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SB—128—2022

FACULTY OF ARTS/SCIENCES

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

MAY/JUNE, 2022

(CBCS/New Pattern)

MATHEMATICS

Paper XIV

(Mechanics-I)

(Monday, 20-06-2022)

Time : 10.00 a.m. to 12.30 p.m.

Time— 2½ 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. Determine the magnitude and direction of the resultant \vec{R} of two forces \vec{P} and \vec{Q} acting at an angle θ and 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) Prove that if three like or unlike parallel forces be in equilibrium, the magnitude of each force varies as the distance between the other two. 7

2. Prove that, the necessary and sufficient condition for a system of forces acting on a particle to be in equilibrium is that the algebraic sum of the resolved parts of the given forces along any three non-coplanar directions must be separately vanish. 15

P.T.O.

Or

- (a) Prove that, two couples, acting in one plane upon a rigid body, whose moments are equal and opposite, balance each other. When the forces constituting the couples are not parallel. 8
- (b) Prove that the necessary and sufficient condition that a given system of forces acting upon a rigid body is in equilibrium is that the force-sum and moment-sum must separately vanish. 7
3. Attempt any *two* of the following : 10
- (a) State and prove the law of the parallelogram of forces.
- (b) State and prove Triangle law of forces.
- (c) Three forces of magnitudes P, Q, R acting on a particle are in equilibrium and the angle between P and Q is double the angle between P and R. Then show that $R^2 = Q(Q - P)$.
- (d) 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 $2\vec{i} + \vec{j} + 2\vec{k}$ about the point (2, 3, 1).