This question paper contains **2** printed pages]

# W—84—2018

## FACULTY OF SCIENCE

## B.Sc. (Fifth Semester) EXAMINATION

## OCTOBER/NOVEMBER, 2018

## (CGPA Pattern)

MATHEMATICS

Paper XV

[Mechanics-I (Statics)]

**(Friday, 19-10-2018)** **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 like parallel forces.

(*b*) If $\theta = 0$ i.e. when the two forces $\vec{P}$ and $\vec{Q}$ act along the same straight line and in the same direction then prove that :

$$R = P + Q \text{ and } \alpha = 0$$

(*c*) State Lami's theorem.

(*d*) State Triangle Law of forces.

(*e*) Define couple.

(*f*) Define motion of rotation.

2. Attempt any *two* of the following : 5 each

(*a*) Prove that the resultant of two forces given by $m.\overrightarrow{OA}$ and $n.\overrightarrow{OB}$ is represented by $(m + n)$ OC, where the point C divides AB internally in the ratio $n : m$.

(*b*) Find the resultant of two unlike parallel forces acting upon a rigid body.

(*c*) A particle is acted upon by three forces in one plane, equal to 2, $2\sqrt{2}$ and 1 kg. 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.

P.T.O.

3. Attempt any *two* of the following : 5 each

(*a*) State and prove converse of the triangle law of forces.

(*b*) 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 separately vanish.

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

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

4. Attempt any *two* of the following : 5 each

(*a*) 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.

(*b*) 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.

(*c*) Three forces $\vec{P}, \vec{Q}, \vec{R}$ act along the sides BC, CA, AB of $\Delta$ ABC, taken in order; prove that if the resultant passes through the incentre of $\Delta$ ABC, then P + Q + R = 0, where P, Q, R are the magnitudes of the forces.