LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SIXTH SEMESTER – **NOVEMBER 2023**

UMT 6503 – MECHANICS

Date: 07-11-2023
Time: 01:00 PM - 04:00 PM

Dept. No.

Max. : 100 Marks

PART-A

(Answer all questions) **(10X2=20)**

1. When do you say that a body is in equilibrium?

2. Define Parallelogram Law of forces.

3. State the conditions of equilibrium of three coplanar parallel forces.

4. Define arm of a couple.

5. State Newton's first law of motion.

6. Define force of friction.

7. Define trajectory.

8. Write the formula for finding the greatest height attained by a projectile.

9. State the theorem of perpendicular axis for moments of inertia.

10. State Dr. Routh's rule.

PART-B

(Answer any FIVE questions) **(5X8=40)**

11. The magnitude of the resultant of two given forces P, Q is R if Q is doubled. If Q is reversed, then also R is doubled. Show that $P:Q:R = \sqrt{2}:\sqrt{3}:\sqrt{2}$.

12. State and prove the triangle law of forces.

13. Find the resultant of two like parallel forces.

14. If $P \,\&\, Q$ be interchanged in position, show that the point of application of the resultant will be displaced along AB through a distance $'d'$ where $d = \frac{P-Q}{P+Q}.AB$.

15. Explain Atwood's machine.

16. A mass of $20kg$ falls $500\ cms$ from rest and then penerates to a depth of $50\ cm$ into the sand before coming to rest. Find the average thrust of the sand.

17. Show that the greatest height which a particle with initial velocity v can reach on a vertical wall at a distance $'a'$ from the point of projection is $\frac{v^2}{2g} - \frac{ga^2}{2v^2}$.

18. Find the moment of inertia of uniform rectangular parallelopiped of edges 2a, 2b and 2c.

1

PART-C

(Answer any TWO questions)

19. a) State and prove Lami's theorem. (10 marks)

b) $ABCDEF$ is a regular hexagon and at A, act forces represented by $\overline{AB}, \ 2\overline{AC}, \ 3\overline{AD}, \ 4\overline{AE}$

and $5\overline{AF}$.Show that the magnitude of the resultant is $AB\sqrt{351}$ and that it makes an angle

$tan^{-1}\left(\frac{7}{\sqrt{3}}\right)$ with AB. (10 marks)

20. a) Show that when masses P and Q are connected by a string passing over the edge of
a smooth table, the tension in the same whether **P** hangs and Q is on the table or **Q**
hangs and is on the table. (10 marks)
b) State and prove Varigon's theorem on moments. (10 marks)

21 Show that the path of a projectile is a parabola.

22.a) Find the moment of inerita of the uniform elleptic lamina. (10 marks)

b) State and prove the parallel axis theorem in moment if inertia. (10 marks)

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