MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :…………………   Name :………………….

Second Semester B.Sc. Degree Examination, June 2016
First Degree Programme under CBCSS
Foundation Course – II: (for Physics)
AUPY221: Classical Mechanics

Time: **3** Hours   Max. Marks: **80**

SECTION – A

*Answer **ALL** questions in a word or one or two sentences.*

1. Explain weak principle of equivalence.

2. When does the Newton's third law breaks down ?

3. If no torque is acting on a particle, what about its angular momentum ? Give an example.

4. What is tunneling effect ?

5. What are the condition for the orbit be hyperbola, parabola, ellipse and circle ?

6. What do you mean by degree of freedom ?

7. What are generalized coordinates ?

8. What is meant by Scattering Cross Section ?

9. What is the principle of Virtual work ?

10. What do you mean by centre of mass of a system ?

$(10 \times 1 = 10$ **Marks**$)$

SECTION – B

*Answer any **EIGHT** questions, not exceeding a paragraph.*

11. Discuss the validity of Newton's Laws.

12. Explain the work energy theorem.

13. Explain Holonomic constraints and non holonomic constraints.

P.T.O.

14. State and Explain the D'Alemberts Principle.
15. Discuss the motion of a particle in constant electric field.
16. Discuss the superiority of Lagrangian approach over Newtonian approach.
17. Distinguish between centre of mass and centre of gravity.
18. Distinguish between inertial and gravitational masses.
19. Show that central   force is conservative.
20. What do you mean by geo stationary satellites?What are uses of artificial satellites?
21. What are conservative and non conservative constraints ?
22. Show that the curl of a conservative force vanishes.

(8 × 2 = 16 Marks)

SECTION – C

*Short essay type / Problems : Answer any **SIX** questions.*

23. Show that the gravitational force between two masses is conservative.
24. A particle is acted upon by a force $F = kx^2$ at angle of 60° to the axis. . Calculate the work done to displace it from $x = 1$ to $x = 2$ m.
25. Three particles of masses 1kg, 2kg and 3kg are placed at the corners of an equilateral triangle of side 1m. Locate the centre of mass. Given $x_1 = 0$, $x_2 = 1$, $x_3 = 1/2$ and $y_1 = 0$, $y_2 = 0$, $y_3 = \sqrt{3}/2$.
26. A satellite orbits the earth at a height of 500km from its surface. Calculate its
    i). kinetic energy   ii). potential energy and iii). total energy.
    Mass of the satellite = 300kg, mass of the earth = 6×10^{24} kg, radius of the earth = 6.4×10^6 m and G = 6.67×10^{-11} Nm^2 kg^{-2}.
27. Applying D'Alembert's principle to Atwood's machine derive the expression for acceleration.
28. What are the applications of Langrange's equations ?
29. Determine the differential scattering cross section for alpha particles by Pb(Z = 82) nucleus, provided that the initial energy of alpha particle is 11×10^{-13} Joule and scattering angle is 30°.
30. A Saturn year is 29.5 times the earth year. How far is the Saturn from the Sun if the earth is 1.5×10^8 km away from the Sun ?
31. Derive the expression for the motion of a charged particle in a constant magnetic field.

(6 × 4 = 24 Marks)

SECTION – D

*Long essay type : Answer any **TWO** questions.*

32. State and prove the Kepler's three laws of Planetary motion.

33. Derive the Langrangian equations of motion from D' Alembert's principle for conservative system. How will the result be modified for non – conservative systems ?

34. Distinguish between lab frame and Centre of mass frame. Derive the relation between displacement, velocity and angle of scattering in the two frames.

35. Derive the equation of motion of a particle and discuss the motion of a particle
    i). under constant force
    ii). subjected to resistive force

(2 × 15 = 30 Marks)

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