Reg.No.

S.No. 392 BATCH: 2000-2015

END OF SEMESTER EXAMINATIONS, APRIL / MAY 2017
MECHANICS
SUBJECT CODE: 08UAMA05

MAJOR: B.Sc. MATHS SEMESTER : III
TIME : 3 HOURS MAX.MARKS: 75

SECTION – A (5 X 2 = 10)

Answer ALL Questions:

1. State parallelogram law of forces.
   (OR)
2. Define moment of a force.

3. Define angle of friction.
   (OR)
4. Define parabolic catenary.

5. Define direct impact.
   (OR)
6. Define linear momentum.

7. What is meant by projectile?
   (OR)
8. Define the term : the range on a plane.

9. Define central orbit.
   (OR)
10. Define equi angular spiral.

SECTION – B (5 X 4 = 20)

Answer ALL Questions:

11. The resultant of two forces P and Q at a certain angle is X and that of P and Q acting at the same angle is also X. The resultant of Q , R acting at the same angle is Y. Prove that $P = \left(X^2 + QR \right)^{1/2}$.
    (OR)
12. State and prove the triangle law of force.

13. State any two laws of friction.
    (OR)
14. Obtain the Cartesian equation of the catenary.

15. Find the velocities of two smooth spheres after a direct impact between them.
    (OR)
16. Write Newton's second and third law of motion.

17. If the greatest height attained by the particle is a quarter of its range on the horizontal plane through the point of projection , find the angle of projection.
    (OR)
18. Find the time of flight of a particle projected.

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19. Obtain the differential equation of a central orbit in p-r-co-ordinates.

(OR)

20. State Kepler's law of motion.

SECTION – C (5 X 9 = 45)

Answer ALL Questions:

21. State and prove Varigon's theorem on moments.

(OR)

22. ABC is a give triangle. Forces P, Q, R acting along the lines OA, OB, OC are in equilibrium. Prove that
    a) $P : Q : R = a^2 (b^2 + c^2 - a^2) : b^2 (c^2 + a^2 - b^2) : c^2 (a^2 + b^2 - c^2)$, if O is the circum centre of the triangle.
    b) $P : Q : R = a : b : c$, if O is the orthocenter of the triangle.

23. A square lamina whose plane in vertical rests with the ends of a side against a rough vertical wall and a rough horizontal ground. If the coefficients of friction, for the ground and the wall are μ , μ' respectively. Show that when the lamina is on the point of moving, the inclination of the side in question to the horizontal is $\tan^{-1}\left(\frac{1-\mu\mu'}{1+2\mu+\mu\mu'}\right)$.

(OR)

24. If α , β be the inclinations to the horizon of the tangents at the extremities of the portion of a common catenary and ℓ the length of the portion, show that the height of the one extremity above the other is $\ell\left\{\frac{\sin\left(\frac{\alpha+\beta}{2}\right)}{\cos\left(\frac{\alpha-\beta}{2}\right)}\right\}$, the two extremities being on one side of the vertex of the catenary.

25. Find the loss of kinetic energy due to direct impact of two smooth spheres.

(OR)

26. Two particles of masses m_1 and m_2 are connected by a light in extensible string passing over a light smooth fixed pulley. If $m_1 < m_2$, find the resulting motion of the system and the tension in the string.

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

(OR)

28. 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 $\frac{v^2}{2g} - \frac{ga^2}{2v^2}$.

29. A particle describes elliptic orbit under a central force towards one focus. v_1 is the speed at the end B of the minor axis and v_2 , v_3 are the speeds at the ends A , A' of the major axis. Show that $v_1^2 = v_2 v_3$.

(OR)

30. Obtain the differential equation of a central orbit in polar coordinates.

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