Reg. No ..... Name .....

B. Sc DEGREE END SEMESTER EXAMINATION - MARCH 2020

SEMESTER 2 : COMPLEMENTARY PHYSICS FOR B Sc MATHEMATICS

COURSE : **19U2CPPHY03 : MECHANICS AND ASTROPHYSICS**

(For Regular - 2019 Admission)

Time : Three Hours Max. Marks: 60

Section A
Answer any 8 (2 marks each)

1. Give two advantages of a Kater's pendulum over compound pendulum?
2. Give the relation between torque and angular momentum.
3. What are the essential features of angular momentum?
4. Differentiate between periodic and oscillatory motion.
5. Plot the variation of potential and kinetic energies with displacement of a harmonic osciilator.
6. Plot the displacement vs time graphs of (a)Over damped and (b) Under damped Oscillator.
7. What do you mean by beats?
8. What do you mean by a progressive wave?
9. Define the term density of a wave. What do you mean by the intensity of a wave?
10. What is astrophysics?

(2 x 8 = 16)

Section B
Answer any 6 (4 marks each)

11. A body of mass 100g oscillates about a horizontal axis at a distance of 20 cm from its center of gravity. If the length of the equivalent simple pendulum be 35 cm, find its moment of interia about the axis of suspension.
12. A grind stone has a moment of Inertia of 800 kgm^2. What constant torque is to be applied on it to develop a speed of 180 rotations per minute in 10 s after starting from rest.
13. A wheel is making revolutions about its axis with uniform angular acceleration. Starting from rest it attains 200 rev/s in 5 seconds. Find the angular acceleration and the angle turned during this time.
14. A particle is moving simple harmonically along a straight line. When the distances of the particle from the mean position are x_1 and x_2, the corresponding velocities are v_1 and v_2. Obtain an expression for Time period in terms of the above said parameters.
15. A simple harmonic motion is represented by the equation $x=10 \sin(2\pi t/10 + \pi/4)$, where x is measured in meters and phase angle in radians. Calculate the frequency, phase, displacement and velocity at 1.25 sec.
16. The equation of a plane progressive wave is given by $y= 10 \sin \pi (0.01x-2t)$, where y and x in cm and t is in seconds. Determine a) amplitude of the wave b) frequency of the wave.
17. A plane progressive wave is given by $y= 0.3 \sin 2\pi (40t-3x)$ m. Determine the wavelength of the wave and the phase difference between two points at x=2 m and x=7.232 m.
18. A constant force of 10N acts on a particle having postion vector r = 2i + 3j. If the force is acting parallel to y axis, what is the torque of the force about the origin of co-ordinate system?

(4 x 6 = 24)

Section C
Answer any 2 (10 marks each)

19. What do you mean by a compound pendulum? Obtain an expression for the time period of a compound pendulum? Show that the centre of suspension and entre of oscillation of a compound pendulum are interchangeable.
20. Derive an expression for moment of Inertia of a disc about: a) axis passing through its center and perpendicular to its plane, b) its diameter, c) tangent in its own plane, d) tangent perpendicular to its plane.
21. Set up the differential equation for a damped harmonic oscillator and discuss the various solutions (obtain the expression for the displacement as a function of time and plot the nature)
22. Explain the formation of white dwarfs , neutron stars and black holes.

(10 x 2 = 20)