LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

SIXTH SEMESTER – **APRIL 2023**

UMT 6503 – MECHANICS

Date: 05-05-2023 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART-A

Answer ALL Questions **(10 ×2= 20 Marks)**

1. State perpendicular triangle of forces.
2. Write down the conditions of equilibrium of any number of forces acting upon a particle.
3. What is the magnitude of the resultant of two like parallel forces?
4. Define moment of a force.
5. Define the principle of physical independence of forces.
6. What is principle of conservation of linear momentum?
7. Define the angle and velocity of projection.
8. Write the formula to find the time of flight and the horizontal range.
9. State Dr Routh's rule.
10. Write the statement of perpendicular axes theorem for moment of inertia.

PART-B

Answer any FIVE Questions **(5 × 8= 40 Marks)**

11. Show that P: Q: R =√2: √3: √2 under the following conditions,
    (i) R is the resultant of P and Q
    (ii) If Q is doubled, R is doubled
    (iii) If R is reversed, in direction. R is doubled
12. State and prove Lami's theorem.
13. State and prove equivalence of two couples.
14. Explain about Atwood's machine.
15. Show that the path of a projectile is a parabola.
16. Show that the M.I of a triangular lamina of mass M about a side is $\frac{Mh^2}{6}$,where h is the altitude from the opposite vertex.
17. Find the velocity of projectile in magnitude and direction at the end of time t.
18. State and prove the theorem of parallel axes.

PART-C

Answer any TWO questions **(2 ×20= 40 Marks)**

19. *ABC* is a given triangle. Forces *P*, *Q*, *R* acting along the lines *OA*, *OB*, *OC* are in equilibrium.

Prove that

(i) P:Q:R = $a^2(b^2 + c^2 - a^2)$: $b^2(c^2 + a^2 - b^2)$: $c^2(a^2 + b^2 - c^2)$

If *O* is the circumcenter of the triangle.

(ii) P:Q:R = cosA/2 : cosB/2 : cosC/2, if O is the incentre of the triangle.

(iii) P:Q:R = a:b:c if *O* is the ortho centre of the triangle.

(iv) P:Q:R = OA:OB:OC if *O* is the centroid of the triangle. **(20)**

20. (a) Find the resultant of two like parallel forces acting on a rigid body.

(b) State and prove Varigon's theorem on moments. **(10+10)**

21. Explain and illustrate Newton's first and second laws. **(20)**

22. (a) A particle is thrown over a triangle from one end of a horizontal base and grazing the vertex falls on the other end of the base. If *A*, *B* are the base angles, and α the angle of projection, show that $tan \propto = tanA + tan\, B$.

(b) Find the moment of inertia of a hollow cone about its axis. **(10+10)**

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