20U316S (Pages: 2) Name: ………..……….….

Reg. No: …………………

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2021
(CUCBCSS-UG)
CC15U PH3 B05 - MECHANICS
(Physics - Core Course)
(2015 to 2018 Admissions – Supplementary/improvement)

Time: Three Hours   Maximum: 80 Marks

Section A
Answer *all* questions. Each question carries 1 mark

1. Explain generalised coordinates.

2. What is frame of reference?

3. Write down the relation between angular momentum and torque.

4. What is a central force? Give two examples.

5. State work - energy theorem.

6. What are holonomic and non-holonomic constraints?

7. State the law of conservation of linear momentum.

8. Define escape velocity. Give its value for earth.

9. What are cyclic co-ordinates?

10. Define proper time.

(10 × 1 = 10 Marks)

Section B
Answer *all* questions. Each question carries 2 marks

11. What is D' Alembert's principle?

12. What are the postulates of special theory of relativity?

13. Explain conservative and non-conservative forces with examples.

14. Distinguish between elastic collision and inelastic collision.

15. Explain time dilation.

16. State and explain the superposition principle.

17. Explain why moon has no atmosphere.

(7 × 2 = 14 Marks)

Section C
Answer any *five* questions. Each question carries 4 marks

18. Derive Lagrange's equation from Hamilton's principle.

19. Briefly explain conservation laws and symmetry properties.

20. Describe Foucault's pendulum.

21. Show that areal velocity of a particle moving under central force is a constant.

22. What is orbital velocity of a satellite? Derive an expression for time period of a satellite.

23. Show that electrostatic force between two charges is conservative.

24. Establish mathematically Einstein's mass energy relation $E = mc^2$.

(5 × 4 = 20 Marks)

Section D
Answer any *four* questions. Each question carries 4 marks

25. The length of a space ship is measured to be exactly half its proper length. What is the speed of space ship relative to the observer's frame?

26. An electron and a positron practically at rest come together and annihilate each other. Calculate the energy released in MeV.

27. F= $(2xy + z)\hat{\imath} + xy\hat{\jmath} + z^2\hat{k}$. Show that F is conservative.

28. Obtain Lagrange's equation for a one- dimensional harmonic oscillator.

29. Prove that generalised momentum corresponding to cyclic co-ordinate is conserved.

30. An artificial satellite is revolving around the earth at a height of 250Km above the surface of the earth. Find the orbital velocity and period of revolution. (g= 9.8 & R=6380Km)

31. A particle moves in a potential energy field $Ax^3 - Bx^2$. Find the expression for force.

(4 × 4 = 16 Marks)

Section E
Answer any *two* questions. Each question carries 10 marks

32. Deduce Kepler's laws from Newton's law of gravitation

33. What is the basic principle of Rocket Propulsion? Derive an expression for final velocity of rocket.

34. Derive an expression for the relativistic variation of mass with velocity.

35. Set up the Lagrangian of a simple pendulum and obtain the equation of motion.

(2 × 10 = 20 Marks)

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