Sr. No. 2728

Exam Code: 103204
Subject Code: 7441

B.A./B.Sc. - 4th Sem. (old syllabus 2016)

(2519)

Paper: Mathematics Paper-I

(Statics & Solid Geometry)

Time allowed: 3 hrs.   Max. Marks: 50

Note: Attempt any five questions, selecting at least two questions from each section. All questions carry equal marks.

Section-A

1. a) Show that the resultant of two forces acting at a point is maximum when they act in the same direction and is minimum when they act in opposite direction.

    b) ABC is a triangle. D, E, F are the middle points of the sides BC, CA and AB respectively, Show that the forces acting on a particle and represented by AD, BE and CF are in equilibrium.

2. a) State and prove Polygon Law of Forces concerning forces acting at a point.

    b) Prove that if three parallel forces acting on a rigid body be in equilibrium, each is proportional to the distance between the other two.

3. a) Prove that two couples acting in the same plane are equivalent to a single couple whose moment is the algebraic sum of the moments of the separate couple.

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b) **P and Q are two like parallel forces. A couple of moment G is combined with them. Show that their resultant is displaced through a distance $\frac{G}{P+Q}$.**

4. a) **Show that a system of coplanar forces is in equilibrium if the algebraic sum of the moments of all forces about each of three non-collinear points in their plane is zero separately.**

 b) **A body whose weight is W can be just sustained on a rough inclined plane by a force P along the plane by a horizontal force Q. Show that the coefficient of friction is**

$$P\left[\frac{1}{W^2} + \frac{1}{Q^2} - \frac{1}{P^2}\right]^{1/2}.$$

5. a) **Find the C.G. of a solid right circular cone.**

 b) **The sides of a uniform triangular lamina are 5, 6 and 9 cms in length. Find the perpendicular distance of its C.G. from the shortest side.**

Section-B

6. a) **Find the equation of the cylinder whose generators intersect the conic $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, $z = 0$ and are parallel to z-axis.**

 b) **Find the equation of the right circular cylinder having for its base the circle $x^2+y^2+z^2=9$, $x-y+z=3$.**

7. a) **Show that the equation $f(x, y)=0$, where $f(x,y)$ is a polynomial in x and y, represents a cylinder. What is the locus represented by $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$?**

 b) **Obtain the equation of the right circular cylinder described on the circle through the points $(a,0,0)$, $(0,a,0)$, $(0,0,a)$ as the guiding circle.**

8. a) Find the equation of the cone whose vertex is the point $(1,1,0)$ and whose guiding curve is $y=0$, $x^2+z^2=4$.

   b) Find the equation of the cone which contains the three co-ordinate axes and the two lines through the origin with direction cosines (l_1, m_1, n_1) and (l_2, m_2, n_2).

9. a) Show that the equation $4x^2 - y^2 + 2z^2 + 2xy - 3yz + 12x - 11y + 6z + 4 = 0$ represents a cone with vertex $(-1, -2, -3)$.

   b) Prove that the equation $\sqrt{fx} + \sqrt{gy} + \sqrt{hz} = 0$ represents a cone which touches the co-ordinate planes and that the equation of the reciprocal cone is $fyz+gzx+hxy=0$.

10. a) Find the equation of the right circular cone generated by straight lines drawn from the origin to cut the circle through the three points $(1, 2, 2)$, $(2, 1, -2)$ and $(2, -2, 1)$.

    b) Show that the equation of the right circular cone whose vertex is the origin, axis the z-axis and semi vertical angle α is $x^2+y^2=z^2 \tan^2\alpha$. What is α if this cone has three mutually perpendicular generators?

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