

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2019
(Third Semester)

Branch – MATHEMATICS

MECHANICS – I (STATICS)

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (10 x 1 = 10)

- 1 1 Newton = _____.
(i) 10^5 dynes (ii) 10^6 dynes (iii) 10^{-5} dynes (iv) 10^{-6} dynes
- 2 A system of particles such that the distance between any two of them is always constant is called _____.
(i) Rigid body (ii) Applied Force
(iii) Solid Body (iv) dynes
- 3 The resultant of forces of earth gravitation acting on a system of particle is called _____.
(i) centre of gravity (ii) centre of axis
(iii) gyration (iv) mass
- 4 Forces whose line of action are called _____.
(i) Parallel forces (ii) unlike parallel forces
(iii) directions (iv) equal
- 5 If the body tends to return to the original position of equilibrium, then the equilibrium is called _____.
(i) stable (ii) unstable (iii) neutral (iv) zero
- 6 If m_1, m_2, m_3, \dots are the masses of a system of particles at points whose position vectors are r_1, r_2, r_3, \dots then the point G whose position vector is called _____.
(i) centre of mass (ii) mass of particle
(iii) energy (iv) work
- 7 If the M.I of a system of mass M about a straight line is written as MK^2 then K is called _____.
(i) radius of gyration (ii) velocity
(iii) speed (iv) momentum
- 8 Moment of Inertia of solid right circular cone _____.
(i) $I = \frac{3}{10} ma^2$ (ii) $I = \frac{3}{8} ma^2$ (iii) $I = \frac{3}{6} ma^2$ (iv) $I = \frac{3}{5} ma^2$
- 9 Moment of Inertia of solid right circular cylinder is _____.
(i) $\frac{1}{2} ma^2$ (ii) $\frac{1}{2} mb^2$ (iii) $\frac{1}{2} mc^2$ (iv) $\frac{1}{3} md^2$
- 10 Moment of Inertia of parabolic lamina is _____.
(i) $\frac{4}{5} ma^2$ (ii) $\frac{3}{5} ma^2$ (iii) $\frac{4}{5} mb^2$ (iv) $\frac{4}{5} mc^2$

SECTION - B (25 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 5 = 25)

- 11 a Calculate the magnitude and direction of the Resultant \vec{F}_1 & \vec{F}_2 .

OR

- b State resolve a force \vec{F} into components in two directions.

- 12 a Explain the resultant of two parallel forces acting on a rigid body.
OR
b Show that a system of coplanar forces reduce either to a single force or to a couple.
- 13 a Determine the lamina in the sector of a circle by using Integration.
OR
b Find the triangular lamina ABC right angled at A is suspended from A and $AB=3AC$. Show that if the hypotenuse is inclined to the vertical at an angle θ , then $\sin \theta = \frac{3}{5}$.
- 14 a Find the moment of inertia of Elliptic Lamina.
OR
b State and prove parallel axis theorem.
- 15 a State and prove principle of virtual work.
OR
b Find the moment of inertia of a solid sphere.

SECTION -C (40 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 8 = 40)

- 16 a Discuss to show that if three forces keep a particle in equilibrium then the forces are coplanar.
OR
b State and prove Lami's theorem.
- 17 a Derive three line parallel forces P, Q, R act at the vertices of a triangle ABC. If $\frac{P}{\tan A} = \frac{Q}{\tan B} = \frac{R}{\tan C} = K$. Show that the resultant of the forces pass through the orthocenter.
OR
b Discuss show that a system of coplanar couples acting on a rigid body is equivalent to a couple in the same place whose moment is equal to the sum of the moments of the given couple.
- 18 a Explain three particles of same mass using find mass centre.
OR
b Show that the moment of inertia of a solid hemisphere of radius 'a' using integration.
- 19 a Determine the moment of inertia of a rod using integrations.
OR
b Show that the M.I of a rectangular lamina of mass m and sides 2a and 2b about the diagonal is $M \frac{2a^2b^2}{3(a^2 + b^2)}$
- 20 a Show that a rod of length 2a can be in equilibrium about a fixed end. It is held vertically at rest in the unstable equilibrium position. Show that when it passes through the lower vertical position its angular velocity is $\sqrt{\frac{3s}{a}}$.
OR
b Derive the expression for the moment of inertia of a circular ring.