



THE AMERICAN COLLEGE, MADURAI

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-accredited (2nd Cycle) by NAAC with Grade "A", CGPA – 3.46 on a 4-point scale

Backlog Arrear Examination, March 2021

MECHANICS

MAT / MAS 3611 / 3441

TIME: 3 Hour

TOTAL: 75 Marks

PART A

Answer any FIVE Questions:

5 × 15 = 75

1. ABC is a given triangle. Forces P, Q, R acting along the lines OA, OB, OC are in equilibrium.
 - (i). Show that $P:Q:R = \cos \frac{A}{2} : \cos \frac{B}{2} : \cos \frac{C}{2}$ if O is the incentre of the triangle.
 - (ii). Show that $P:Q:R = a : b : c$ if O is the orthocentre of the triangle.
 - (iii). Show that $P:Q:R = a^2(b^2 + c^2 - a^2) : b^2(c^2 + a^2 - b^2) : c^2(a^2 + b^2 - c^2)$
2. State and Prove Varignon's theorem.
3. A uniform rod of length a , hangs against a smooth vertical wall being supported by means of a string, of length l , tied to one end of the rod, the other end of the string being attached to a point in the wall. Show that the rod can rest inclined to the wall at an angle θ given by $\cos^2 \theta = \frac{l^2 - a^2}{3a^2}$. What are the limits of the ratio of $a : l$ in order that equilibrium may be possible?
4. A weight can be supported on a rough inclined plane by a force P acting along the plane or by a force Q acting horizontally. Show that the weight is $\frac{PQ}{\sqrt{Q^2 \sec^2 \lambda - P^2}}$ where λ is the angle of friction.
5. A particle falls from a height h upon a fixed horizontal plane: if e be the coefficient of restitution, show that the whole distance described before the particle has finished rebounding is $h \left(\frac{1+e^2}{1-e^2} \right)$. Also show that the whole time taken is $\frac{1+e}{1-e} \sqrt{\frac{2h}{g}}$
6. State and Prove the Law of inverse squares.
7. Discuss about the Pedal equation.