TWO questions:

(2x20=40 Marks)

19. (a) A uniform plane lamina in the form of rhombus one of whose angles is 120° is supported by two forces of magnitudes P and Q applied at the centre in the directions of the diagonals so that one side is horizontal. Show that if $P > Q$, the $P^2 = 3Q^2$.
(b) State and prove polygon of forces. (10+10)

20. (a) State and prove Varignon's theorem on moments. **(10)**
(b) State Laws of friction and describe the cone of friction. **(10)**
21. (a) Find the centre of gravity of three uniform thin rods (of the same density) forming a triangle. **(10)**
(b) A uniform chain, of length l , is to be suspended from two points A and B , in the same horizontal line so that either terminal tension is n times that at the lowest point. Show that the span AB must be $\frac{l}{\sqrt{n^2-1}} \log(n + \sqrt{n^2-1})$. **(10)**
22. (a) Calculate the work done in stretching an elastic string from its natural length l to length l' . **(10)**
(b) Describe the forces which can be ignored in forming the equation of virtual work. **(10)**
