D 73760 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CUCBCSS—UG) SPECIAL DEGREE EXAMINATION NOVEMBER 2019

Physics/Applied Physics

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*
Answer in a word **or** *phrase*

1. State Fermat's principle
2. Two light waves of amplitude 'a' and '$2a$' super impose each other. What is the intensity of a bright band ?
3. In Newtons' ring by reflection the central fringe is ———.
4. In Fraunhofer class of diffraction the source and screen are at at ——— distance
5. What is the shape of wave front for a point source.
6. Plane of vibration and plane of polarization are ——— to each other
7. Give an example for polarizer.
8. In LASER what type of emission takes place ?
9. Give an example of three level LASER.
10. What is a rectifier ?

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*
Answer in two **or** *three sentences*

11. Define coherent sources.
12. Briefly explain the colours of thin film.
13. What are Newton's rings ?
14. Obtain the relation connecting α, β and Y.
15. What is a half period element ? Why is it so called ?

Turn over

16. How you can produce plane polarized light ?

17. What is population inversion ?

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*
Answer in **one paragraph.**

18. Explain interference in a wedge shaped thin film.

19. Differentiate Fresnel and Fraunhofer diffractions.

20. Write note on LC and RC oscillators.

21. Write a note on population inversion.

22. Briefly explain modulation and demodulation.

(3 × 4 = 12 marks)

Section D

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

23. Two coherent sources whose intensity ratio is 100 : 1 produce interference fringes. Deduce the ratio of maximum intensity to minimum intensity in fringe system.

24. In young's experiment fringes of 0.327 mm. wide are obtained on a screen 30 cm. from the slits. The distance between the slits is 0.5 mm. What is the wavelength of the light used ?

25. What is the radius of the first zone in a zone plate of focal length 40 cm. for a light of wavelength 5000 A°.

26. If the plane of vibration of the incident beam makes an angle. 30° with the optic axis, compare the intensities of extraordinary and ordinary light.

27. Calculate the velocities of O and E rays in calcite in a plane perpendicular to the optic axis. Given $\mu_0 = 1.486$.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 8 *marks.*

28. Discuss the theory of Young's double slit experiment. Derive the expression for band width.

29. What is the principle of laser ? Explain the production of Ruby laser

30. Briefly explain Logic gates, Universal gates, Exclusive OR and Exclusive NOR.

(2 × 8 = 16 marks)

D 73759 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER (CUCBCSS—UG) SPECIAL DEGREE EXAMINATION NOVEMBER 2019

Physics/Applied Physics

PHY 3B 03/APY 3B 03—MECHANICS

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*

Each question carries 1 *mark.*

1. The path traced by the Foucault's pendulum during one complete turn is ————.
2. Rest mass of photon is ————.
3. A frame of reference attached on earth is inertial or non inertial frame of reference ?
4. Write down expression for centrifugal force.
5. Give an example of non-conservative forces ?
6. What is the relation between conservative force and potential ?
7. Ii the external torque is absent the value of angular momentum of the system is ————.
8. Write the expression for escape velocity.
9. Length measured by an observer for him the object rest is ————.
10. Write the mathematical expression for D'Alembert's principle.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*

Each question carries 2 *marks.*

11. Define cyclic co-ordinates. Give examples.
12. Write down the postulates of special theory of relativity.
13. Why hydrogen atom escape from earth's surface more readily than oxygen ?
14. Define center of mass of frame of reference.
15. Derive the expression for center of mass of triangular lamina.

Turn over

16. Calculate the escape velocity of earth.

17. What is torque ? How it is related to angular momentum ?

(7 × 2 = 14 marks)

Section C

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

18. Set up the Lagrangian and Lagrangian equation for Atwood's machine.

19. What is meant by Hamiltonian ? Derive the expression for the Hamiltonian.

20. What is meant by time dialation ? Derive the expression for time dialation.

21. Derive the expression for relativistic velocity addition formula.

22. Define Kepler's law of planetary motion. Deduce Kepler's second law.

23. Show that the escape velocity of earth is $\sqrt{2}$ times the orbital velocity of artificial satellite orbiting close to earth.

24. What is meant by pseudo force ? Derive the expression for Corioli's force. Explain its effects

(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 (I) upward and (II) downward with 6g acceleration.

26. A meson has a speed 0.8C relative to the ground. Find how far the meson travels relative to the ground if its speed remains constant at the time of its flight relative to the system in which it is rest, is 2×10^{-8} second.

27. Calculate the speed of an electron which has kinetic energy 2MeV.

28. A particle moves along half the circumference of a circle of 1 metre radius. Calculate the work done if the force at a point is inclined at 60° to the tangent at the point and has 5 Newton magnitude.

29. If $F = (2xy + z^2)i + x^2j + 2xzk$, then show that it is conservative.

30. Two particles of masses 100g and 300g have at a given position $(2i + 5j + 13k)m$ and $(-6i + 4j - 2k)m$ respectively, and the velocities $(10i - 7j - 3k)m/s$ and $(7i - 9j + 6k)m/s$ respectively. Deduce

    a) Instantaneous position of centre of mass.

    b) Velocity of centre of mass.

31. Set up the Lagrangian equation of motion for a particle moving under central force.

(4 × 4 = 16 marks)

Section E

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

32. Explain Michelson Morley experiment and give the significance of negative result.

33. Discuss the principle of virtual work. Derive Lagrangian equation of motion from it.

34. Derive the expression for relativistic variation of mass.

35. Derive Newton's laws of gravitation from Kepler's law of motion.

(2 × 10 = 20 marks)

D 12041 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS–UG) DEGREE EXAMINATION, NOVEMBER 2021

Applied Physics

APH 3C 03—DIGITAL INTEGRATED CIRCUITS

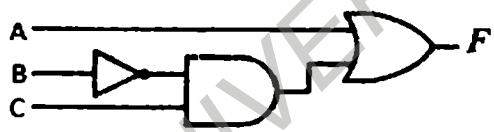
(2019–2020 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. How can a NOR gate be used as an inverter ?
2. What is meant by a bubbled AND gate?
3. Identify the Boolean function and give its truth table from the following :



4. Write down the possible minterms of a two variable K- map f (A, B).
5. What are the advantages of CMOS ICs over TTL ?
6. What is meant by fan-out of a logic gate ?
7. What is meant by toggle condition in JK flip flops ?
8. Explain the operation of a D flip flop.
9. Why asynchronous counters are called ripple counters ?
10. How many flip flops are needed in a register used to store an eight bit binary number ?
11. How many flip flops are needed to construct a mod-6 counter ?
12. What are the features of an XOR gate ?

(8 × 3 = 24 marks)

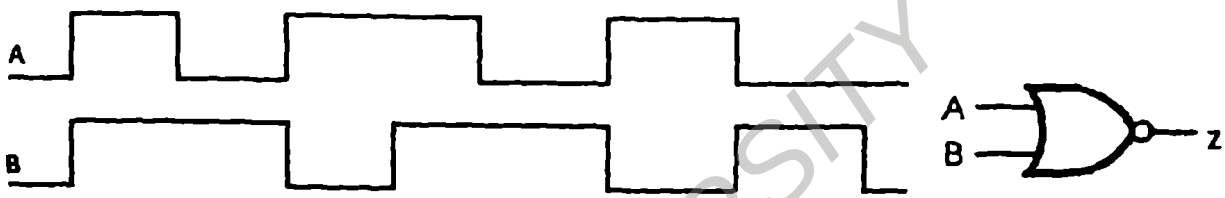
Section B

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Using Karnaugh map, obtain a simplified Boolean equation for the following logic equation :

$Y = \bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + AB\bar{C}\bar{D} + \bar{A}\bar{B}CD + A\bar{B}CD + \bar{A}\bar{B}C\bar{D} + \bar{A}BC\bar{D} + ABC\bar{D} + A\bar{B}C\bar{D}$

14. For a two input NOR gate, determine the output waveform corresponding to the input waveforms A and B as given :



15. Explain the working of a CMOS NAND gate.
16. Explain the working of a TTL NOR gate.
17. With logic circuit, truth table and timing diagram explain the operation of JK flip flop.
18. With logic circuit, explain the operation of a serial in-serial out shift register.
19. Explain the principle of a full adder.

(5 × 5 = 25 marks)

Section C

Answer any **one** *question.*
The question carries 11 *marks.*

20. Explain the different methods to interface a TTL to CMOS.
21. Explain how an analog signal be converted into the corresponding digital signal ?

(1 × 11 = 11 marks)

D 12040 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION NOVEMBER 2021

Physics/Applied Physics

PHY 3C 03—MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

(2019—2020 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What do you mean by centrifugal force ? What is its direction ? Give an expression for the centrifugal force.
2. What do you mean by a conservative force ? Is the central force conservative ?
3. What was the purpose of Michelson-Morley experiment ? Why we say that the result of Michelson-Morley experiment was negative ?
4. What do you mean by twin paradox ?
5. Write down the principle of equivalence of mass and energy. Give an experiment to illustrate the principle.
6. Write down the relativistic expression connecting energy and momentum. What are the terms involved ?
7. What do you mean by simple harmonic motion? Give the differential equation for a simple harmonic oscillator.
8. Give an expression for the time period of a loaded spring system. What are the terms involved in the expression ?
9. Give an example of an anharmonic oscillator. What is the effect of increasing the amplitude on the time period of an anharmonic oscillator ?

10. What is ultraviolet catastrophe ?

11. Write down the general eigen value equation. Give the momentum operator in three dimensions.

12. Write down the time independent Schrödinger equation. What are stationary states ?

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Obtain Galilean transformation equations. Show that the distance between two points is invariant under a Galilean transformation.

14. Determine the fictitious force and the total force acting on a freely falling body of mass 20 kg with reference to a frame moving with a downward acceleration of $6 m/sec^2$.

15. Three interacting particles of masses 100, 200 and 400 grams, each having a velocity of 20 m/s magnitude move along the positive X, Y, Z axes, having unit vectors $\hat{i}, \hat{j}, \hat{k}$, respectively. Estimate the velocity of the first particle, if due to the force of attraction, the third particle stops and the velocity of the second particle becomes $\left(10\,\hat{j} + 5\,\hat{k}\right)$.

16. In a laboratory, the life-time of a particle moving with speed 2.8×10^8 m/sec is observed to be 2.5×10^{-7} sec. Determine the proper life-time of the particle.

17. A plane progressive wave is given by $y = 0.3 \sin (40t - 3x)$ m. Determine the wavelength of the wave and the phase difference between two points at $x = 2$ m and $x = 7.232$ m.

18. The photoelectric threshold for a material is 3000 A°. Determine the kinetic energy of an electron emitted from it by a radiation of wavelength 1000 A°

19. An electron moves in the x direction with a speed of 3.6×10^6 m/s. Suppose that we can measure its speed to a precision of 1 %. With what precision can we simultaneously measure its position ?

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss the conservation theorem for angular momentum. Illustrate the origin for the shape of a galaxy using the angular momentum conservation theorem.

21. What do you mean by a simple pendulum. Obtain an expression for the time period of a simple pendulum.

(1 × 11 = 11 marks)

D 12039 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION NOVEMBER 2021

Physics/Applied Physics

PHY 3B 03/APH 3B 03—ELECTRODYNAMICS—I

(2019—2020 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Explain Coulomb's law in electrostatics.
2. Give an expression for the electric field due to a surface charge. Explain the terms involved.
3. How is electric field and potential related in electrostatics ? What is Laplace's equation in electrostatics ?
4. Write down the relation connecting polarization and electric field in linear dielectrics. What do you mean by a polar dielectric ?
5. Write down Gauss's law in presence of a dielectric.
6. Give the relation connecting permittivity and susceptibility in linear dielectrics. Explain the terms involved. How is relative permittivity connected to susceptibility ?
7. Check whether the following statements are true or false : (i) stationary charges create constant magnetic field ; and (ii) a moving point charge cannot constitute a steady current.
8. Give Biot-Savart law. Explain the terms involved.
9. Give the differential and integral forms of Ampere's law in magnetostatics.
10. Write down the relation connecting magnetic flux density B and magnetic vector potential A. What is the divergence of A ?

11. Explain the physical meaning of the equation of continuity.

12. What is the basic difference between electric and magnetic polarizations ?

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Prove that the divergence of the curl of a vector is always zero.

14. Check whether $\mathrm{E} = k\left[xy\hat{x} + 2yz\hat{y} + 3xz\hat{z}\right]$, is a possible electrostatic field ? Here, k is a constant with appropriate units.

15. Show that the energy of an ideal dipole p in an electric field E is given by $\mathrm{U} = -p.\mathrm{E}$.

16. Compare electrostatics and magnetostatics in terms of the Maxwell's equations applicable. Compare the nature of the fields with respect to their source.

17. Define the term surface current density. A current I flows down a wire of radius a. If the current is uniformly distributed over the surface, what is the surface current density ?

18. Write an expression for the field of a magnetized object. Explain the terms involved.

19. Explain the domain model of ferromagnets.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss the divergence of a vector function and give its geometrical interpretation. Explain Green's theorem and illustrate it geometrically.

21. Explain the term electric potential. Obtain an expression for the electric potential of a localized charge distribution.

(1 × 11 = 11 marks)

D 11869 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION NOVEMBER 2021

Physics/Applied Physics

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

(2014—2018 Admissions)

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*
Answer in a word **or** *a phrase.*

1. The product of the geometric length of the path light follows through the system and the refractive index of the medium is known as ————————.
2. The phenomenon of redistribution of energy in the region of superposition of waves is called.....
3. The shape of the fringes observed in interference is ————————.
4. ———————— is the phenomenon which is responsible for bending of light around sharp corners of an obstacle.
5. The ———————— of the angle of polarization is numerically equal to the refractive index of the medium.
6. The relation between α and β of a transistor is ————————.
7. An amplifier with positive feedback is used in ————————.
8. When the output of a NOR gate is connected to the input of a NOT gate, it works as a ———————— gate.
9. An example for doped insulator laser is ————————.
10. ———————— in which amplitude is varied keeping frequency and phase constant.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*
Answer in two **or** *three sentences.*

11. Explain Fermat's principle of extremum path ?
12. What are coherent sources ? Give example.
13. State two differences between interference and diffraction.
14. What is meant by double refraction ? Explain
15. Describe the action of a capacitor filter circuit.
16. What is population inversion and how it can be achieved ?
17. Why we need modulation in communication ?

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*
Answer in **one paragraph**.

18. What is the idea behind colour of thin films ? Explain why excessively thin films seen in reflected light appear dark.
19. Explain the principle and construction of a zone plate.
20. What is meant by circularly and elliptically polarized light.
21. Draw the loadline of transistor and explain Q-point. Obtain expressions for voltage gain and current gain.
22. Explain the principle and working of Ruby laser.

(3 × 4 = 12 marks)

Section D

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

23. Calculate the separation between the coherent sources formed by a biprism whose inclined faces make angles of 2° with its base, the slit being 0.1 m away from the biprism. Refractive index of the prism material is 1.5.

24. Newton's rings are formed with red light of $\lambda = 670$ nm. The radius of the 20^{th} dark ring is found to be 1.1×10^{-2} m. Find the radius of curvature of the lens and the radius of 30^{th} ring.

25. A plane transmission diffraction grating has 40,000 lines in all with grating element 12.5×10^{-5} cm. Calculate the maximum resolving power for which it can be used in the range of wavelength 5000 A°.

26. Find the thickness of a) Quarter wave plate ; and b) Half-wave plate when light of wavelength 559 nm is used. Given $\mu_0 = 1.55$, $\mu_e = 1.54$.

27. A full wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20 Ω. The transformer rms secondary voltage from centre tap to each end of secondary is 50V and load resistance is 980 Ω. Find the dc load current and rectifier efficiency.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 8 *marks.*

28. Explain with theory Young's slit experiment for determining bandwidth of interference pattern due to two coherent sources. Also draw the intensity distribution for the same.

29. Discuss Fraunhofer diffraction due to a single slit. Find the position of maximum and minimum intensity.

30. With the help of circuit diagram, explain the principle and working of a half wave rectifier. Show that the rectification efficiency of full wave rectifier is twice that of a half wave rectifier.

(2 × 8 = 16 marks)

D 11868 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION NOVEMBER 2021

Physics/Applied Physics

PHY 3B 03/APY 3B 03—MECHANICS

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*
Answer in a word **or** *phrase.*

1. State law of inertia.
2. What is the work done by conservative forces ?
3. Define elastic collision.
4. Define inelastic collision.
5. Rocket works on the principle of ————————.
6. Define angular momentum.
7. Give one example for central force.
8. Write down the expression for Newton's law of gravitation.
9. Write down the relation connecting angular momentum and torque.
10. Define holonomic constraint.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*
Answer in two **or** *three sentences.*

11. What are fictitious forces ?
12. Define Potential energy.

13. Define centre of mass.

14. What is the equation for the centre of mass of a solid hemisphere of radius R ?

15. Explain satellite motion.

16. What is two stage rocket ?

17. With equation define central force.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions.*
Each question carries 4 *marks.*
Answer in **one paragraph**.

18. Define and obtain work-energy theorem.

19. Obtain the relation of force as the gradient of potential.

20. Derive an expression for the centre of mass of thin uniform rod.

21. Define areal velocity. Derive expression.

22. With figure explain scattering of protons by a heavy nucleus.

23. Define gravitational i) Field ; and ii) Potential.

24. Write down Lorentz transformation equations.

(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 60 kg when his rocket moves vertically (1) upward ; and (ii) downward with 6g Acceleration.

26. A 1 kg stone at the end of a 2 metres long string makes 5 revolutions per second. Calculate the force on the stone as measured in an inertial frame and in a frame which is rotating with the string

27. Derive an expression for the P.E of a system of charges

28. An artificial satellite is revolving round the earth at a distance 620 km. Calculate the minimum velocity and the period of revolution. R_E = 6380 km ; g = 9.8m/s^2.

29. Derive the equation of motion of a spherical pendulum using Lagrange equation.

30. Explain time dilation.

31. Explain the variation of mass with velocity.

(4 × 4 = 16 marks)

Section E

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

32. Explain i) Force ; ii) Conservative force ; iii) Work done ; and iv) Work done for a conservative force around any closed path.

33. Explain the deflection of a moving particle by a particle at rest.

34. With figure explain the principle and working of rocket propulsion.

35. With figure explain Michelson Morley experiment.

(2 × 10 = 20 marks)