

TSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)  
**BSc DEGREE EXAMINATION DECEMBER 2017**  
(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 equilibrium.
- 2 State Polygon law of forces.
- 3 What is the magnitude and direction of the resultant of two like parallel forces acting on a rigid body.
- 4 Define moment about a point.
- 5 Define moment of a couple.
- 6 Define arm of a couple.
- 7 State the third form of condition of equilibrium.
- 8 State the theorem on reduction of any number of coplanar forces.
- 9 Define centre of gravity.
- 10 What is the C.G. of a uniform solid 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 Lami's theorem.  
OR  
b Show that a given force may be resolved into three components, acting in three given lines which are not all parallel or all concurrent.
- 12 a Derive the conditions of equilibrium of three coplanar parallel forces.  
OR  
b State and prove Generalised theorem of moments (Principles of moments).
- 13 a Prove that a couple and a single force acting on a body cannot be in equilibrium but they are equivalent to a single force acting at some other points parallel to its original directions.  
OR  
b ABC is an equilateral triangle of side a: D, E, F divides 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 Obtain the equation to the line of action of the resultant.  
OR  
b State and prove the second form of the conditions of equilibrium of a system of coplanar forces.

Cont ...

- 15 a Prove that the centre of gravity of a body is unique.  
OR  
b Find the C.G of a hollow hemisphere of radius 'a'.

**SECTION - C (30 Marks)**

Answer any **THREE** Questions

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

- 16 Prove that the algebraic sum of the resolved parts of two forces in any direction is equal to the resolved part of the resultant the resultant in the same direction.
- 17 State and prove Varignon's theorem of moments.
- 18 Prove that two couples in the same plane whose moments are equal and of the same sign are equivalent to one another.
- 19 Forces 3, 2, 4, 5 kg wt. act respectively along the sides AB, BC, CD and DA of a square. Find the magnitude of their resultant and the points where its line of action meets AB and AD.
- 20 Find the C.G of a uniform circular arc subtending an angle  $2\alpha$  at the centre.

Z-Z-Z

END