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R—76—2017

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

MARCH/APRIL, 2017

MATHEMATICS

Paper XV

[Mechanics—I (Statics)]

(Monday, 3-4-2017)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

N.B. :— (i) All questions are compulsory.

(ii) Figures to the right indicate full marks.

1. Attempt any *five* of the following : 2 each
 - (a) Define an axiom for equilibrium of two forces.
 - (b) Define the resultant of system of forces.
 - (c) If the magnitudes of two forces \vec{P} and \vec{Q} are equal, then find the magnitude and direction of the resultant of the two forces \vec{P} and \vec{Q} .
 - (d) State the triangle law of forces.
 - (e) Define the moment of the force \vec{F} about O.
 - (f) Write the conditions of equilibrium of forces acting on a rigid body in cartesian form.
2. Attempt any *two* of the following : 5 each
 - (a) Find the resultant of two unlike parallel forces acting upon a rigid body.
 - (b) State and prove the law of parallelogram of forces.

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- (c) A particle is acted upon by three forces in one plane, equal to 2, $2\sqrt{2}$ and 1 kg respectively. The first force is horizontal, the second acts at 45° to the horizontal, and the third is vertical. Find the magnitude and direction of the resultant.
3. Attempt any *two* of the following : 5 each
- (a) State and prove Lami's theorem.
- (b) State and prove triangle law of forces.
- (c) A and B are two smooth pegs in a horizontal line at a distance 5 m apart. Two light inextensible strings CA and CB of lengths 3 m and 4 m respectively attached to pegs. Find the tensions in the strings, when a weight of 10 kg is suspended from C.
4. Attempt any *two* of the following : 5 each
- (a) Prove that the sum of the vector moments of two like parallel forces acting on a rigid body about any point is equal to the vector moment of their resultant about the same point.
- (b) Find the necessary and sufficient condition that a given system of forces acting upon a rigid body in equilibrium is that the force-sum and moment-sum must separately vanish.
- (c) A force \vec{F} of magnitude 8 units acts at a point P(2, 3, 4) along the line :
- $$\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}.$$
- Find the moment of the force \vec{F} about x -axis.