

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

**BSc DEGREE EXAMINATION MAY 2018**  
(Third Semester)

Branch – MATHEMATICS

**MECHANICS – I (STATICS)**

Time : Three Hours

Maximum : 75 Marks

**SECTION-A (20 Marks)**

Answer ALL questions

ALL questions carry EQUAL marks (10 x 2 = 20)

- 1 Define a Force.
- 2 State triangle law of forces.
- 3 What is the magnitude and direction of the resultant of two unlike and unequal parallel forces acting on a rigid body.
- 4 State Varignon's Theorem.
- 5 Define a Couple.
- 6 Define arm of a Couple.
- 7 Given  $R=0$  but  $G \neq 0$ , what is the reduction of system of forces?
- 8 State the third form of condition of Equilibrium.
- 9 Write any two differences between centre of gravity and centre of mass.
- 10 What is the C.G. of a hollow hemisphere of radius 'a'?

**SECTION - B (25 Marks)**

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 5 = 25)

- 11 a State and prove Parallelogram law of forces.  
OR  
b Five forces acting at a point are represented in magnitude and direction by the lines joining the vertices of any pentagon to the midpoints of their opposite sides. Show that they are in equilibrium.
- 12 a Two men, one stronger than the other, have to remove a block of stone weighing 300kgs. With a light pole whose length is 6 metre. The weaker man cannot carry more than 100kgs. Where must the stone be fastened to the pole, so as to allow him his full share of weight.  
OR  
b Define a moment of a force about any point and explain geometrical representation of a moment.
- 13 a Prove that a force acting at any point A of a body is equivalent to an equal and parallel force acting at any other arbitrary point B of the body together with a couple.  
OR  
b ABC is an equilateral triangle of side a: D,E,F divide the sides BC,CA,AB respectively in the ratio 2:1. Three forces each equal to P act at D,E,F perpendicularly to the sides and outward from the triangle. Prove that they are equivalent to a couple of moment  $\frac{1}{2} pa$ .
- 14 a Derive the conditions for a system of forces to reduce to a single force or to a couple.  
OR  
b Find the equation to the line of action of the resultant.
- 15 a Prove that the center of gravity of a body is unique.  
OR  
b Find the C.G of a uniform solid hemisphere.

**SECTION - C (30 Marks)**

Answer any **THREE** Questions

**ALL** Questions Carry **EQUAL** Marks (3 x 10 = 30)

- 16 A and B are two fixed points on a horizontal line at a distance  $c$  apart. Two fine light strings AC and BC of lengths  $b$  and  $a$  respectively support a mass at C. Show that the tension of the strings are in the ratio  $b(a^2+c^2-b^2) : a(b^2+c^2-a)$
- 17 Find resultant of two like parallel forces acting on a rigid body.
- 18 If two couples, whose moments are equal and opposite, act in the same plane upon a rigid body, they balance one another.
- 19 Prove that any system of forces acting in one plane on a rigid body can be reduced to a single force or a couple.
- 20 Find the C.G of a hollow hemisphere of radius 'a'.

Z-Z-Z

END