FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Third Semester B.Sc Physics Degree Examination, November 2019
BPHY3B03 – Mechanics
(2018 Admission onwards)

Time: 3 hours   Max. Marks: 80

Section A
Answer All questions each question carries 1 Mark

1. Newton's laws do not hold true for _____ frame of reference.

2. Work done by a conservative force in a closed loop is _____

3. Spatial invariance leads to the conservation of _____

4. The _____ of a system of particles is constant if the resulting torque acting on the system is zero.

5. The _____ velocity will just take a body beyond the gravitational field of the earth.

6. According to Kepler, Planetary orbits are _____

7. _____ constraints are independent of time.

8. Michelson-Morley experiment leads to the rejection of the _____

9. Twin paradox is related to the relativistic effect of _____

10. A particle with _____ rest mass travels with the speed of light.

(1 x 10 = 10 Marks)

Section B.
Answer All questions each question carries 2 Marks

11. Is the centrifugal force fictitious one? Explain

12. What is the physical significance of conservation of energy?

13. Why we call centre of mass frame of reference as "zero-momentum frame"?

14. Show that angular momentum is conserved in a central force field

15. Show that the generalized momentum conjugate to cyclic coordinate is conserved

16. What are space- like and time-like intervals?

17. Show that Lorentz transformations reduce to Galilean transformations at low velocities.

(2 x 7 = 14 Marks)

Section C.
Answer Any Five questions each question carries 4 Marks

18. What is Coriolis force? Explain the effect of the Coriolis force on a freely falling body?

19. Show that the total energy of a particle moving in a conservative force field remains constant.

20. Prove that the areal velocity remains constant. when the particle moves in the influence of a central force.

21. Derive Kepler's law of period.

22. Write down the Lagrangian of an Atwood's machine and hence derive the equation of motion.

23. Write a brief note on mass-energy equivalence

24. What are Four vectors? Discuss one example

(4 x 5 = 20 Marks

Section D.
Answer Any Four questions each question carries 4 Marks

25. Calculate the fictitious force and the total force on a body of mass 5 kg in a frame of reference moving (1) vertically upwards, and (2) vertically downwards, with an acceleration of 5 m/s^2.

26. A particle moves along half the circumference of a circle of 1 metre radius. Calculate the work done if the force at any point is inclined at 60^0 to the tangent at that point and has 5 newtons magnitude,

27. The maximum and minimum distances of a comet from the sun are 1.4×10^{12} m and 7×10^{10} m respectively. If its velocity nearest to the sun is 6×10^4 m/sec, what is the velocity when farthest. Assume in both positions that comet is moving in circular orbit.

28. Distance from the Sun to Neptune is roughly 30 times the distance of the Earth from the Sun. Use Kepler's third law to make an estimate of the period of Neptune in years

29. The eccentricity of the earth's orbit is 0.0167. Calculate the ratio of maximum and minimum speeds of the earth in its orbit.

30. It is estimated that a cosmic ray primary proton can have energy up to 10^{13} MeV. Our galaxy has a diameter about 10^5 years. How long does it take the proton to traverse the galaxy, in its own rest frame? (1 eV = 1.6×10^{-19} J, M_p=1.6×10^{-27} kg)

31. What is the potential energy of a mass 1 kg on the surface of the earth, referred to zero potential energy at infinite distance? Calculate also its potential energy at a distance of 10^5 km from the centre of the earth

(4 x 4 = 16 Marks

Section E.
Answer Any two questions each question carries 10 Mark

32. Discuss the principle of working of a rocket. Obtain the expression for final velocity of a rocket.

33. Deduce Kepler's first law from Newton's laws.

34. State d' Alembert's principle and derive Lagrange's equations.

35. State postulates of relativity and derive Lorentz transformations.

(2 x 10 = 20 Marks

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2019

BPHY3C03 – Optics, Laser, Electronics and Communication

(2018 Admission onwards)

Time: 3 hours   Max. Marks: 64

Section A (One Word)

Answer all questions.

Each question carries 1 mark.

1. The ratio of intensities of two waves is given by 4:1. The ratio of amplitudes of the two waves is ?

   a) 2:1   b) 1:2   c) 4:1   d) 1:4

2. In the break down region, a zener diode behave like a .... source

   a) constant voltage source b)constant current source c) either a or b d) none of these

3. In a transistor $\beta = 100$ and collector current is 10mA, then I_E is

   a) 100mA   b) 100.1mA   c)110mA   d) none of these

4. When the output of a NAND gate is connected to the input of a NOT gate it works as a .... gate.

5. In the interference pattern, the energy is

   a) Destroyed at the position of minima   b) created at the position of maxima

   c) Conserved and distributed   d) created at all positions

6. In a ruby laser .... ions is responsible for lasing action.

7. The angle of biprism is

   a)180°   b)179°   c) 1°   d) 90°

8. Dispersive power of a grating is defined as the rate of change of angle of .... with respect to wavelength

9. The relation between β and α is?

   a) $\beta = \frac{1}{1-\alpha}$ b) $\beta = \frac{1-\alpha}{\alpha}$ c) $\beta = \frac{\alpha}{1-\alpha}$ d) $\beta = \frac{\alpha}{1+\alpha}$

10. When light reflects from spherical reflector, light prefers to take ....

                                                         (10 x 1 = 10 marks)

Section B (Short Answer Questions)

Answer all questions

Each question carries 2 marks.

11. Write the conditions for constructive and destructive interferences.

12. Define Optical path length.

13. What are filter circuits?

14. Explain Fermat's Principle

15. Draw the circuit diagram of a pnp transistor.

16. What is meant by efficiency of a rectifier? What is its value for a full wave rectifier?

17. Two independent sources cannot produce interference. Why?

(7 x 2 = 14 marks)

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

18. Explain the fundamental gates with truth table

19. Explain Fresnel two mirror arrangements with the help of a diagram.

20. Explain the input characteristics of a CE configuration transistor

21. Deduce the laws of refraction using Fermat's principle

22. Find the efficiency of a full wave rectifier.

(2 x 4 = 8 marks)

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

23. When −ve voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50. Calculate the fraction of the output voltage feedback?

24. A biprism is kept at a distance of 5cm from slit illuminated by a monochromatic light of wavelength 5890Å. The width of the fringes formed on a screen at 75cm from the biprism is 9.424×10^{-2} cm. Find the separation between the coherent sources.

25. In Youngs experiment, the interference pattern is found to have an intensity ratio between the bright and dark fringes as 9. What is the ratio of (a) intensities and (b) amplitudes of the two interfering waves?

26. Using the truth table show that (i) $A + AB = A$ (ii) $A + \bar{A}B = A+B$

27. Find the thickness of a a) quarter wave plate; b) half wave plate when light of wavelength 589nm is used ($\mu_O = 1.55$ and $\mu_E = 1.54$)

(3 x 4 = 12 marks)

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

28. Explain the superposition principle and obtain the expression for the resultant intensity of two waves. What are the conditions of maximum and minimum intensity?

29. Explain in detail with neat circuit diagram the input characteristics. output characteristics and current amplification factor of common base transistor configuration.

30. Describe an experiment to determine the wavelength of sodium light using Fresnel biprism with the help of a diagram.

(2 x 10 = 20 marks)