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GA—102—2023

FACULTY OF SCIENCE/ARTS

B.A./B.Sc. (Third Year) (Fifth Sem.) EXAMINATION

APRIL/MAY, 2023

(New/CBCS Pattern)

MATHEMATICS

Paper XIV

(Mechanics-I)

(Tuesday, 9-5-2023)

Time : 10.00 a.m. to 12.00 noon

Time—Two Hours

Maximum Marks—40

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

(ii) Figures to the right indicate full marks

(iii) Use of non-scientific/non-programmable calculator is allowed.

1. State and prove law of the parallelogram of forces. Find the resultant of two forces whose magnitudes are 8 kg and 7 kg respectively at an angle of 60° . 15

Or

(a) State and prove Lami's theorem. 8

(b) If two like parallel forces of magnitudes P and Q act on a rigid body at A and B respectively. Then show that if they interchange position, the point of application of the resultant is displaced through a distance : 7

$$\left(\frac{P - Q}{P + Q} \right)$$

AB along AB.

P.T.O.

2. Prove that the vector moment of the resultant couple of two couples acting upon a rigid body is the sum of the vector moments of the given couples. Find the vector moment of a force \vec{F} of magnitude 10 units acting at a point (1, 2, 3) in the direction of the vector :

15

$$2\vec{i} + \vec{j} + 2\vec{k}$$

about the point (2, 3, 1)

Or

- (a) 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. 8
- (b) Prove that the sum of the vector moment of a system of forces acting on a particle about any point equals to the vector moment of their resultant about the same point. 7
3. Attempt any *two* of the following : 10
- (a) Find the magnitude and direction of the resultant \vec{R} when the two forces \vec{P} and \vec{Q} act along the same straight line and in the same direction.
- (b) Prove that triangle law of forces if the three forces acting on a particle be represented in magnitude and direction by the three sides of a triangle, taken in order, then the forces are in equilibrium.

- (c) A particle is placed at the centre O of the circle inscribed in a ΔABC . Forces $\vec{P}, \vec{Q}, \vec{R}$ acting along \vec{OA}, \vec{OB} and \vec{OC} respectively are in equilibrium then prove that :

$$P : Q : R = \cos \frac{A}{2} : \cos \frac{B}{2} : \cos \frac{C}{2}.$$

- (d) Find the vector moment of force :

$$\vec{F} = \vec{i} + 2\vec{j} + 3\vec{k}$$

acting at a point $(-1, 2, 3)$ about the origin.