21U311S (Pages: 2) Name: ……..…….….

Reg. No: ……

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(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. What are inertial frames?
2. What is a fictitious force?
3. What are conservative forces?
4. State work - energy Principle.
5. What is center of mass of a system?
6. State law of conservation of angular momentum.
7. Give expression for escape velocity of a planet.
8. What are generalized coordinates?
9. What do you understand by constraints?
10. Explain the term ‘proper length’.

(10 × 1 = 10 Marks)

Section B

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

11. What is the effect of a Coriolis force on a particle falling freely to the earth?
12. Show that for a conservative force the work done around a closed path is zero.
13. Give any three characteristics of central force motions.
14. What is meant by a center of mass frame?
15. Explain time dilation.
16. Why is it difficult to retain atmosphere on smaller planet?
17. State the principle of virtual work.

(7 × 2 = 14 Marks)

Section

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

18. Show that the length of a rod is invariant under Galilean transformation.
19. With the help of potential energy curve, explain the conditions of stable and unstable

equilibrium and a potential well.

20. Show that the angular momentum of a particle moving under central force is conserved.
21. Obtain the expression for the escape velocity of a planet.
22. Explain D'Alembert's principle.
23. Explain 'red shift'. What is its implication?
24. Explain the phenomenon of pair production.

(5 × 4 = 20 Marks)

Section D

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

25. Calculate the effective weight of an astronaut ordinarily weighing 60kg when his rocket moves vertically upward with 5g acceleration.
26. An electron and a positron practically at rest come together and annihilate each other. Calculate the energy released in MeV.
27. $\mathbf{F} = (y^2 - x^2)\hat{i} + 2xy\hat{j}$. Show that **F** is conservative.
28. Obtain Lagrange's equation for the simple pendulum by considering the angle of swing as the generalized coordinate.
29. Three particles of masses 1kg, 2kg and 3kg are at the corners of an equilateral triangle of sides 1m. Locate the center of mass of the system.
30. Estimate the values of escape velocity and acceleration due to gravity on Mars. Mass of Mars =0.11 times that of earth. Radius of mars=0.53 times that of the earth. Radius of the earth = 6370 km.
31. Find the velocity at which the mass of a particle is double its rest mass. $c = 3 \times 10^8\ ms^{-1}$

(4 × 4 = 16 Marks)

Section E

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

32. Explain Michelson-Morley experiment. Discuss the importance of negative results of this experiment.
33. Derive Lagrange's equations from D'Alembert's principle.
34. Deduce Kepler's laws from Newton's law of gravitation.
35. Explain the principle of rocket. Derive expression for the final velocity of rocket.

(2 × 10 = 20 Marks)

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