1B3N17097 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2017

PH3B03 - Mechanics

(2016 Admission onwards)

Max. Time: 3 hours Max. Marks: 80

Section A

Answer all questions. Each question carries 1 mark

1 The frame of reference attached to .....can be thought as an ideal inertial frame for studying the solar system.
(Moon, Centre of earth, Sun, Distant stars)

2 Foucault pendulum demonstrates the .....
(rotation of earth, revolution of earth, rotation of moon, earth's spherical shape)

3 If **F** is a conservative force, we have ..... $(\nabla.\mathbf{F} = 0,\ \nabla\times\mathbf{F} = 0,\ \frac{\partial \mathbf{F}}{\partial t} = 0,\ \int_A^B \mathbf{F}.d\mathbf{l} = 0)$

4 The centre of mass of a ring .....
(is at its centre, is at a point on the rim, depends on the axis of rotation, depends on the gravitational force)

5 The expression for escape velocity in terms of mass and radius of the planet is.....

6 .....(name the scientist) formulated three laws to describe the planetary motion.

7 An ant moves on a ring which is kept fixed. The ant has ..... degree(s) of freedom.

8 For a conservative system, the Hamiltonian is .....
(T+V, T–V, 2T+V, 2T–V)

State True/False

9 Charge is a world scalar (True/False).

10 The rest mass of x-rays is zero (True/False).

(10 × 1 = 10 Marks)

Section B

Answer all questions. Each question carries 2 marks

11 What is Coriolis force? Give its expression.

12 Name one example each for a conservative force and a non conservative force.

13 What is meant by areal velocity in planetary motion?

14 Write the expression for the net gravitational potential energy of an assembly of 'n' discrete masses.

15 What is scleronomic constraints in mechanics? Give an example.

16 What is time dilation? Give the expression.

17 What is a cyclic coordinate? Give an example.

(7 × 2 =14 Marks)

Section C

Answer any 5 questions. Each question carries 4 marks

18 Derive Galilean coordinate transformation equations.

19 Explain the features of potential energy curve.

20 Obtain the expression for the centre of mass of a right circular cone.

21 Derive Langrange's equations of motions both for r and θ for a particle moving under central force field.

22 Show that simultaneity is relative according to the special theory of relativity.

23 Derive the mass – energy relation.

24 Show that all central forces are conservative.

(5 × 4 = 20 Marks)

Section D

Answer any 4 questions. Each question carries 4 marks

25 A person is travelling in the east direction with a speed of 2 km/hr. He finds that the wind seems to blow from the North. When he doubles his speed, the wind appears to come from North-East. Determine the velocity vector of the wind.

26 Calculate the speed of an electron which has kinetic energy 2 MeV. ($m_e = 9.1 \times 10^{-31}$ kg)

27 A ring of mass 2 kg and radius 0.50 m is rolling down along the x-axis with a speed 3 m/s in the x-y plane. Calculate the angular momentum of the ring about the z-axis.

28 An artificial satellite is revolving around the earth at a height of 250 km above the surface of the earth. Find the orbital velocity and period of revolution. ($g = 9.8$ m/s^2, $R_e = 6380$ km.)

29 Using the principle of virtual work, derive the condition for static equilibrium for a Atwood's machine.

30 What is the mean life of a π^+ meson travelling with $v = 0.73c$, if the proper mean life time is 2.3×10^{-8} s.

31 If ϕ is the latitude; prove that the angle turned per hour by a Foucault's pendulum is $15^\circ \sin\phi$.

(4 × 4 = 16 Marks)

Section E

Answer any 2 questions. Each question carries 10 marks

32 Derive an expression for the apparent force acting on a particle having a force **F** on it and moving with velocity **v′** in a rotating frame rotating with angular velocity ω.

33 Obtain Langrange's equation of motion from D'Alembert's principle for a conservative force field.

34 Describe Michel-Morley experiment and the interpretation of the negative result.

35 Describe the elastic collision is one dimension and its various special cases.

(2 × 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2017

PH3C03 - Optics, Laser, Electronics and Communication

(2016 Admission onwards)

Max. Time: 3 hours Max. Marks: 64

Section A (One Word)

Answer All Questions. Each Question carries one mark

1. Optical path is stationary for all paths of light in the case of .....
2. When two coherent light waves of same intensity superimpose one another, the ratio of minimum intensity to maximum intensity is .....
3. In Fresnel's double mirror arrangement, coherent waves are produced by means of ..... (refraction, reflection, polarization, diffraction)
4. In diffraction grating spectrum, principal maxima are produced due to ..... (diffraction, interference, refraction, polarization)
5. Soap bubble appears multicolored in white light due to .....
6. The ripple factor of a full wave rectifier is .....
7. Exclusive OR gate produces a high output, when.....
8. What is the minimum number of energy levels required by a lasing medium to have laser emission?
9. In He-Ne Laser, the active medium is .....
10. When the output of a NOR gate is connected to the input of NOT gate, it works as ..... gate.

(10 x 1 = 10 Marks)

Section B (Short Answer Questions)

Answer all questions.

Each question carries 2 marks.

11. Why are coherent waves required to produce a sustained interference pattern?
12. The central spot of Newton's Rings is dark instead of white. Why?
13. What is meant by resolving power of a grating?
14. What is a Flip flop?
15. Construct the basic gates using universal gates.
16. Draw and explain the working of π filter.
17. What is population inversion? Why is it necessary in laser production?

(7 x 2 =1 4 Marks)

Section C (Paragraph Questions)
Answer any two questions
Each question carries 4 marks

18. Deduce the laws of refraction from Fermat's Principle.
19. Explain the construction and working of a zone plate. How does it differ from a convex lens?
20. Explain the production of circularly polarized light.
21. Write a brief note on electronic adders.
22. Explain the pumping mechanism and laser production in Ruby laser.

(2 x 4 = 8 Marks)

Section D (Problems)
Answer any three questions
Each question carries 4 marks

23. A parallel beam of visible light is incident on a thin film of refractive index 1.38 and thickness $9x10^{-5}$cm and is refracted at an angle of 60°. Calculate the wavelengths of light (in visible region) for which the film will be non-reflecting.
24. On introducing a Polari meter tube 25cm long and containing sugar solution of unknown strength, it is found that the plane of polarization is rotated through 10°. Find the strength of sugar solution in $8g/cm^3$. Given that the specific rotation of sugar solution is 60° per decimeter per unit concentration.
25. A plane polarized light passes through a uniaxial crystal with its optic axis parallel to the faces. Determine the least thickness of the plate for which the emergent beam is plane polarized. Given μ_e=1.5533 and μ_o=1.5442, λ=500nm.
26. A transistor is connected in common emitter (CE) configuration in which collector supply is 8V and the voltage drop across the resistor R_c connected in collector circuit is 0.5V. the value of R_c =800Ω. If α=0.96, determine the i) collector –emitter voltage ii) base current.
27. A crystal diode having internal resistance r_f=20Ω is used in half wave rectifier. If the applied voltage is V=50sinωt and load resistance R_L=800Ω, find i) DC output power ii) AC output power iii) Dc output voltage and iv) efficiency.

(3 x 4 = 12 Marks)

Section E (Essays)
Answer any two questions
Each question carries 10marks

28. With the help of a neat diagram, explain the construction and working of Fresnel's biprism. Describe the determination of wavelength of an unknown monochromatic light using biprism, if the refractive index and refracting angle of biprism are not known.
29. Describe the Fraunhofer diffraction due to a single slit, with necessary diagram. Draw the intensity distribution curve. How does it differ from double slit interference pattern?
30. Explain positive feedback and negative feedback in transistor amplifiers. With the help of neat diagram, explain how a Hartley Oscillator produces sustained oscillations.

(2 x 10 = 10 Marks)