1B3N16216 (Pages :2) Reg. No:.....
Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2016

PH3B03 - Mechanics

(2015 Admission onwards)

Max. Time: 3 hours Max. Marks: 80

Section A

Answer all

1. The expression for Coriolis force is .....
2. The ratio of radii of planets A and B is ***k***, the ratio of acceleration due to gravity on them is ***r***. Then the ratio of escape velocity from them .....
3. The homogeneity of space leads to law of conservation of .....
4. The relation between angular momentum (L) and torque (τ) of a system is given by .....
5. Two bodies of masses m_1 and m_2 have equal momentum. Their kinetic energies E_1 and E_2 are in the ratio .....
6. Lagrangian of a system is given by L, where T is kinetic energy and U is potential energy of the system, then L =.....
7. A conservative force **F** is related to the potential energy U by the relation.....
8. The energy equivalent of 1 amu is .....
9. The motion of one projectile as seen from another projectile will always be.....
10. A clock is moving with a velocity c/3. In one hour, clock appears to be slow by.....

(10 × 1 =10)

Section B

Answer all

11. Differentiate between real and fictitious force?
12. Bring out impact of negative results of Michelson-Morley experiment?
13. What do you understand by proper length and proper time ?
14. What is meant by cyclic co-ordinates ?
15. Distinguish between conservative and non conservative forces ?
16. The atmosphere on the moon surface is rarer. Why ?
17. Prove that the centripetal force acting on a particle doing uniform circular motion is conservative?

(7 ×2 = 14)

Answer any *five*

18. Draw a potential energy curve for conservative force and briefly explain various equilibrium points.
19. When a particle moves under the action of a central force prove that its angular momentum is conserved and the motion takes place in a plane?
20. Show that $x^2 - c^2t^2$ is invariant under Lorentz transformation.
21. What is a Faucault pendulum ? How does it enables us to demonstrate the rotation of the earth about its own axis ?
22. Derive relativistic expression for the kinetic energy of a particle ? Show that it reduces to the classical expression when $\mathbf{v} << c$.
23. What is conservation of angular momentum? Discuss the shape of galaxies.
24. Obtain the expression for escape velocity and orbital velocity of a planet of mass M and radius R ?

(5 x 4 = 20)

Section D

Answer any *four*

25. Find the mass of electron and kinetic energy of an electron moving with a velocity is 0.99c
26. If a mass 50 kg is raised to a height 2R from earth's surface, calculate the change in potential energy . (g = 9.8 m/s2 and R=6.4×106m)
27. Find Gravitational potential and Field due to a thin spherical shell of radius R. Sketch the variation?
28. Particle moves in potential energy field $U= Uo-px+Qx^2$. Find the expression for the force, force constant. At what point the force vanishes? Check this stable or unstable equilibrium?
29. Arrive at the Lagrangian equation of motion for one dimensional harmonic oscillator?
30. Check the Force $F = (2xy + yz^2)\hat{i} + (x^2 + xz^2)\hat{j} + 2xyz\hat{k}$ is conservative or not ?
31. If the centre of mass of three particles of masses 10, 20 and 30 gm be at the point (1,1,1) m, then where should be the fourth particle of 50 gm be placed so that the combined centre of mass be at (0,0,0)

(4 x 4 =16)

Section E

Answer any two questions

32. Describe the principle of a rocket. Derive the equation for instantaneous velocity and burnout velocity of rocket?
33. What are generalized coordinates? Derive Lagrange's equation from d'Alemberts Principle
34. Derive variation of mass with velocity ?
35. Define centre of mass. Locate centre of mass of right circular cone.

(2 × 10 = 20)

1B3N16217 (Pages :2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2016

PH3C03 - Optics, Laser, Electronics and Communication

(2015 Admission onwards)

Max. Time: 3 hours Max. Marks: 64

Section A (one word)

Answer all questions. Each question carries 1 mark

1 ..... is defined as the product of geometrical distance and refractive index.

2 Two interfering monochromatic light waves have the amplitudes in the ratio 5:1. The ratio of the maximum intensity to minimum intensity on interference is .....

3 The area of n^{th} Fresnel's half period zones for a wave length λ, when the screen is at a distance of 'b' from the diffracting element is .....

4 The ripple factor of a full wave rectifier is .....

5 The angle of incidence for which the reflected light is completely plane polarized is called the .....

6 Thrissur radio station transmits AM radio waves with a carrier frequency of 630 KHZ. If the signal frequency is 5 KHZ, the lower side band frequency of the modulated signal is .....

7 LASER is an acronym for (i.e., expand the term LASER) .....

8 .....logic gate is an example of a universal gate.

9 The division of ..... is used in air wedge and Newton's rings arrangement to get coherent beams form a single source.

10 .....circuit is used to remove the a.c. components from rectified outputs.

(10 × 1 = 10)

Section B (Short answer questions)

11 Write the Fermat's principle of least time.

12 What are the conditions to have coherent beam of light?

13 What are the differences in Fresnel and Fraunhofer diffractions?

14 What is a quarter wave plate?

15 What is meant by bandwidth in a transistor amplifier?

16 What are the minimum requirements for a lasing medium?

17 Construct a Not gate using NOR gates.

(7 × 2 =14)

Section C (Paragraph questions)

Answer **any 2** questions. Each question carries 4 marks

18 Explain the working and construction of a semiconducting laser.

19 Explain the working of a Zenar diode as voltage stabiliser.

20 Derive the conditions for maxima and minima for Fraunhofer single slit experiments.

21 What is modulation? What are the various types of modulations used in analogue communication?

22 Explain with example the two types of optical activity and specific rotation.

(2 × 4 = 8)

Section D (Problems)

Answer any 3 questions. Each question carries 4 marks

23 Specific rotation of sugar solution is 65°. If the glass tube of the saccharimeter having length 20 cm. contains sugar solution of concentration 0.1 gcm^{-3}, through what angle the plane of polarisation is rotated?

24 A plane transmission grating has 5000 lines per cm for a length of 6 cm. If the wavelength under study is nearly 5×10^{-7} m, find the resolving power of the grating for the first order and the smallest wavelength that can be resolved.

25 An NPN silicon transistor has $V_{cc} = 6V$ and the collector resistance 2.5 kΩ. Find the maximum collector current that can be allowed during the amplification of the signal for faithful amplification. (Hint: For faithful amplification V_{CE} should not be less than 1 V and assume that there is no potential difference across the emitter and ground.)

26 Construct OR and AND gates using NAND gates.

27 In Fresnel biprism experiment using sodium light (λ = 5893Å) we get 62 fringes in the field of view of the eyepiece. How many fringes will be observed within this field of view, if the sodium light is replaced by a wavelength λ = 5461Å?

(3 × 4 = 12)

Section E (Essays)

Answer **any 2** questions. Each question carries 10 marks

28 Explain the determination of the wavelength λ of a monochromatic light using Newton's rings arrangements in the reflected system.

29 Explain the theory of production of circularly and elliptically polarized lights using the crystals showing double refraction.

30 (a)Draw the simple Common Base (C.B.), Common Emitter (C.E.) and Common Collector (C.C.) configurations using NPN transistors with proper biasing.

(b)Derive the relation between the current amplification factors α, β and γ of an NPN transistor.

(c)Compare at least three characteristics of C.B., C.E. and C.C. configurations.

(2 × 10 = 20)

1M3N16219 (Pages :2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2016

PHY3C09 - Quantum Mechanics

(2015 Admission onwards)

Max. Time: 3 hours Max. Weightage: 36

PART A

Answer **all** questions

All questions carry 1 weightage

1. Obtain the condition for validity of WKB approximation.
2. In WKB approximation, why we need connection formula.
3. Obtain the expression for transition probability when a system is perturbed by a potential $v(x,t)$
4. What is dipole approximation.
5. Obtain Schrodinger equation from Ritz variation principle.
6. Discuss how we can get correct eigen value by Ritz variational principle.
7. Show that Schrodinger equation is not Lorentz invariant.
8. Obtain the expression for Dirac matrices.
9. Discuss the stability of Dirac vacuum.
10. Why we say about the helicity of neutrinos instead of its spin.
11. What is meant by second quantization. Why it is called second quantization?.
12. Obtain the expression for canonical momentum of the Schrodinger field.

(12 x 1 = 12)

PART B

Answer any **two** questions

Each question carry 6 weightage

13. Discuss variation method for the evaluation of eigen values. Obtain the ground state energy of hydrogen atom by variation method.
14. Use WKB method to calculate transmission and reflection coefficient for a particle penetrating through an arbitrary potential V (x).
15. Obtain the expression for Fermi's Golden rule.
16. What are the drawbacks of Klein-Gorden equation. Discuss how these problems are resolved in Dirac theory.

(2 x 6= 12)

PART C

Answer any **four** questions

Each question carries 3 weightage

17. Calculate eigen values of a matrix $\begin{pmatrix} 1 & 0 & 3 \\ 5 & 2 & 1 \\ 0 & 6 & 3 \end{pmatrix}$ by perturbation method.

18 In the functional defined as $E\left[|\psi\rangle\right] = \dfrac{\langle\psi|\hat{\mathrm{H}}|\psi\rangle}{\langle\psi|\psi\rangle}$

If $|\psi\rangle$ is orthogonal to ground state $|\psi_0\rangle$, show that $E\left[|\psi\rangle\right] > E_1$, the first excited state.

19 One dimensional harmonic oscillator of charge e is perturbed by an electric field

$$\mathrm{E} = 2\mathrm{E}_0 \cos\omega \mathrm{t}$$

Show that transition can take place only to the first excited state.

20 Obtain Bohr- sommerfeld quantization condition from WKB method.

21 Show that $(\sigma \,.\, \mathbf{a})\,(\sigma \,.\mathrm{b}) = (\mathbf{a}.\mathbf{b}) + \mathrm{i}\,\sigma \,.\, (\mathbf{a} \times \mathbf{b})$. Where σ are Pauli's spin marrices and **a** and **b** are polar three vectors.

22 Show that $\left(\overline{\psi}\gamma^{\mu}\gamma^{\nu}\psi\right)$ behaves like a second rank tensor under Lorentz transformation .

(4 x 3 = 12)