AS PER NEW PATTERN 2023-2024

PREPARATORY EXAMINATION-2024

SUPER COLLECTION OF QUESTION PAPERS FOR

POCKET MARKS 70/70

PUC II YEAR
PHYSICS

COLLECTION OF DIFFERENT DISTRICT

PREPARATORY EXAMINATION JANUARY-2024

QUESTION PAPERS

By :

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PHYSICS
SUPER COLLECTION OF QUESTION PAPERS FOR
POCKET MARKS 70/70

DISTRICT DEPUTY DIRECTOR DEPT. OF SCHOOL EDUCATION (PU), BAGALKOTE

II PUC Preparatory Examination - Jan. - 2024

Time : 3.15 hours   Sub : PHYSICS (33)   Marks : 70

General Instructions:
1. All parts are compulsory.
2. Part-A questions have to be answered in the first two pages of the answer-booklet. For Part – A questions, first written- answer will be considered for awarding marks.
3. Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

I. Pick the correct option among the four given options for All of the following questions: 15×1=15

1. If the charge on one proton is 1.6×10^{-19}C then charge on the helium nucleus is
   (A) 1.6×10^{-19}C (B) 3.2×10^{-19}C (C) -1.6×10^{-19}C (D) -3.2×10^{-19}C

2. If the electric potential at the centre of the charged spherical conductor is V, then the electric potential at the surface of the conductor is
   (A) infinity   (B) V   (C) 2V   (D) V / 2

3. Consider the following two statements
   (A) Kirchhoff's junction law follows from the conservation of charge.
   (B) Kirchhoff's loop law follows from the conservation of energy Which of the following is correct?
      A) Both (A) and (B) are wrong   B) (A) is correct and (B) is wrong
      C) (A) is wrong (B) is correct   D) Both (A) and (B) are correct

4. Equal currents are passing through two very long and straight parallel wires in the same direction. They will
      A) attract each other.   B) repel each other
      C) lean towards each other   D) Neither attract nor repel each other

5. If a diamagnetic substance is brought near the north or the south pole of a bar magnet, it is
      A) repelled by the north pole and attracted by the south pole
      B) attracted by the north pole and repelled by the south pole
      C) attracted by the poles
      D) repelled by both the poles

6. The transformer is worked on the principle of:
      A) self-induction   B) mutual induction   C) eddy currents   D) None of the above

7. The Law which gives the direction of the induced current in the coil is
      A) Lenz's law   B) Faraday's law   C) Ampere's law   D) Gauss's law

8. The alternating current in RCL series circuit is maximum when
      A) $X_L = 0$ B) $X_C = 0$ C) $X_L = X_C$ D) $X^2_L + X^2_C = 1$

9. If λ_v, λ_x, and λ_m represents the wavelengths of visible light, X – rays and microwaves respectively, then
      A) $\lambda_m > \lambda_x > \lambda_v$ B) $\lambda_m > \lambda_v > \lambda_x$ C) $\lambda_v > \lambda_x > \lambda_m$ D) $\lambda_v > \lambda_m > \lambda_x$

10. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen,
      A) half the image will disappear   B) complete image will disappear
      C) intensity of image will decrease   D) intensity of image will increase

11. An electromagnetic radiation of frequency n, wavelength ?, travelling with velocity v in air, enters a glass slab of refractive index μ. The frequency, wavelength and velocity of light in the glass slab will be respectively
      A) n, 2λ and $\dfrac{v}{\mu}$ B) $\dfrac{2n}{\mu}$, $\dfrac{\lambda}{\mu}$ and v   C) $\dfrac{n}{\mu}$, $\dfrac{\lambda}{\mu}$ and $\dfrac{v}{\mu}$ D) n, $\dfrac{\lambda}{\mu}$ and $\dfrac{v}{\mu}$

12. The kinetic energy of emitted electron for metal is 3 eV and work function is 2.5 eV Then the Stopping potential in volt is
      A) 2 V   B) 2.5 V   C) 3 V   D) 5 V

13. The ratio of the total energy to kinetic energy of the electron in the ground state of the hydrogen atom is
      A) -1:1   B) 1:-1   C) 2:1   D) 1:2

14. The number of neutrons in a $_{92}U^{235}$ nucleus is
      A) 92   B) 235   C) 327   D) 143

15. Hole is
      A) An anti – particle of electron
      B) a vacancy created when an electron leaves a covalent bond
      C) absence of free electrons
      D) an artificially created particle

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II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL The following questions.
(Equal, Zero, Eddy current loss, 50% percentage, Isotones)   5x1 =05

16. The magnetic field on the axis of the current element is ---------------------
17. In a transformer, the core is made up of soft iron insulated strips to reduce..........,
18. The intensity of the emergent light from the polaroid is...............percentage of incident unpolarized light.
19. The atoms having same numbers of neutrons are called as.............
20. In intrinsic semiconductor holes and electrons are .... in number

PART – B

III. Answer any FIVE of the following questions: 5×2=10

21. Write any two basic properties of electric charge.
22. On what factors capacitance of the parallel plate capacitor depends?
23. State and explain Biot savert law.
24. Define the terms   1) magnetization   2) magnetic susceptibility
25. The current in a coil of self-inductance 0.1 H changes from 2 mA to 1mA in a time 1 second. Find emf induced in a coil.
26. Write the expression for rms voltage and mean voltage and relation between them.
27. What is displacement current ? Write the expression displacement current.
28. Mention the conditions for total internal reflection.
29. Write any two differences between nuclear fission and fusion.

PART – C

IV. Answer any FIVE of the following questions: 5×3=15

30. Obtain the expression for the torque acting on an electric dipole, when held in a uniform electric field.
31. Derive the expression for the potential energy of the system of three charges.
32. Derive the relation $J = \sigma E$ with terms having usual meaning.
33. With a circuit diagram, explain how the galvanometer can be converted into a voltmeter?
34. Write the properties of ferromagnetic materials.
35. Derive an expression for motional emf induced in a rod moving in a uniform magnetic field.
36. An object is placed at a distance of 0.15 m from a convex lens of focal length 0.5 m. Find the position of the image.
37. Write the three Bohr's postulates for hydrogen atom.
38. Write the difference between N type and P type semiconductor.

PART – D

V. Answer any THREE of the following questions: 3×5=15

39. Derive an expression for electric potential at a point due to point charge.
40. Derive the expression for effective internal resistance and effective emf of two unidentical cells connected in parallel.
41. Using Biot savert law, derive the expression for the magnetic field at a point on the axis of the circular wire carrying electric current.
42. Derive the expression for the refractive index of the material of the prism in terms of angle of the prism A and angle of minimum deviation D.
43. (i) Define Interference of light.   1m
    (ii)Explain the Theory of interference of light.   4m
44. (i) What is rectification?   1m
    (ii) Draw the circuit diagram and input and output waveforms for a half wave rectifier.   2m
    (iii) Explain the working of half wave rectifier.   2m

VI. Answer any TWO of the following questions: 5×2=10

45. Two small metal spheres are charged so that they repel each other with a force of 2×10^{-5} N. The charge on the one sphere is twice that on other. When they are moved 0.1m farther apart, the force reduces to 5×10^{-5}N.What are the charges and what is the initial separation between them?
46. Four resistances of 12 Ω, 15 Ω, 10 Ω and 4 Ω respectively are connected in cyclic order to from a Wheatstone's network. Is the network balanced? if not, calculate the resistance to be connected in parallel with the resistance of 10 Ω to balance the network.
47. A resistor of 100 Ω, a pure inductance of coil of L = 0.5 H and capacitor are in series in a circuit containing an AC source of 200 V, 50 Hz. In the circuit, current is ahead of the voltage by 30^0 Find the value of the capacitance.
48. A photon of energy 8 eV is incident on a metal surface of threshold frequency 1.6×10^{15} Hz. What will be the kinetic energy of the photoelectrons emitted? Take $h = 6 \times 10^{-34}$ Js.

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DISTRICT LEVEL II PUC PREPARATORY EXAM, JANUARY – 2024

Time: 3 Hrs. 15 Mins.   Sub: PHYSICS (33)   Max. Marks: 70

General Instructions:
1. All parts are compulsory.
2. Part – A questions have to be answered in the first two pages of the answer booklet. For Part – A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

I. Pick the correct option among the four given options for **ALL** of the following questions:

$15 \times 1 = 15$

1. Two point charges $-q$ and $+q$ are placed at a distance of L, as shown in the figure
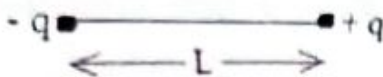
The magnitude of electric field intensity at a distance $R(R \gg L)$ varies as:

(A) $\dfrac{1}{R^2}$ (B) $\dfrac{1}{R^3}$ (C) $\dfrac{1}{R^4}$ (D) $\dfrac{1}{R^6}$

2. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 \gg R_2$) have equal charges. The potential would be
 (A) more on smaller sphere
 (B) equal on both the spheres
 (C) more on bigger sphere
 (D) depending on the material property of the sphere

3. A piece of copper is to be shaped into a conducting wire of maximum resistance. The suitable length L and diameter d are _____ and _____ respectively.
 (A) L and d   (B) 2L and d   (C) L/2 and 2d   (D) 2L and d/2

4. A charged particle moving parallel to the magnetic field, then its path becomes
 (A) Circular   (B) Straight line   (C) Parabolic   (D) Hyperbola

5. The net magnetic flux through any closed surface is zero is in accordance with
 (A) Gauss's law in magnetism   (B) Gauss's law in electrostatics
 (C) Ampere's circuital law   (D) Biot – Savart's law

6. The phenomenon in which an emf is induced in a coil whenever the magnetic flux linked with it changes is known as
 (A) Magnetic effect of an electric current   (B) Mechanical effect of an electric current
 (C) Electromagnetic induction   (D) Photoelectric effect

7. Dimensional formula of $\left[Li^2 \right]$ is (where 'L' is inductance and 'i' is current)
 (A) $\left[M^1 L^2 T^2 A^2 \right]$ (B) $\left[M^1 L^2 T^{-2} \right]$ (C) $\left[M^0 L^0 T^0 A^1 \right]$ (D) $\left[M^1 L^2 T^{-2} A^2 \right]$

8. In LCR series circuit, when $\omega L > \dfrac{1}{\omega C}$, the voltage
 (A) leads the current   (B) lags the current
 (C) is in phase with current   (D) first leads then lags with current

9. Which of the following rays has highest wavelength?
 (A) X – rays   (B) Radio waves   (C) UV – rays   (D) Microwaves

10. For the refraction through prism, as angle of incidence increases, the angle of deviation
    (A) first decreases then increases
    (B) first increases then decreases
    (C) increases continuously
    (D) decreases continuously

11. If two waves $y_1 = a \cos \omega t$ and $y_2 = a \cos \omega t$ if interfere, the amplitude of resultant wave is
    (A) $a/2$ (B) $2a$ (C) a (D) $4a$

12. Which of the following is Einstein's photoelectric equation(where symbols have their usual meaning)
    (A) $KE_{max} = W - h\upsilon$
    (B) $KE_{max} = h\upsilon - W$
    (C) $KE_{max} = W + h\upsilon$
    (D) $KE_{max} = \dfrac{h\upsilon}{W}$

13. Which of the following spectral series of hydrogen atom is lying in visible range of electromagnetic wave?
    (A) Paschen series (B) Pfund series (C) Lyman series (D) Balmer series

14. The nuclides $_1^3 H \; and \; _2^3 He$ are
    (A) radioactive (B) isotope (C) isotones (D) isobars

15. Which of the following is incorrect for semiconductors?
    (A) Conductivity of semiconductor increases with rise in temperature
    (B) Resistivity of semiconductor increases with rise in temperature
    (C) Ohm's law is not strictly obeyed by semiconductors
    (D) Mobility of holes are less as compared to electrons in semiconductors

II. **Fill in the blanks choosing appropriate answers given in the bracket for <u>ALL</u> the following questions:** $5 \times 1 = 5$

(Nuclear force, Shunt, Transverse, Zero, Energy)

16. A galvanometer is converted into ammeter by connecting _____ resistance in parallel.
17. On the basis Lenz's law, _____ physical quantity is conserved.
18. Phenomenon of polarization proves the _____ nature of light waves.
19. The force between two protons is same as the force between proton and neutron. The nature of the force is _____.
20. Energy gap (E_g) in case of conductors is _____.

PART – B

III. **Answer any <u>FIVE</u> of the following questions:** $5 \times 2 = 10$

21. Sketch the electric lines of force due to a point charge q. If (i) q < 0 and (ii) q > 0.

22. Mention any two factors on which the capacitance of a parallel plate capacitor depends.

23. State Ampere's circuital law and represent it mathematically.

24. Write two properties of magnetic line of force.

25. The current through a coil of inductance 2mH changes from zero ampere to 5mA in 0.1 second. What is the emf induced in the coil?

26. What is resonant frequency of series LCR – circuit? Write the expression for it.

27. Mention two applications of infrared radiation.

28. Define power of a lens. How does the power of a lens vary with its focal length?

29. Distinguish between n – type and p – type semiconductors.

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P.T.O.

PART – C $5 \times 3 = 15$

IV. **Answer any FIVE of the following questions:**

30. Write Coulomb's law in vector form. Explain the terms.

31. Obtain the expression for effective capacitance of two capacitors connected in series.

32. Derive the relation $\vec{j} = \sigma \vec{E}$ with terms have usual meaning.

33. Explain with circuit diagram how to convert galvanometer into voltmeter.

34. Distinguish between 'dia' and 'ferro' magnetic materials.

35. Derive the expression for motional EMF induced in a conductor moving in a uniform magnetic field.

36. Write the ray diagram for formation of image at near point for simple microscope.

37. Write Bohr's postulates for the hydrogen atom model.

38. Calculate the mass defect and binding energy of helium nucleus ($_2He^4$) using the following data in MeV (Mass of proton = 1.00727u, Mass of neutron = 1.00866 u, Mass of helium nucleus = 4.00260 u).

PART – D $3 \times 5 = 15$

V. **Answer any THREE of the following questions:**

39. Define electric potential due to a point charge and arrive at the expression for the electric potential at a point due to a point charge.

40. Deduce the condition for balance of Wheatstone's bridge using Kirchhoff's rule.

41. Obtain the expression for the force between two straight long parallel conductors carrying currents. Hence define "ampere".

42. (a) State Huygen's principle of wave front.   [2M]
    (b) Arrive at snell's law of refraction, using Huygen's principle for refraction of a plane wave. [3M]

43. (a) Give Einstein's explanation of photoelectric effect.   [3M]
    (b) Mention any two properties of photons.   [2M]

44. What is rectification? With relevant circuit diagram and waveforms explain the working of P-N junction diode as a full-wave rectifier.

VI. **Answer any TWO of the following questions:** $2 \times 5 = 10$

45. Three point charges each equal to +4nC are placed at the three corners of a square of side 2cm. Find the electric field intensity at the fourth corner.

46. Two identical cells either in series or in parallel combination gives the same current of 0.5A through external resistance of 4Ω. Find the emf and internal resistance of each cell.

47. A source of alternating emf of 220V – 50Hz is connected in series with a resistance of 200Ω an inductance of 100mH and a capacitance of 30µF. Does the current lead or lag the voltage and by what angle?

48. Two lenses of focal lengths 0.20m and 0.30m are kept in contact. Find the focal length of the combination. Calculate powers of two lenses and combination.

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3

SECOND PUC PREPARATORY EXAM JANUARY - 2024

Code : 33   Subject : **PHYSICS**   Duration : **3 Hrs 15 Min.**

Date :   Max. Marks : **70**

General Instructions :

i) All parts are compulsory.

ii) For Part-A questions, first written answer will be considered for awarding marks.

iii) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

iv) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART - A

I.   **Pick the correct option among the four given options for ALL of the following questions.**   **15 x 1 = 15**

1) The angle between the electric dipole moment and the electric field strength due to it on the equatorial line is

    a) $0°$ b) $90°$ c) $180°$ d) $270°$

2) **Statement I :-** Electrostatic potential is constant throughout the volume of the conductor and has the same value (as inside) on it's surface.

    Statement II :- Electric field inside a charged conductor is zero and has no tangential component on the surface.

    a) Both the statements I and II are correct and II is the correct explanation for I.

    b) Both the statements I and II are correct and II is not the correct explanation for I.

    c) Statement I is wrong but statement II is correct.

    d) Statement I is correct but statement II is wrong.

3) The direction of current density is

    a) Opposite to the direction of electric field.

    b) along the direction of electric field.

    c) perpendicular to the direction of electric field.

    d) $30°$ to the direction of electric field.

4) Lorentz force is a force on a charged particle moving in a region containing

    a) Only electric field.

    b) Only magnetic field.

    c) Both electric and magnetic fields.

    d) Only crossed electric and magnetic fields.

5) At high enough temperature, a ferromagnet becomes

    a) Paramagnet   b) diamagnet

    c) remains a ferromagnet   d) Non-magnetic

                                                     (P.T.O.)

6) SI unit of magnetic flux is
   a) Wbm^{-2} b) Tm^{-2} c) Wbm^{-1} d) Weber

7) The law which gives the polarity of induced emf is
   a) Faraday's law   b) Ampere's law   c) Lenz's law   d) Gauss' law

8), The relation between rms voltage and peak voltage of ac is

   a) $Vrms = \dfrac{Vo}{\sqrt{2}}$ b) $Vrms = \sqrt{2} \times Vo$

   c) $Vrms = \dfrac{Vo}{2}$ d) $Vrms = 2Vo$

9) The sources of electromagnetic waves are
   a) Stationary charges   b) Charges in uniform motion
   c) Neutrons   d) Accelerated charges

10) A converging lens is kept in contact co-axially with a diverging lens, both the lenses being of equal focal lengths. What is the focal length of the combination ?
   a) Zero   b) Infinity   c) f   d) 2f.

11) Materials used to control the intensity of light in sunglasses, window panes etc. are
   a) Polaroids   b) Cameras   c) Single slits   d) Double slits

12) Which of the following method can not be used to liberate electrons from metal surface ?
   a) Heating   b) Using very high electric field
   c) Using light radiation of suitable frequency   d) Cooling

13) The minimum energy required to free an electron from the ground state of hydrogen atom is
   a) 0.85 eV   b) 3.4 eV   c) 13.6 eV   d) 1.51 eV

14) The radio active decay in which high energy photons are emitted is known as
   a) Alpha decay   b) Positive beta decay
   c) gamma decay   d) Negative beta decay

15) A P-type semiconductor is
   a) positively charged   b) Negatively charged
   c) positively charged or negatively charged depending upon the type of impurity added to it.
   d) Electrically neutral.

PHYSICS P.U.C. SECOND YEAR (PREPARATORY)   PAGE NO. 3

II. Fill in the blanks by choosing appropriate answer given in the bracket   5 x 1 = 5
for ALL the following questions.

(Nuclear fusion, repulsion, attraction, energy band gap, permeability,
Interference of light)

16) There is a force of _____ between two straight parallel conductors carrying
current in the same direction.

17) Self-inductance of a coil depends upon _____ of the medium.

18) The phenomenon of _____ is consistent with the principle of conservation
of energy.

19) The process responsible for energy generation in stars is _____.

20) The gap between the top of the valence band and bottom of the conduction
band is called _____.

PART - B

III. Answer any FIVE of the following questions.   5 x 2 = 10

21) Define electric field. Give the direction of electric field due to a positive charge.

22) What is an equipotential surface ? Mention the shape of equipotential surface
due to a single isolated charge.

23) Mention the nature of trajectory of a charged particle moving i) parallel, and
ii) perpendicular to the direction of uniform magnetic field.

24) Define magnetisation. Write it's SI unit.

25) State Faraday's law of electromagnetic induction. Write it's mathematical form.

26) What is a transformer ? Name the principle on which it works ?

27) List any two uses of microwaves.

28) Write the two conditions required for total internal reflection of light to occur.

29) Give an example each for an elemental semiconductor and a compound
semiconductor.

PART - C

IV. Answer any FIVE of the following questions.   5 x 3 = 15

30) Mention basic properties of electric charge.

31) Three capacitors of capacitances 2pF, 3pF and 4pF are connected in parallel.

   a) What is the total capacitance of the combination ?   [1]

   b) Determine the charge on each capacitor, if the combination is connected   [2]
   to a 100V supply.

32) Write three limitations of Ohm's law.

33) Explain with a circuit diagram, how do you convert a moving coil galvanometer
into a volt meter ?

(P.T.O.)

34) Write any three differences between diamagnetic and paramagnetic substances.

35) Name any three types of commercial ac generators which use different types of energies to generate mechanical energy required to rotate the armature.

36) What is reflecting telescope ? Name any two advantages of reflecting telescope over refracting telescopes.

37) State Bohr's postulates of hydrogen atom model.

38) List any three characteristics of nuclear force.

PART – D

V. Answer any THREE of the following questions.   3 x 5 = 15

39) Derive an expression for potential energy of an electric dipole placed in uniform electric field.

40) Obtain the condition for balance of Wheatstone's bridge using Kirchhoff's rules.

41) Arrive at an expression for magentic field at a point on the axis of a circular loop carrying current.

42) a) Draw a diagram showing refraction of a plane wave by a thin prism.   [2]
    b) Using Huygens principle arrive at Snell's law of refraction for a plane wave.   [3]

43) a) Define work function of a metal.   [1]
    b) Write the experimental observations of photo-electric effect.   [4]

44) What is rectification ? Describe the working of a full-wave rectifier using the circuit diagram. Draw input and output waveforms.

VI. Answer any TWO of the following questions.   2 x 5 = 10

45) A charged spherical conductor has a surface charge density of 0.7 Cm^{-2}. When it's charge is increased by 0.44 C, the charge density increases by 0.14 Cm^{-2}. Find the initial charge on the spherical conductor and also radius of the sphere ?

46) A battery of emf E and internal resistance r, gives a current of 0.5A with an external resistor of 12 ohm and a current of 0.25A with an external resistor of 25 ohm. Calculate
    i) Internal resistance of the cell, and   ii) Emf of the cell.

47) A resistance of 50 ohm, an inductor of 10H and a capacitor of 2μF are connected in series with an ac source of 250V, 50Hz. Find the current in the circuit and the power factor.

48) A monochromatic light is incident at a certain angle on an equilateral triangle prism and suffers minimum deviation. If Refractive Index of material of prism is $\sqrt{3}$, find the angle of incidence.

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II PUC-PREPARATORY EXAMINATION, JANUARY-2024

Time : 3 Hrs. 15 Mins. SUBJECT : PHYSICS (33) Max Marks : 70

General Instructions :
1) All parts are compulsory
2) Part-A questions, first written - answer will be considered for awarding marks.
3) Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART - A

I   Pick the correct option among the four given options for all the following questions:

15x1=15

1) Which of the following statement is true for an electric dipole.
a) total charge is zero but electric field is not zero
b) only electric field is zero but total charge is not zero
c) both total charge and electric field are not zero
d) both total charge and electric field are zero

2) The workdone in carrying an election from A to B lying on an equipotential surface of one volt potential is
a) 1eV   b) 10 eV   c) 1V   d) zero

3) The SI unit of conductance
a) Ohm   b) mho   c) ampere   d) volt

4) The force between two parallel current carrying wires is dependent on
i) their distance of separation   ii) the length of the wires
iii) the magnitude of currents   iv) the medium in which they are placed
a) only (i) and (ii) are correct
b) only (ii) and (iii) are correct
c) only (iii) and (iv) are correct
d) All are correct

5) Substance which are strongly attracted by a magnet are
a) paramagnetic substances
b) Diamagnetic substances
c) ferromagnetic substances
b) none of these

6) An AC generator converts
a) Mechanical energy to chemical energy
b) Mechanical energy to electrical energy
c) Electrical energy to mechanical energy
d) Chemical energy to mechanical energy

7) The phenomenon in which an emf is induced in a coil due to change in the current in the same coil is
a) self induction   b) Electromagnetic induction   c) mutual induction   d) Eddy current

8) When a sinusoidal voltage $V = V_m \sin \omega t$ is applied across a capacitor, the current through the capacitor at any instant is
a) $i = i_m \sin \omega t$ b) $i = i_m \sin\left(\omega t - \pi/2\right)$ c) $i = i_m \sin\left(\omega t + \pi/2\right)$ d) $i = i_m \sin\left(\omega t + \phi\right)$

9) The speed of electromagnetic wave in free space interms of permittivity ε_0 and permeability μ_0 is
a) $c = \sqrt{\mu_0 \varepsilon_0}$ b) $c = \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}}$ c) $c = \sqrt{\dfrac{\mu_0}{\varepsilon_0}}$ d) $c = \sqrt{\dfrac{\varepsilon_0}{\mu_0}}$

10) An object is placed within the principal focus of a concave lens. Pick out the correct statement
a) Real and inverted image is formed
b) Real and erect image is formed
c) Virtual and inverted image is formed
d) Virtual and erect image is formed

(P.T.O.)

11) When a wavefront travels from rarer medium to denser medium then,
   a) speed decreases but frequency remains same   b) speed increases but frequency remains same
   c) both speed and frequency remains the same   d) both speed and frequency decreases

12) The following are the statements related to photo emission.
   Statement (I) : Light of frequency 1.5 times the threshold frequency is incident on photosensitive material. If the frequency is halved and intensity is doubled, the photocurrent remains unchanged.
   Statement (II) : The photoelectric current varies directly with the intensity of light and frequency of light.
   a) Both the statements I and II are correct and II is the correct explanation of I
   b) Both the statements I and II are correct and II is not the correct explanation for I
   c) Statement I is wrong but the statement II is correct
   d) Both the statements I and II are wrong

13) In Bohr's atomic model for hydrogen which of the following is wrong

   a) orbital radius $r_n \propto n^2$ b) orbital velocity $V_n \propto \dfrac{1}{n}$

   c) Energy $E_n \propto n^2$ d) angular momentum $L_n \propto n$

14) The density of a nucleus
   a) decreases with increase in its mass number
   b) decreases with decrease in its mass number
   c) increases with increase in its mass number
   d) is independent of mass number

15) According to band theory of solids, this energy diagram corresponds to,
   a) Silicon
   b) Germanium
   c) Gallium Arsenide
   d) Gallium phosphate
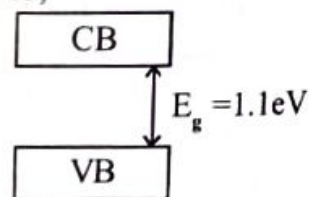
II Fill in the blanks by choosing appropriate answer given in the brackets, for all the questions: 5x1=5
   (zero, intrinsic, opposes, charge of the nucleons, directly, inversly)

16) The magnetic field inside a solenoid is _____ proportional to its applied current.

17) Induced emf always _____ the change in the magnetic flux.

18) The phase difference between any two points in a given wavefront is _____.

19) Nuclear force does not depend on _____.

20) A semiconductor in the pure form is called _____ semiconductor.

PART-B

III Answer any FIVE of the following questions: 2x5=10
21) State and explain coulomb's law in electrostatics.
22) Distinguish between polar and non polar dielectrics.
23) Mention the expression for Lorentz force and explain the terms.
24) Define magnetic intensity and magnetic susceptibility of a magnetic material.
25) What is meant by mutual inductance ? Mention any one device that works on the principle of mutual induction.
26) Draw the waveform representing current and voltage across a resistance when AC is applied to a pure resistor.
27) What is displacement current ? Give the expression for it.

28) Write the conditions for total internal reflection of light.
29) What is meant by doping of a semiconductor ? Why is it necessary ?

PART-C

IV   Answer any FIVE of the following questions: 3x5=15

30) Give any three properties of electric field lines.
31) Obtain expression for the equivalent capacitance of two capacitors connected in series.
32) a) Define electrical resistivity of conductor.
    b) How does the resistance of a conductor vary with its (i) length and (ii) area of cross section?
33) Explain how a galvanometer is connected into voltmeter.
34) Write any three differences between diamagnetic and paramagnetic material.
35) Describe magnet-coil experiment to demonstrate electromagnetic induction.
36) Draw the ray diagram when the image is formed at least distance of distinct vision in case of a simple microscope and write an expression for magnification of it.
37) State Bohr's postulate of hydrogen atom.
38) Calculate the binding energy of an Oxygen nucleus ($_8O^{16}$) given rest mass of a proton = 1.007825 U that of a neutron = 1.008665 U and mass of oxygen nucleus = 15.995 U.

PART-D

V   Answer any THREE of the following questions: 3x5=15

39) Deduce an expression for electrostatic potential at a point due to a point charge.

40) Derive the expression for conductivity of a material $\sigma = \dfrac{ne^2\tau}{m}$, where the symbols have their usual meaning.

41) Derive an expression for magnitude of the magnetic field at a point along the axis of the circular conductor carrying current.
42) What is interference ? Give the theory of interference.
43) a) Write Einstein's photoelectric equation.
    b) Explain the experimental results of photoelectric effect on the basis of photoelectric equation.
44) With a neat circuit diagram explain the working of a full wave rectifier. Indicate the wave forms of input and output voltage.

VI   Answer any TWO of the following questions: 2x5=10

45) Two point charges $q_A = 3\,\mu c$ and $q_B = -3\,\mu c$ are placed 20 cm apart in vacuum.
    a) What is the electric field at the mid point of the line joining the two charges.
    b) If a negative test charge of magnitude 1.5×10^{-9} C is placed at the mid point what is the force experienced by the test charge.

46) Two cells of emf 2V and 4V and internal resistances $1\,\Omega$ and $2\,\Omega$ respectively are connected in parallel so as to send current in the same direction through an external resistance of $20\,\Omega$ coil. Find the potential difference across the resistor.

47) A sinusoidal voltage of peak value 285 V is applied to a series LCR circuit in which resistor of resistance $5\,\Omega$ pure inductor of inductance 28.5 mH and capacitance $800\,\mu F$ are connected.
    a) Find the resonant frequency
    b) Calculate the impedance and maximum current.

48) A prism of angle 60° produces angle of minimum deviation 40°. What is its refractive index ? Calculate the angle of incidence.

II PUC PREPARATORY EXAMINATION, JANUARY- 2024

Time : 3 Hrs. 15 Mins. SUBJECT : PHYSICS (33) Max Marks : 70

General Instructions :

1) All parts are compulsory
2) Part-A questions have to be answered in the first two pages of the answer booklet. For Part -A questions, first written answer will be considered for awarding marks.
3) Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I Pick the correct option among the four given options for ALL the following questions:
15x1=15

1) An electric dipole is kept in a uniform electric field E, it experiences
   A) A force and a torque
   B) A force but not a torque
   C) A torque but not a force
   D) Neither a for a nor a torque

2) Resistivity of a conducting wire depends on
   A) Area of cross section B) Temperature C) Length D) None of these

3) Two long parallel wires carrying currents in same direction
   A) Attract each other B) Repel each other
   C) Neither attract nor repel D) Get rotated to be perpendicular to each other

4) To convert a galvanometer into an ammeter one should connect a
   A) Low resistance in series with a galvanometer
   B) High resistance in series with a galvanometer
   C) Low resistance in parallel with a galvanometer
   D) High resistance in parallel with a galvanometer

5) One of the inconsistencies of amperee's circuital law is
   A) Fails to determine magnetic field due to conduction current
   B) Fails to determine magnetic field due to displacement current
   C) Fails to explain both (A) and (B)
   D) None of these

6) Virtual images are formed
   A) Infront of the mirrors B) Behind the mirrors
   C) Both infront and behind the mirrors D) Neither infront nor behind the mirrors

7) For critical angle of incidence angle of refraction is
   A) $0°$ B) $30°$ C) $60°$ D) $90°$

8) The source of the cylindrical wavefront is a
   A) Point source B) Linear Source C) Both (A) & (B) D) Source at large distance

9) Polaroids are used to produce
   A) Monochromatic light B) White light C) Polarised light D) All of these

10) The thickness of gold foil used in α - particle scattering experiment is
    A) 2.1×10^{-7} m B) 2.1×10^{-7} m.m C) 6.1×10^{-8} m D) 6.1×10^{-8} m.m

11) The energy of the electron in the ground state of hydrogen atom is
    A) $+ 13.6$ eV B) $+ 13.6$ J C) $- 13.6$ J D) $- 13.6$ eV

12) Which of the following are not emitted by radio active substances ?
    A) Protons B) Electrons C) Helium nucleus D) Gamma rays

(P.T.O.)

13) Isotones have the same number of
A) Protons   B) Electrons   C) Neutrons   D) All of these

14) Among the following, the wrong statement in the case of semiconductor is
A) At absolute zero temperature it behaves like a conductor
B) Resistivity is in between that of a conductor and insulator
C) Doping increases conductivity
D) Temperature co-efficient of resistance is negative

15) The diffusion current in a p-n junction is greater than the drift current when the junction is
A) Forward biased   B) Reverse biased   C) Unbiased   D) Both (A) & (B)

II Fill in the blanks by choosing appropriate answer given in the brackets, for all the questions: 5×1=5

(Frequency, Intensity, Lorentz force, anticlockwise, dielectric strength)

16) The north pole of a magnet is brought near a metallic ring, the direction of the induced current in the ring will be _____.

17) _____ is the force acting on a charged particle moving in a combined electric and magnetic fields.

18) The maximum electric field that a dielectric medium can withstand without breakdown is called its _____.

19) For a given metal, the maximum kinetic energy of emitted electrons in a photoelectric effect doesnot depend upon _____.

20) _____ remains same when light travel from air to glass.

PART-B

III Answer any FIVE of the following questions: 5×2=10

21) Mention two properties of electric charge.

22) What are polar and nonpolar dielectrics ?

23) State Ohm's law and mention one limitation.

24) What is the magnetic field at the centre of a toroid of 25 turns carrying a current of 2A ?

25) Define voltage sensitivity of a moving coil galvanometer write its SI unit.

26) Write the expression for speed of electromagnetic wave in vacuum and explain the terms.

27) State and explain Lenz's law.

28) Mention two postulates of Bohr's atom model.

29) Write two differences between p-type and n-type semiconductors.

PART-C

IV Answer any FIVE of the following questions: 3×5=15

30) State and explain Coulomb's law in electrostatics. Express it in vector form.

31) Obtain the relation between electric field and electric potential.

32) Arrive at the expression for drift velocity in terms of electric field and relaxation time.

33) State and explain Kirchoff's laws of electrical network.

34) Write three properties of magnetic field lines.

35) Define the terms
     i) Magnetisation (M)
     ii) Magnetic permeability (μ)
     iii) Magnetic susceptibility (χ)

(P.T.O.)

-3-

36) Show that the voltage leads current by $\pi/2$ when AC voltage is applied to a pure inductor.

37) Derive the relation $f = R/2$ in the case of a concave mirror, where the symbols have their usual meanings

38) Calculate the binding energy of the nuclei $_{26}F^{56}$ in MEV.

Mass of $_{26}F^{56}$ = 55.934939 amu

Mass of proton = 1.00728 amu

Mass of neutron = 1.00867 amu

PART-D

V   Answer any THREE of the following questions: 3x5=15

39) Obtain the expression for electric field at a point on the equatorial plane of an electric dipole.

40) Arrive at the expression for magnetic field at a point on the axis of a circular current loop.

41) Write the principle of working of ac generator and hence deduce the expression for emf induced in it.

42) Arrive at the theory of interference of light waves. Write the conditions for constructive and destructive interference in terms of path difference.

43) (i) Mention three experimental observations of photoelectric effect.

(ii) Write two properties of photons.

44) What is rectification ? Explain the working of a PN junction diode as full wave rectifier with the help of a circuit diagram. Draw input and output waveforms.

VI   Answer any TWO of the following questions: 2x5=10

45) A circular parallel plate capacitor of radius 6 cm are separated by a distance of 3 mm. Calculate the capacitance and energy stored, when it is charged by connecting the battery of 200 V.

$\left(\text{Given } \epsilon_0 = 8.854 \times 10^{-12} \, Fm^{-1} \right)$

46) Two cells of emf 2V and 3V and internal resistances $1\,\Omega$ and $2\,\Omega$ respectively are connected in parallel so as to send current in the same direction through an external resistance of $10\,\Omega$. Find the power dissipated across $10\,\Omega$ resistor.

47) An inductor and a bulb are connected in series to an ac source of 200 V, 50 Hz. A current of 10 A flows in the circuit and phase angle between voltage and current is $\pi/4$ radians calculate the impedance and inductance of the circuit.

48) A prism of RI 1.5 produces a minimum deviation of 40°. Find the angle of the prism.

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PUC-II YEAR PREPARATORY EXAMINATION-2024

Time : 3 Hours 15 Minutes

SUBJECT : **PHYSICS (33)**

MARKS : 70

Instructions :
1) All parts are compulsory.
2) For Part-A questions, first written answer will be considered for awarding marks.
3) Answers without relevant diagram/ figure/ circuit diagram wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four options for ALL of the following questions : 15X1=15

1) If the distance between two charged particle is doubled then the force between them
   A) Remain same   B) Doubled   C) Halved   D) One Fourth

2) Two radii of two metallic spheres A and B are r_1 & r_2 respectively. (r_1>r_2). They are connected by a thin wire and the system is given a certain charge. The charge will be greater.
   A) On the surface of the sphere B
   B) On the surface of the sphere A
   C) Equal on both
   D) Zero on both

3) The drift velocity of electrons does not depend upon
   A) Cross section of the wire
   B) Length of the wire
   C) Number of free electrons
   D) Magnitude of the current

4) The magnetic force $\vec{F}$ on a current carrying conductor of length 'l' in an external magnetic field $\vec{B}$ is
   A) $\dfrac{I \times \vec{B}}{\vec{l}}$
   B) $\dfrac{\vec{l} \times \vec{B}}{I}$
   C) $I(\vec{l} \times \vec{B})$
   D) $I^2 (\vec{l} \times \vec{B})$

5) Below are the two statements related to magnetic field lines :
   Statement - I : The magnetic field lines do not intersect
   Statement - II : The direction of magnetic field at a point is unique
   A) Both the statements I and II are correct and II is the correct explanation for I
   B) Both the statements I and II are correct and II is not the correct explanation for I
   C) Statement I is wrong but the statement II is correct
   D) Statement I is correct but the statement II is wrong

6) Identify the statement which is the correct
   A) Only on Emf is induced when the flux linked with a closed circuit changes
   B) Only a current is induced when the flux linked with a closed circuit changes
   C) Both Emf and current are induced when the flux linked with an open circuit changes
   D) Both Emf and current are induced when the flux linked with a closed circuit changes

7) Linzis law is a direct consequences of
   A) The law of conservation of momentum
   B) The law of conservation of charges
   C) The law of conservation of energy
   D) The law of conservation of Emf

8) The relation between current amplitude (Im) and average value of current is (i) is
   A) $i = \dfrac{2}{\pi} i_m$
   B) $\bar{i} = \dfrac{2}{\pi\, im}$
   C) $\bar{i} = \dfrac{im}{\sqrt{2}}$
   D) $\bar{i} = \dfrac{im}{2\pi}$

9) If the total energy of electromagnetic wave falling on a surface is U. Then the total momentum delivered for complete absorbtion is
   A) $P = \dfrac{U}{C^2}$
   B) $\dfrac{U}{C}$
   C) $P = UC$
   D) $P = \sqrt{\dfrac{U}{C}}$

10) The power of lens is –4D. It is a
    A) Convex lens   B) Concave lens   C) Plano- convex lens   D) Converging lens

11) Which of the following exhibits particle nature of light
    A) Photo electric effect
    B) Interference of light
    C) Polarizalion of light
    D) Diffraction of light

12) The phenomenon of bending of light around the edges of an obstacle is called
    A) Polarization   B) Interference   C) Diffraction   D) Refraction

13) The minimum energy require to free from the ground state of the hydrogen atom is said to be
    A) First excitation   B) Ionization energy   C) Excitetion energy   D) Zero potential energy

14) Among the following which set of nuclear isotopes
    A) $^{1u}_{6}C$ and $^{1u}_{7}N$
    B) $^{3}_{2}He$ and $^{3}_{1}H$
    C) $^{28}_{14}Si$ and $^{73}_{32}Ge$
    D) $^{235}_{92}U$ and $^{238}_{92}U$

15) At T=0K, an intrinsic semiconductor behaves as
    A) A semiconductor
    B) A conductor
    C) A Insulate
    D) A super-conductor

II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL the following questions : 5X1=5

(Zero, opposes, attracts, increases, charge of nucleons)

16) Two infinitely long conductors carrying current in the same direction .... each other.

17) Induced Emf always .... changes in the magnetic flux.

18) The face difference between any two points in a given wave front is ....

19) Nuclear force does not depend upon ....

20) When the pn junction is forward biased the width of the depletion region ....

PART-B

III. Answer ANY FIVE of the following questions. 5X2=10

21) Define electric field ? Mention its SI unit ?

22) The amount of work done brining a point charge of 4 micro column from infinity to a point is 0.08J. Calculate electric potential at a point ?

23) State and explain Amperes circuital law.

24) The current in a coil falls from 25mA in 2ms and induces an Emf of 10V in it find the self-Inductance of a coil ?

25) What are electromagnetic waves ? Write an expression for velocity of electromagnetic waves in term of permeability. Explain the terms.

26) What is total internal reflection ? Mention the condition for total internal reflection.

27) State and explain Gauss law in magnetism.

28) Explain the construction of transformer.

29) Write any two differences between P-type and n-type semiconductor.

PART-C

IV. Answer ANY FIVE of the following questions. 5X3=15

30) Write any three properties of electric field lines.

31) Obtain the relation between electric field and electric potential ?

32) Show with schematic graphs, variation of resistivity with absolute temperature for.
   a) Silicon   b) Nichrome and   c) Copper

33) Derive an expression for torque on a rectangular loop placed in a uniform magnetic field.

34) Distinguish between dia and ferro magnetic materials.

35) Describe Faradays and Henry Coil and Magnet Experiment to exhibit electromagnetic induction.

36) Obtain the relation between refractive index and critical angle for a medium ?

37) Obtain the expression for radius of the electron orbit using Rutherford atomic model.

38) Calculate nuclear density of iron nucleus ? [Given mass of Iron Nucleus=55.85u and A=56, 1u=1.66×10^{-27} Kg]

PART-D

V. Answer ANY THREE of the following questions : 3X5=15

39) Derive an expression for potential energy of electric dipole placed in an uniform electric field.

40) Deduce the balancing condition of wheatstone bridge using Kirchhoffs laws.

41) Obtain an expression for the force between two parallel current carrying conductors and hence define Ampere.

42) a) State Hygens principle.
   b) Explain refraction of a plane wave using Hygens principle at rarer medium.

43) a) Define stopping potential ?
   b) Mention the experimental results of photo electric effect.

44) Explain with necessary diagram the forward and reverse based characteristics of semiconductor diode.

VI. Answer ANY TWO of the following questions. 2X5=10

45) Three charges each equal to +4nC are placed at the three corners of a square of side 2 cm find electrifield at the fourth corner.

46) Two identical cells either in series or in parallel gives the same current of 0.5 A through external resistance of 4Ω. find Emf and internal resistance of each cell.

47) A 20Ω resistor 1.5H inductor and 35μF capacitor are connected in series with a 220V 50Hz ac supply calculate the impendence of the circuit and also current through the circuit.

48) The radii of curvature of two sources of a convex lens is 0.2 m and 0.22 m find the focal length of the lens if refractive index of the material of lens is 1.5. Also change in focal length

II PUC PREPARATORY EXAMINATION JANUARY- 2024

Subject Code : 33
Time : 3-15 hours

PHYSICS

Total No.of Ques.48
Max Marks : 70

General Instructions: 1] All parts are compulsory.
2] For Part-A questions First written answer will be considered for awarding marks.
3] Answers without relevent diagram/figure/ circuit wherever necessary will not carry any marks.
4] Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART -A

I **Pick the correct options among the four given options for All the following questions.**

15x1=15

1) The charging of an uncharged conductor by physical contact with a charged conductor is
a] charging by conduction b]charging by inductioon c] both a and b d] none of these

2) The molecules in which centres of positive an negative charges do not coinside are
a] Non polar molecules   b]dipolar molecules c] polar molecules   d] None of these

3) Which one is not true?
a] $E = \frac{1}{\sigma}$ b] $J = \sigma E$ c] $E = \frac{1}{\rho}$ d] $\rho J = E$

4) If the charges are not in motion then magnetic force is ____
a] zero b] unity c] infinity d] constant

5) The magnetic lines of force inside a bar magnet
a]are from N-pole to s-pole of magnet   b] do not exist
c] depend upon the area of cross section of bar magnet
d] are from s-pole to N-pole magnet

6) The laws of electro magnetic Induction have been used in construction of a
a]Galvanometer b] Voltmeter c] electric motor d] generator

7) The SI unit of permeability of the material is ___
a]Hm^{-1} b] Fm^{-1} c] JS   d] None of these

8) Current in a circuit is Wattless if ____
a] inductance in the circuit is zero   b]resistance in the circuit is zero
c]current is alternating   d] resistance and inductance both are zero

9) Which of the following is used heat radiation?
a]X-rays   b] γ-rays   c] IR-radiation   d] Microwaves

10) If a ray of light passing through the principal focus of the concave mirror , the reflected ray is ____
a]parallel to then principal axis   b] perpendicular to principal axis
c] retraces the path   d] None of these

11) The portion of the wavefront of light from a distant star intercepted by the earth is
a]Plane wavefront b] spherical wavefront c] Both a and b d] cylindrical wavefront

12) Formula for de-Broglie wavelength is ____
a] $\lambda = \frac{h}{mv}$ b] $\lambda = \frac{h}{\sqrt{2mE_K}}$ c] $\lambda = \frac{h}{\sqrt{2mqv}}$ d] All

13) The angular momentum of the electron in hydrogen atom in the ground state is ____
a]2h   b] $\frac{h}{2}$ c] $\frac{h}{2\pi}$ d] $\frac{h}{4\pi}$

14) Nucleides with same mass number are called ____
a]Isotones b] Isobars c] Isotopes   d] None of these

15) Which of the following is not trivalent
a] Indium b] Boron c] Phosphorous   d] Aluminium

II **Fill in the Blanks by choosing the appropriate word/words from those given below:**
[Energy , Momentum , increases, binding energy, infinite, limit of resolution]   5x1=5

16) Resistance of an ideal voltmeters is ____

17) Lenz's law is in accordance with law of conservation of ____

18) The ability of an optical instrument to form distinctly separate images of two closely placed point objects is called ____ of an optical instrument.

19) The average energy required to release a nucleon from the nucleus is called ____

20) The width of depletion region of a pn-junction diode will ____ on increasing the forward bias.

III   Answer any FIVE of the following questions in 3-5 sentences each wherever applicable.

21)   State and explain Coulomb's law in electro statics.   5x2=10
22)   If three capacitors of capacitances $10\mu P$ are connected in series . Then calculate effective capacitance of the combination.
23)   When is the force acting on a charged particle moving in magnetic field a]Maximum b] Minimum
24)   What is meant by self induction ? Write the expression for induced emf for self inductance .
25)   Write any two uses of uv radiation.
26)   Draw the diagram of total reflecting prisms which bends the image a] through 90^0 b] through 180^0
27)   Mention any two power losses in transformes.
28)   Define magnetic susceptibility. For which material it is low and positive?
29)   Give any two differences between intrinsic and extrinsic semi conductors.

PART -C

IV   Answer any FIVE of the following questions in 3-5 sentences each wherever applicable.   5x3=15

30)   Obtain an expression for electric field at a point just outside a changed them spherical shell by using Gauss law.
31)   Obtain an expression for potential energy of a system of two charges in an external field .
32)   a] Define drift velocity   b]Write the expression for drift velocity and explain the symbols.
33)   Explain with circuit diagram how to convert galvanometer into an ammeters.
34)   Write any three properties of magnetic field lines .
35)   a] State and explain Faraday's law of electromagnetic induction   b] Mention the SI unit of magnetic flux.
36)   Derive an expression for equivalent focal length of the combination of two thin convex lenses in contact.
37)   State postulates of Bohr's theory of hydrogen atom.
38)   Calculate the mass defect and binding energy of $_5B^{10}$, given that the rest mass of Boron 10.01295U rest mass of proton is 1.00783U and rest mass of neutron is 1.00867U.

PART -D

V   Answer any THREE of the following questions .   3x5=15

39)   Derive an expression for the electric potential at a point on the axial line of an electric dipole.
40)   Obtain an expression for equivalent emf and equivalent internal resistance when two cells are connected in series.
41)   Derive an expression for the magnetic field at any point on the axis of a circular current loop by applying Biot-savart's law.
42)   a] What is diffraction of light? Give the condition for diffraction .
       b] Mention any two applications of polarids.   c] State Brewster's law.   (2+2+1)
43)   a] Define Work function. b] How does photoelectric current varies with frequency of incident radiation
       c] Write the three experimental observations of photo electric effect.   (1+1+3)
44)   What is rectifies? With a circuit diagram, explain the working of pn junction as Half wave rectifies. Draw input and output wave forms.

VI   Answer any TWO of the following questions .   2x5=10

45)   Four point charges $q_A = 2\mu C$, $q_B = -5\mu C$, $q_C = 2\mu C$ and $q_D = -5\mu C$ are located at the corners of a square ABCD of side 10cm. What is the force on a charge of $1\mu C$ placed at the centre of the square?
46)   The four arms of a Wheatstone bridge have the following resistances. AB=100Ω, BC=10Ω, CD=5Ω and DA= 60Ω. A galvanometer of 15Ω resistance is connected across BD. Calculate the current through the galvanometer. When a potential difference of 10V is maintained across AC.
47)   A source of alternating emf of 220V- 50Hz is connected in series with a resistance of 200Ω, an inductance 100mH and a capacitance of $30\mu F$. Does the current lead or lag the voltage and by what angle?
48)   A ray of light is incident on one face of an equilateral prism of glass of refractive index 1.5 at an angle of 30^0. Find the angle of deviation produced by the prism.

EXAMINATION 2023-24

PHYSICS (33)

Time: 3hours 15 min.

Max. Marks:

General instructions:
- All parts are compulsory.
- For Part-A questions, first written answer will be considered for awarding the marks.
- Answers without relevant diagram/figure/circuit-diagram wherever necessary will not carry marks.
- Direct answers to the numerical problems without solution will not carry any marks.

PART-A

I. Pick the correct option among the four given options for **ALL** of the following questions: 15 × 1=

1. The number of electrons contained in -1C of charge is

   a) 9.1×10^{31}
   b) 6.25×10^{18}
   c) 1.6×10^{19}
   d) 6.25×10^{17}

2. The relation between electric field and electric potential is given by

   a) $E = \frac{dV}{dl}$
   b) $E = -\frac{dV}{dl}$
   c) $V = \frac{dE}{dl}$
   d) $V = -\frac{dE}{dl}$

3. Kirchhoff's junction rule signifies the law of conservation of

   a) charge
   b) mass
   c) energy
   d) momentum

4. Galvanometer can be converted into voltmeter by connecting

   a) a low resistance in series with the galvanometer
   b) a high resistance in series with the galvanometer
   c) a low resistance in parallel with the galvanometer
   d) a high resistance in parallel with the galvanometer

5. Below are the two statements related to magnetic field lines:

   Statement –I: *The magnetic field lines do not intersect.*

   Statement –II: *The direction of magnetic field at a point is unique.*

   a) Both the statements I and II are correct and II is not the correct explanation for I.
   b) Both the statements I and II are correct and II is the correct explanation for I.
   c) Statement I is correct but the statement II is wrong
   d) Statement I is wrong but the statement II is correct

6. Which of the following law explains the polarity of induced emf?

   a) Ampere's circuital law
   b) Lenz's law
   c) Biot-Savart's law
   d) Faraday's law

7. Weber is the S.I. unit of

   a) Electric flux
   b) magnetic flux
   c) Electric field
   d) magnetic field

8. In the case of alternating voltage applied to a resistor
   a) voltage leads the current by $\frac{\pi}{2}$.
   b) voltage lags behind the current by $\frac{\pi}{2}$.
   c) voltage and current are in phase.
   d) voltage leads the current by $\frac{\pi}{4}$.

9. Correct expression for displacement current is
   a) $I_d = \frac{d\phi_E}{dt}$
   b) $I_d = \frac{d\phi_B}{dt}$
   c) $I_d = \epsilon_0 \frac{d\phi_E}{dt}$
   d) $I_d = \mu_0 \frac{d\phi_E}{dt}$

10. For critical angle of incidence, angle of refraction is
    a) 0°
    b) 90°
    c) 30°
    d) 60°

11. Waves undergo constructive interference if phase difference between them is
    a) zero
    b) $\frac{\pi}{6}$
    c) $\frac{\pi}{2}$
    d) $\frac{\pi}{4}$

12. Following are the statements related to photon:
    i. Radiation consists of packets of energy called photon
    ii. Photons are electrically charged
    iii. Rest mass of photon is zero
    iv. Momentum of photon $p = \frac{\lambda}{h}$

    Among the given statements
    a) only (ii) and (iii) are correct
    b) only (i) and (iii) are correct
    c) only (ii) and (iv) are correct
    d) only (iv) and (iii) are correct

13. Ground state energy of hydrogen atom is
    a) – 13.6eV
    b) 13.6eV
    c) 0eV
    d) 10.2eV

14. Radioactivity was discovered by
    a) Mary curie
    b) Einstein → radioactivity fst pram
    c) James Chadwick
    d) Henry Becquerel

15. Depletion region in p-n junction contains
    a) holes
    b) immobile ions
    c) electrons
    d) both electrons and holes

II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL the following questions. 1×5=5

(Isotopes, diffraction, equal, opposite, isobars, ac generator)

16. The two long parallel conductors carrying currents in the _____ direction repel each other.

17. _____ converts mechanical energy into electrical energy.   elec → mech. → dynamo

18. The phenomenon where light bends around corners and enters shadow region is known as _____.

19. Nuclides with same atomic number and different neutron number are called _isotopes_.

20. In intrinsic semiconductor, number of holes and number of free electrons are _equal_.

PART-B

III. Answer any FIVE of the following questions: 5×2=10

21. State and explain Gauss law in electrostatics.

22. Two capacitors of capacitance $2\mu F$ and $3\mu F$ are connected in series. Calculate the capacitance of equivalent capacitor of the combination.

23. What is Lorentz force? Write the expression for it in vector form.

24. Define magnetization. For which type of magnetic material magnetic susceptibility is large and positive?

25. Write any two factors on which self-inductance of a long solenoid depend. $L = \mu_0 n^2 A l$.

26. On what principle does a transformer work? Write one source of energy loss in an actual transformer.

27. Write any one use each for X-rays and microwaves.

28. Draw a neat labeled ray diagram for image formation at near point by a simple microscope.

29. Write any two differences between semiconductors and insulators on the basis of band theory of solids.

PART-C

IV. Answer any FIVE of the following questions: 5×3=15

30. Derive an expression for torque acting on a dipole placed in a uniform electric field.

31. What are polar and non-polar molecules? Give one example for each.

32. State and explain Ohm's law. Write one limitation of Ohm's law. $I \propto V$.

33. Using Ampere's circuital law, derive an expression for magnetic field at a point due to a long straight current carrying conductor.

34. Write the expression for magnetic potential energy of a magnetic dipole kept in uniform magnetic field. When is the magnetic potential energy(i) maximum and (ii) minimum?

35. Derive an expression for motional emf.

36. Derive the relation $f = \frac{R}{2}$ for a concave mirror.

37. State Bohr's postulates of hydrogen atom.

38. Obtain the binding energy in MeV of $^{209}_{83}Bi$ from the following data:
    $m(^{209}_{83}Bi) = 208.980388$ u, $m_n = 1.008665$ u, $m_p = 1.007825$ u

PART-D

V. Answer any THREE of the following questions: 5×3=15

39. Derive an expression for electric potential at a point due to an isolated point charge.

40. Derive an expression for effective emf and effective internal resistance when two cells are connected in series.

41. Obtain an expression for magnitude of magnetic field at a point along the axis of the circular coil carrying current using Biot – Savart's law.

42. (a) State Huygens principle on wave theory of light.

(b) Using Huygens principle, show that the angle of incidence is equal to angle of reflection for a plane wave undergoing reflection at a plane surface. (2+3)

43. (a) Write any three experimental observations of photoelectric effect.

(b) Write Einstein's photoelectric equation. Explain the symbols. (3+2)

44. What is rectification? With a circuit diagram, explain the working of a full wave rectifier. Draw the input and output waveforms.

VI. Answer any TWO of the following questions: 5×2=10

45. Two charged spheres A and B have their centers separated by distance of 50 cm in air. What is the mutual force of electrostatic repulsion if the charge on each sphere is 6.5×10^{-7} C? The radii of two spheres are negligible when compared to distance. Also calculate force of repulsion if charge on each sphere is doubled and the distance between them is halved.

46. The number density of free electrons in a copper conductor is estimated to be 8.5×10^{28} m^{-3}. How long does an electron take to drift from one end of a copper wire 3m long to its other end? Thickness of the copper wire is 1.6mm and it carries a current of 2A.

47. A resistor of resistance 200Ω and a capacitor of capacitance 15μF are connected in series to a 220V,50Hz a.c. source. Calculate the impedance and r.m.s current in the circuit. Also calculate the voltage across the capacitor

48. The radii of curvatures of two surfaces of a convex lens are 0.2m and 0.25m. Calculate the focal length of the lens and power of the lens in air. What is the focal length of the lens if it is immersed in water? (Given: Refractive index of the material of the lens is 1.5 and refractive index of water is 1.33).

SC I

II PUC Preparatory Examination Jan. 2024

Time : 3.15 hours   SUBJECT : PHYSICS (33)   Marks : 70
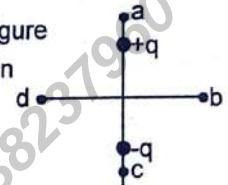
GENERAL INSTRUCTIONS :
1. All Parts are Compulsory
2. For Part A Question, first written answer will be considered for awarding marks.
3. Answer without relevant daigram / Figure / Circuit wherever necesarry will not carry any marks.
4. Direct answer to numerical problems without detailed solutions will not carry any marks.

PART- A

I. **Pick the correct option among the four given options for all of the following questions**   15 x 1 = 15

1. If the charge on an object is doubled then electric field becomes
   a) Half   b) double   c) Unchanged   d) Thrice.

2. Four points a, b,c and d are set at equal distance from the centre of a dipole as shown in figure
   The Magnitude of electrostatic potential Va, Vb, Vc and Vd would satisfy the following relation
   a) Va > Vb > Vc > Vd   b) Va > Vb = Vd > Vc
   c) Va = Vc > Vb = Vd   c) Vb = Vd > Va > Vc

3. The direction of the current through electric circuit is
   a) from low potential to high potential   b) from high potential to low potential
   c) does not depend upon potential value   d) Current can not flow through the circuit.

4. The Force experienced by a moving charge in a magnetic field is
   a) $\vec{F} = q (\vec{V} \cdot \vec{B})$ b) $\vec{F} = q \dfrac{}{(\vec{V}\cdot\vec{B})}$ c) $\vec{F} = q \dfrac{(\vec{V} \times \vec{B})}{2}$ d) $\vec{F} = q (\vec{V} \times \vec{B})$

5. Below are two statements
   Statement (1) : Magnetic feild lines always form closed loops.
   Statement (2) : Moving charges produce a magnetic field
   A) Both the statement (1) and (2) are correct and (2) is the correct explanation for (1).
   B) Both the statement (1) and (2) are correct and (2) is not the correct explanation of (1).
   C) Statement (1) is wrong but statement (2) is correct.
   D) Statement (1) is correct but statement (2) is wrong.

6. The S. I unit of inductance of a coil is
   a) Ampere   b) coulomb   c) joule   d) henry

7. Lenz's law is the consequence of the law of conservation of
   a) Charge   b) Mass   c) Energy   d) Momentum

8. The frequency of AC mains in India is
   a) 30 Hz   b) 50 Hz   c) 60 Hz   d) 120 Hz

9. The velocity of electromagnetic wave in free space is
   a) $C = \sqrt{\mu_o \varepsilon_o}$ b) $C = \dfrac{1}{\sqrt{\mu_o \varepsilon_o}}$ c) $C = \dfrac{1}{\mu_o \varepsilon_o}$ d) $C = \mu_o \varepsilon_o$

10. The focal length of a lens of power 4 dioptre is
    a) 0.25 m   b) 0.25 cm   c) 0.35 m   d) 0.35 cm

11. When light passes from one medium to another which of the following quantity remain constant
    a) Velocity   b) Wavelength   c) Both velocity and wavelength   d) Frequency

12. The following are the statements related to photon
    i) Photons exert pressure   ii) momentum of photon is hv /c
    iii) Rest mass of photon is zero   iv) Energy of photon is hv
    a) only (i) and (ii) are Qorrect   b) only (ii) and (iii) are correct
    c) Only (iii) and (iv) are correct   d) All are correct

13. As the radius of the orbit of an electron in an atom increases the velocity of electron
    a) increases   b) Decreases   c) remains constant   d) First increases and then decreases

14. The nucleus having highest specific binding energy is
    a) $^{4}_{2}He$ b) $^{12}_{6}C$ c) $^{56}_{26}Fe$ d) $^{238}_{92}U$

15. For semiconductors energy gap between conduction band and valence band is
    a) Greater than 3eV   b) Less than 3eV   c) Equal to 3eV   d) Greater than 4eV

II. Fill in the blanks by choosing the appropriate answer given in the bracket for all the following questions

(Reflection, Periodically, low refraction, independent, Pure)

16. Galvanometer can be coverted into ammeter by connecting .... resistance in parallel

17. The direction of current changes .... in alternating current.

18. For reflection of light at plane surface angle of incidence is equal to angle of ....

19. Nuclear force is charge ....

20. .... germanium is an intrinsic semiconductor

PART - B

III. Answer any five of the following questions   5 x 2 = 10

21. State and explain coulomb's law in electrostatics.

22. The potential difference between two points is 20 V How much work will be done in carrying a charge of 400 μc from one point to the another?

23. Write the expression for lorentz force and explain the symbols.

24. State and explain Gauss law in magnetism

25. Draw neat labelled diagram of AC-generator

26. Write any two energy losses in transformers.

27. What is displacement current ? Write the expression for it.

28. Mention the conditions required for total internal reflection.

29. Write any two differences between n-type and p-type semiconductor.

PART - C

IV. Answer any five of the following questions   5 x 3 = 15

30. Mention the properties of electric field lines.

31. Derive the relation between electric field and electric potential

32. Derive the realtion $\vec{J} = \sigma \vec{E}$, where the symbols have their usual meaning

33. State and explain Biot - Savart's law.

34. Distinguish between diamagnetic and paramagnetic materials

35. Explain briefly the coil and magnet experiment to demostrate electromagnetic induction.

36. Arrive the relation f = R/2 in case of concave mirror, where the symbols have their usual meanings.

37. State three Bohr's postulates.

38. Find the binding energy of $_{20}^{40}$Ca nucleus

    Given Rest mass of $_{20}^{40}$Ca = 39.962589 u

    Rest mass of neutron = 1.008665 u

    Rest mass of proton = 1.007825u

PART - D

V. Answer any three of the following questions   3 x 5 = 15

39. Define effective capacitance ? Derive an expression for the effective capacitance of two capacitors connected in series.

40. Obtain the balancing condition of Wheatstone's bridge using kirchchoff's law.

41. Derive an expressions for the force between two parallel conductors carrying current and hence define ampere.

42. a) State Huygen's Principle   (1)

    b) Using Huygens Principle arrive the law of reflection for a plane wave front.   (4)

43. a) Mention Einstains photoelectric equation and explain the terms.   (2)

    b) Give any three expermental observations of photoelectric effect.   (3)

44. What is rectification ? Explain the working of a full wave rectifier using the circuit daigram. Draw input and output waveforms.

VI. Answer any two of the following questions   2 x 5 = 10

45. Two point charges +4 μc and +1 μc are separated by 30 cm in air. Find the position between them at which resulttant electric field is zero.

46. A cell of emf 'E' and internal resistance 'r' gives a current of 0.5 A with an external resistance of 12 Ω and a current of 0.25 A with an external resistance of 25 Ω Calculate the
    i) Internal resistance of the Cell   ii) emf of Cell

47. A capacitor of 100 μf and a coil of resistance 50 Ω and inductance 0.5 H are connected in series with a 220 V-50 Hz source Calculate the rms value of current in the circuit.

DISTRICT LEVEL II PUC PREPARATORY EXAM, JANUARY – 2024

Time: 3 Hrs. 15 Mins. Sub: PHYSICS (33) Max. Marks: 70

General Instructions:
1. All parts are compulsory.
2. Part – A questions have to be answered in the first two pages of the answer booklet. For Part – A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

I. **Pick the correct option among the four given options for ALL of the following questions:**

$15 \times 1 = 15$

1. An electric dipole is kept in uniform electric field. It experiences
   (A) A force and a torque
   (B) A force but not a torque
   (C) A torque but not a force
   (D) Neither a force nor a torque

2. SI unit of electric potential is
   (A) volt
   (B) watt
   (C) farad
   (D) coulomb

3. Resistance of a conducting wire increases when
   (A) Area increases
   (B) Temperature increases
   (C) Length increases
   (D) None of these

4. In a moving coil galvanometer, the deflection of the coil 'θ' is related to the electrical current 'i' by the relation
   (A) $i \alpha \tan \theta$
   (B) $i \alpha \theta$
   (C) $i \alpha \theta^2$
   (D) None of these

5. Susceptibility is positive and large for
   (A) Paramagnetic material
   (B) Ferromagnetic material
   (C) Diamagnetic material
   (D) None of these

6. The significance of Lenz's law is
   (A) Law of conservation of energy
   (B) Law of conservation of mass
   (C) Law of conservation of charge
   (D) None of these

7. The principle of alternating current generator is
   (A) Electromagnetic induction
   (B) Ampere's circuital law
   (C) Photoelectric effect
   (D) None of these

8. When the frequency of alternating current is doubled, the impedance of an LCR circuit
   (A) Is doubled
   (B) Increases
   (C) Decreases
   (D) is halved

9. The maximum frequency wave in the electromagnetic spectrum is
   (A) Gamma rays
   (B) X – rays
   (C) Ultra violet-rays
   (D) Infra red-rays

10. Dioptre is equivalent to
    (A) meter
    (B) meter^2
    (C) $meter^{-1}$
    (D) $meter^{-2}$

11. Polarization is the phenomenon of light based on
    (A) Particle nature
    (B) Wave nature
    (C) Quantum phenomenon
    (D) Transverse electromagnetic nature

12. Which of the following has the largest de-Broglie wavelength if they are moving with the same velocity?
    (A) neutron
    (B) proton
    (C) alpha particle
    (D) beta particle

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1 P.T.O.

13. In the case of hydrogen atom, the energy required to excite an electron from first orbit to second orbit is
    (A) 13.6 eV   (B) $-13.6\ eV$ (C) $-3.4\ eV$ (D) 10.2 eV

14. Isotones have the same number of
    (A) Protons   (B) Electrons   (C) Neutrons   (D) All of the above

15. The element that can be used as acceptor impurity to dope Germanium is
    (A) Antimony   (B) Arsenic   (C) Boron   (D) Phosphorous

II. **Fill in the blanks choosing appropriate answer given in the bracket for <u>ALL</u> the following questions:**   5 × 1 = 5

     (mass defect, spherical, equal, a moving charge, inductor)

16. A magnetic field can be produced by _____.

17. The circuit element which opposes the change in the current flowing through it is _____.

18. A point source at finite distance is the source of _____ wavefront.

19. The difference between the sum of the masses of the nucleons forming the nucleus and the rest mass of the nucleus is called _____.

20. In intrinsic semiconductor, at room temperature, the number of electrons and holes will be _____

PART – B

III. **Answer any <u>FIVE</u> of the following questions:**   5 × 2 = 10

21. Write Coulomb's law in vector form. Explain the terms.

22. Mention any two factors on which the capacitance of a parallel plate capacitor depends.

23. State and explain Ampere's circuital law.

24. Define (a) Magnetic intensity and (b) Magnetic permeability.

25. What is self inductance of a coil? Mention its SI unit.

26. What is a transformer? Mention any one source of energy loss.

27. Mention any two uses of gamma rays.

28. Write the conditions for total internal reflection.

29. Give any two differences between n – type and p – type semiconductors.

PART – C

IV. **Answer any <u>FIVE</u> of the following questions:**   5 × 3 = 15

30. Write any three basic properties of an electric charge.

31. Obtain the relation between electric field and electric potential.

32. Derive an expression for drift velocity of free electrons in a conductor.

33. Explain with circuit diagram how to convert galvanometer into an ammeter.

34. What are diamagnetic, paramagnetic and ferromagnetic materials?

35. Derive an expression for electromotive force (motional emf) induced in a rod moving perpendicular to the uniform magnetic field.

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36. Derive the relation between focal length and the radius of curvature of a concave mirror.

37. State Bohr's postulates of hydrogen atom.

38. Mention any three properties of nuclear forces.

PART – D

V. **Answer any THREE of the following questions:** $3 \times 5 = 15$

39. Define electric potential due to a point charge and arrive at the expression for electric potential due to an isolated point charge.

40. Deduce the condition for balance of a Wheatstone's bridge using Kirchhoff's law.

41. Derive an expression for magnetic field at any point on the axis of a circular loop by applying Biot – Savart's law.

42. (i) State the Huygen's principle of secondary wavelets.   [2M]
    (ii) Derive the law of reflection of light on the basis of Huygen's wave theory of light.   [3M]

43. (i) Give Einstein's explanation of photoelectric effect.   [3M]
    (ii) Mention any two properties of photons.   [2M]

44. What is a rectifier? With a circuit diagram explain the working of p – n junction (diode) as half wave rectifier. Draw input and output waveforms.

VI. **Answer any TWO of the following questions:** $2 \times 5 = 10$

45. Two point charges 2mC and 4mC are placed at A and C respectively of right angled triangle ABC. AB = 3 cm, BC = 2 cm and angle B = 90^0. Calculate the magnitude of the resultant electric field at B.

46. A wire having length 2.0m, diameter 1.0 m and resistivity $1.963 \times 10^{-8} \Omega m$ is connected in series with a battery of emf 3V and internal resistance 1Ω. Calculate the resistance of the wire and current in the circuit.

47. An alternating current source of 220V, 50Hz is applied to a circuit having resistance 200Ω, inductance 4H and capacitance of $2\mu F$ in series. Calculate (a) impedance of the circuit (b) maximum current in the circuit.

48. The radii of curvature of the faces of a double convex glass lens are 10cm and 15cm. Its focal length is 12cm. Calculate the Refractive index and power of glass lens.

✿✿✿✿✿✿✿✿

II PUC PREPARATORY EXAMINATION - 2024

Time 3 Hours 15 Minuts   **PHYSICS (33)**   Max Marks 70

General Instructions :

1. All parts are compulsory.
2. For Part - A questions, first written answer will be considered for awarding marks.
3. Answer without relevant diagram / figure wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

I. Pick the correct option among the four given options for ALL of the following questions: 15x1=15

1. The magnitude of electric field near a thin sheet having a uniform surface charge density σ is

     (A) $\dfrac{\sigma}{\varepsilon_0}$ (B) $\dfrac{2\sigma}{\varepsilon_0}$ (C) $\dfrac{\sigma^2}{\varepsilon_0}$ (D) $\dfrac{\sigma}{2\varepsilon_0}$

2. Electric potential inside a conducting sphere :

     (A) increases from the centre to surface.
     (B) decreases form the centre to surface.
     (C) remain constant from centre to surface
     (D) is zero at every point inside.

3. A cell of internal resistance r is connected to an external resistance R. The current will be maximum in R if:

     (A) R > r   (B) R = O   (C) R < r   (D) R = r

4. Below are the two statements related to sensitivity of a galvanometer.

   Statement I : On increasing the current sensitivity of a galvanometer by increasing the number of turns, may not necessarily increase its voltage sensitivity.

   Statement II : The resistance of the coil of a galvanometer increases on increasing the number of turns.

     (A) Both the statement I and II are correct and II is the correct explanation for I
     (B) Both the statement I and II are correct and II is not the correct explanation for I
     (C) Statement I is correct and the statement II is worng
     (D) Statement I is wrong and the statement II is correct.

5. The magnetic field lines inside a bar magnet:

     (A) prependicular to magnetic axis.
     (B) are from its north pole to south pole.
     (C) are from its south pole to north pole.
     (D) do not exist.

6. The SI unit of magnetic flux is:

     (A) $Wb\ m^{-1}$ (B) Wb (C) $T\ m^{-2}$ (D) $Wb\ m^{-2}$

7. AC generator converts :

     (A) Mechanical energy in to electrical energy.
     (B) Mechanical energy in to light energy.
     (C) Electrical energy in to mechanical energy.
     (D) Mechanical energy in to chemical energy.

8. The relation between rms value and peak value of alternating voltage is

     (A) $V_{rms} = V_0$ (B) $V_{rms} = \dfrac{V_0}{2}$ (C) $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ (D) $V_{rms} = \dfrac{V_0}{2\sqrt{2}}$

9. The Fundamental source of electromagnetic wave is

     (A) Alternating current
     (B) oscillating charged particles
     (C) changing magnetic field
     (D) direct current

10. Resolving power of a telescope increases with :

     (A) increase in focal length of eye piece.
     (B) increase in focal length of objective.
     (C) increase in aperture of objective.
     (D) increase in aperture of eye piece.

11. The phenomenon which confirms the transverse nature of light is :

     (A) interference of light.
     (B) diffraction of light.
     (C) dispersion of light
     (D) polarization of light.

12. When light is incident on the metal surface the maximum kinetic energy of emitted electrons :
    (A) vary with intensity of light   (B) vary with frequency of light
    (C) vary with speed of light   (D) remain constant

13. According to Rutherford's atomic model
    (A) whole of the positive charge is concentrated at the centre of the atom.
    (B) there are neutrons inside the nucleus.
    (C) there are electrons inside the uncleus.
    (D) electrons are embedded in the atom.

14. During alpha (α) - decay the emitted nucleus is
    (A) Helium   (B) Corbon   (C) Hydrogen   (D) Oxygen

15. The following are the statements related to semiconductors :
    (i) Resistivity is in between that of a conductors and insulators.
    (ii) Temperature coefficient of resistance is negative.
    (iii) Doping increases conductivity of semiconductors.
    (iv) At absolute zero temperature semiconductors behave like a conductor
    (A) Only (i) and (iii) are correct   (B) Only (i) and (ii) are correct
    (C) Only (i) and (iv) are correct   (D) Only (i) (ii) and (iii) are correct

II. Fill in the blanks by choosing appropriate answer given in the brackets for All the following questions :   5x1=5

    (speed, increases, decreases, saturated, torque, wavelength)

16. A current loop experiences .... when it is placed in a uniform magnetic field.
17. The mutual inductance between the pair of coils............. with increasing the number of turns of the coils.
18. Energy carried by a light wave does not depends on............of thewave.
19. Nuclear forces are .... forces.
20. The width of depletion region of a pn-junction diode will .... on increasing the forward bias voltage.

PART-B

III. Answer any FIVE of the following questions :   5x2=10

21. Give Coulomb's law in vector form and explain the terms.
22. How does the capacitance of a parallel plate capacitor depends on (i) area of the plates and (ii) the distance between the plates?
23. On what factors the magnetic field at a point inside an air cored solenoid depends?
24. State and explain Gauss's law in magnetism.
25. The magnetic flux linked with a coil varies as $\emptyset = 3t^2 + 6t + 9$. Find the magnitude of the emf induced at t = 2 s.
26. Mention any two sources of energy loss in a transformer.
27. What is displacement current? Write the expression for it .
28. Mention the two conditions for total internal reflection.
29. Differentiate p type and n type semiconductors.

PART-C

IV. Answer any five of the following question :   5x3=1

30. Write any three properties of electric filed lines.
31. Derive an expression of the effective capacitance of two capacitors connected in parallel.
32. Arrive at $J = \sigma E$, where the symbol have their usual meaning.
33. Obtain an expression for force acting on a conductor carrying current in a uniform magnetic field.
34. Distinguish between diamagnetic and paramagnetic materials.
35. Derive an expression for motional emf. induced across the ends of a conducting rod moving in a uniform perpendicular magnetic field.

36. An object is placed at 10 cm in front of a concave mirror of focal length 7.5 cm. Find the position and magnification of the image.
37. State Bohr's postulates of hydrogen atom.
38. Define : (i) mass defect and (ii) binding energy. Give the relation between them.

PART-D

V. Answer any THREE of the following question :   3x5=15

39. Derive an expression for electric field due to an electric dipole at a point on the equatorial line.
40. Obtain the condition for balance of wheatstone brigde using Kirchhoff's rules.
41. Derive the expression for magnetic field at a point on the axis of a circular current loop.
42. Derive lens maker's formula for convex lens.
43. (a) State Huygens Principle.   (2)
    (b) Using Huygens Principle, show that the angle of incidence is equal to the angle of refraction during a plane wave is reflected by a plane surface.   (3)
44. (a) What is rectification?   (1)
    (b) Explain the working of full wave rectifier using circuit diagram.   (3)
    (c) Also draw its input and output wave forms.   (1)

VI. Answer any TWO of the following questions :   2x5=10

45. ABCD is a square of side 2m. Charges of 5 nC.10 nC and -5 nC are placed at corners A,B and C respectively. What is the work done in transferring a charge of 2 μC from D to the point of intersection of the diagonals?
46. A uniform copper wire of length 2 m and cross-sectional area $5 \times 10^{-7} m^2$ carries a current of 2 A. Assuming that there are 8×10^{28} free electrons per m^3 of copper, calculate the drift velocity of free electrons. How much time will an electron to take drift from one end to another end of the wire? Given: $e = 1.6 \times 10^{-19}$ C.
47. A 20 Ω resistor, 1.5 H inductor and 35 μF capacitor is connected in series with a 220 V, 50 Hz ac supply. Calculate the impedance in the circuit and also find current through the circuit.
48. The work function of caesium is 2.14 eV. Find (a) the threshold frequency for caesium, and (b) the wavelength of the incident light of the photocurrent is brought to zero by a stopping potential of 0.60 V. Given: $h = 6.63 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ C and $c = 3 \times 10^8$ ms^{-1}.

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DISTRICT LEVEL PREPARATORY EXAMINATION - JANUARY 2024

Time : 3-15 Hrs.　　　II PUC - Physics (33)　　　**Max. Marks : 70**

General Instructions:
1. All parts are compulsory.
2. Part – A questions have to be answered in the first two pages of the answer-booklet. For Part – A questions, first written-answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART- A

I Pick the correct option among the four given options for ALL of the following questions: 　　15×1=15

1. The SI unit of electric field is
   A) NC　b) NC^{-2}　c) NC^{-1}　d) Vm

2. Capacitance of a parallel plate capacitor increases if
   a) charge on the capacitor increases
   b) potential difference across the capacitor decreases
   c) area of the plates of the capacitor decreases
   d) dielectric is inserted between the plates of the capacitor

3. With the increase of temperature, relaxation time of free electrons in a conductor ......
   A) increases.　B) decreases.　C) remains same　D) becomes zero.

4. A charged particle is moving on circular path with velocity v in a uniform magnetic field B, if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes
   A) 4 times　B) 8 times　C) 2 times　D) 16 times

5. Correct statement about diamagnetic materials
   A) They are repelled by a magnet.
   B) Their susceptibility value is positive.
   C) Their susceptibility varies inversely as absolute temperature.
   D) They have very high value of susceptibility.

6. Lenz's law is based on
   A) conservation of charge　B) conservation of momentum
   C) conservation of energy　(D) conservation of angular momentum

7. Expression for energy stored in an induction coil carrying current is
   A) $\frac{1}{2}LI^2$　B) 2 LI　C) LI　D) LI^2

8. When an a.c source is connected across a resistor
   A) The current leads the voltage　　B) The current lags behind the voltage
   C) The current and voltage are in phase　D) The current and voltage are out of phase

9. Displacement current is due to
   A) The flow of electrons　　B) The varying electric field
   C) The ionization of atmosphere　　D) The flow of protons

10. In the position of minimum deviation when a ray of yellow light passes through the prism, then its angle of incidence is
    A) Less than the emergent angle　　B) Greater than the emergent angle
    C) Sum of angle of incidence and emergent angle is 90°　D) Equal to the emergent angle

11. A point source of light at finite distance produce
    A) a spherical wavefront　B) cylindrical wavefront　C) planewavefront　D) both (a) and (c)

Physics

12. The slope of stopping potential versus frequency curve represents
    A) h/e   B) h   C) e/h   D) he

13. When a hydrogen atom is raised from the ground state to an excited state.
    (A) K.E and P.E increases
    (B) both K.E and P.E decreases
    (C) P.E decreases and K.E increases
    (D) the P.E increases and K.E decreases

14. If A is the mass number, radius of nucleus is
    A) Directly proportional to $A^{1/3}$
    B) Directly proportional to A^3
    C) Inversely proportional to $A^{1/3}$
    D) Inversely proportional to A^3

15. Statement I: The resistivity of a semiconductor increases with temperature.
    Statement II: The atoms of a semiconductor vibrate with larger amplitudes at higher temperature.
    A) Both statements are true and second statement is the correct explanation of the first statement
    B) Both statements are true but second statement is not the correct explanation of the first statement.
    C) First statement is true but second statement is false
    D) First statement is false but second statement is true

II Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: 5 × 1 = 5
(Radial, Inductance, Interference, semiconductor, Polarization, Isotopes,)

16. In a moving coil galvanometer soft iron cylinder is placed at its centre co-axial with pole faces, to make magnetic field ...Radial...

17. ...Inductance... is the ratio of flux linkage to current

18. The phenomenon that confirms light waves are transverse is ...Polarization... *Same topic*

19. Nuclides with same atomic number but different neutron number are ...Isotopes...

20. Conductivity of a...semiconductor...increases with increase of temperature

PART – B

III Answer any FIVE of the following questions: 5 × 2 = 10

21. State and explain Coulomb's law.
22. What are polar and non-polar molecules
23. What is Lorentz force? What is the condition for a charged particle to move undeflected in a crossed electric and magnetic field region?   *not in Syllabus?*
24. Define (a) magnetisation   (b) magnetic intensity
25. What is AC generator? What is its principle?
26. Define wattless current? What is the value of power factor of AC circuit in which wattless current flows
27. Give any two applications of X-ray
28. Write two conditions for total internal reflection
29. Differentiate between n-type and p-type semiconductor

PART – C

IV Answer any FIVE of the following questions: 5 × 3 = 15

30. Derive the expression for electric field at any point outside a uniformly charged thin spherical shell using Gauss's law.
31. Mention any three properties of equipotential surface
32. Write any three limitations of ohms law.
33. State Ampere's circuital law. Using it, derive the expression for magnetic field at point due to a long current carrying conductor.
34. Distinguish between diamagnetic and paramagnetic materials.
35. Obtain the expression for emf induced in a conductor moving in a magnetic field.
36. Write the Cartesian sign conventions used in analyzing reflection of light by spherical mirrors.

37. Give de Broglie's explanation of Bohr's second postulate of quantization of angular momentum.
38. Calculate the mass defect and binding energy of O_8^{16}, given that the rest mass of oxygen nucleus is 15.99493 u, rest mass of proton is 1.00727 u and rest mass of neutron is 1.00866 u.

PART – D

V Answer any THREE of the following questions: 3 × 5 = 15

39. Derive the expression for the electrical potential at a point due to a point charge.
40. Obtain expression for equivalent emf and internal resistance, when two cells are connected in parallel.
41. Using Biot savart 's law, derive the expression for magnetic field at a point on the axis of a circular current carrying wire.
42. a) State Huygens principle.
    b) Arrive at the Snell's law of refraction by using Huygens principle.
43. a) What is photoelectric effect?
    b) Write four experimental observations of photoelectric effect.
44. What is rectification? Explain the working of a full wave rectifier using the circuit diagram. Also draw input-output waveforms

VI Answer any TWO of the following questions: 2 × 5 = 10

45. Two point charges + 3 µC and -3 µC are placed at the two corners of an equilateral triangle of side 3 cm. Find the magnitude of resultant electric field at the third corner.
46. The number density of free electrons in copper is estimated to be 8.5×10^{28} m^{-3}. A copper wire of length 3.0 m and area of cross-section 2.0 mm^2 is carrying a current of 3.0 A. Calculate the drift velocity of electrons. How long does an electron take to drift from one end of the wire to its other end?
47. An AC source of 220 V, 50 Hz is connected in series with a 100 Ω resistor, 15 µF capacitor and 2200 µH inductor in series. Calculate
    a) Impedance of the circuit.
    b) rms current through the circuit.
48. A solid sphere of diameter 10 cm has a small air bubble trapped at a distance 2 cm from its centre. The refractive index of the material of glass is 1.5. Find the apparent position of the bubble when viewed through nearer surface of the sphere from outside.

---

38) $\Delta m = Z m_p + (A-Z) m_n - M$

$\Delta m = \left[8(1.00727) + (16-8) 1.00866 \right] - 15.99493$
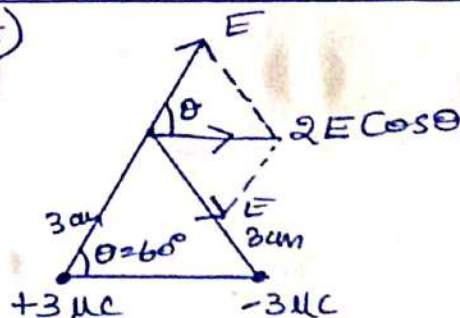
$\Delta m = 16.12744 - 15.99493$

$\Delta m = 0.13251\, u$

Binding energy $= \Delta m \times 931.5\, MeV$

$BE = 0.13251 \times 931.5\, MeV$

$= 123.43\, MeV$

---

45)

$E = \dfrac{1}{4\pi\varepsilon_0} \dfrac{Q}{r^2} = \dfrac{9\times10^9 \times 3\times10^{-6}}{(3\times10^{-2})^2}$

$E = 3\times10^7\, NC^{-1}$

Net electric field

$E' = 2E\cos\theta = 2\times 3\times10^7 \times \cos 60°$

$= 2\times 3\times10^7 \times \dfrac{1}{2} = 3\times10^7\, NC^{-1}$

Department of Pre-University Education   Code No. G

DISTRICT P.U.COLLEGE PRINCIPALS' ASSOCIATION (R)

Date : 22-01-2024   **PUC II–Year Preparatory Examination 2023–24**

Time : 10-00a.m. to 1-15 p.m.]   Subject : **PHYSICS (33)**   [Max. Marks : 70

Instructions : 1) All parts are compulsory.
2) Part–A questions first written answer will be considered for awarding marks.
3) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

PART–A

Q. I. Pick the correct option among the four given options for ALL of the following questions.   15×1=15

1) The minimum amount of charge observed so far is
 a) 1C b) 4.8×10^{-13} C c) 1.6×10^{-19} C d) $1.6 \times 10^{+19}$ C

2) A soap bubble is charged to a potential of 16V. Its radius is then doubled the potential of the bubble now will be
 a) 16V b) 8 V c) 4V d) 2 V

3) Ohm's law is valid when the temperature of the conductor is
 a) constant b) very high c) very low d) varying

4) The resistance of an ideal ammeter is
 a) infinite b) very high c) small d) zero

5) A magnetized needle of magnetic moment 4.8×10^{-2} JT^{-1} is placed at 30° with direction of uniform magnetic field of magnitude 3×10^{-2} T. The torque acting on the needle is
 a) 7.2×10^{-2} Nm b) 7.2×10^{-4} Nm c) $7.2 \times 10^{+4}$ Nm d) 14.4×10^{-4} Nm

6) The induced emf in a coil is independent of
 a) resistance of the coil b) number of turns c) rate of change of flux d) None of these

7) The expression for energy stored in an inductor
 a) $1/2\ L^2 I$ b) $2LI^2$ c) $2L^2 I$ d) $1/2\ LI^2$

8) Power factor of a series LCR circuit is
 a) R b) $\frac{Z}{R}$ c) $\frac{R}{Z}$ d) RZ

9) The minimum deviation of a prism depends on
 a) angle of incidence b) angle of reflection c) angle of prism d) none of these

10) Which of the following is conserved when light waves interfere ?
 a) amplitude b) intensity c) phase d) wavelength

11) A proton and an alpha particle are accelerated under the same potential difference. The ratio of their de-Broglie's wavelengths of the proton and alpha particle is
 a) $\frac{1}{\sqrt{8}}$ b) 1 c) 2 d) $\sqrt{8}$

12) Electrons in the atom are held in the atom due to
 a) Coulomb forces b) nuclear forces c) gravitational force d) molecular forces.

13) The nuclei $_6C^{13}$ and $_6C^{12}$ can be described as
 a) isotones b) isobars c) isotopes d) isomers

14) Which of the following electromagnetic waves has the largest frequency
 a) radio wave b) γ-ray c) ultra–violet rays d) microwaves

15) The resistivity of semiconductor depends on
 a) length b) area of cross-section c) nature of atoms d) none of these

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions:
(Poloroid, external, opposes, magnetic, fusion)   5×1 = 5

16) The magnitude of _____ field at a point due to current element is directly proportional to the current in the current elements.

17) The polarity of induced emf is such that it tends to produce current which _____ the change in magnetic flux that produced it.

18) _____ is a device used to produce and analyze plane-polarized light.

19) The process of combining the two light nuclei in to single nucleus is_____

20) The diode is said to biased, when an _____ potential difference is applied across it.

PART–B

Q. III. Answer any FIVE of the following questions.   **5 × 2 =10**

21) State and explain Coulomb's law in electrostatics.
22) How can you increase the capacitance of parallel plate capacitor ?
23) Write an expression for torque experienced by a current loop placed in magnetic field and explain the terms.
24) What is magnetic permeability ? For which material susceptibility is low and positive.
25) State and explain Faraday's law of electromagnetic induction.
26) What is wattles current ? Give one example.
27) Mention any two uses of gamma (γ) rays.
28) Define power of a lens and mention its S.I. units.
29) What is doping ? Name any one dopant to form p–type semiconductor.

PART–C

Q. IV. Answer any FIVE of the following questions.   **5 × 3 =15**

30) Obtain an expression for electric field due to an infinitely long straight uniformly charged wire by using Gauss's law.
31) Obtain the relation between electric field and electric potential.
32) State and explain Ohm's law and mention one limitation of ohm's law.
33) Explain with circuit diagram how to convert galvanometer in to voltmeter.
34) *Mention any three properties of Magnetic field lines.*
35) Explain briefly the coil–coil experiment to demonstrate the phenomenon of electromagnetic induction.
36) Derive the relation between focal length and the radius of curvature of a concave mirror.
37) *Prove the Bohr's quantization rule of angular momentum using de–Broglie's wavelength.*
38) *Obtain the binding energy of a nitrogen nucleus ($_7N^{14}$) from the following data* $m_p=1.00783u$, $m_n-1.00867u$, $m_N=-14.00307u$

PART–D

V. Answer any THREE of the following questions.   **3 × 5 =15**

39) Define electric potential due to a point charge and arrive at the expression for electric potential due to an isolated point charge.
40) Two cells of different emf's and different internal resistances are connected in series. Find the expressions for the equivalent emf and equivalent internal resistance of the combination.
41) State Ampere's circuital law using it, derive the expression for magnetic field at a point due to a long straight current carrying wire.
42) State and explain Malus law of polarisation and write any three difference between interference and diffraction of light.
43) What are de–Broglie waves ? Mention Einstein's photoelectric equation and explain the experimental results using this equation.
44) What is rectification ? With a circuit diagram explain the working of p–n Junction as half wave rectifier. Draw input and output waveforms.

VI. Answer any TWO of the following questions.   **2 × 5 =10**

45) A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80.4 μC/m^2
    a) Find the charge on the sphere, b) What is the total electric flux leaving the surface of the sphere ?
46) Three resistors 2Ω, 4Ω and 5Ω are combined in parallel.
    a) What is the total resistance of the combination?
    b) If the combination is connected to a battery of emf 20V and neglible internal resistance, determine the current through each resistor.
47) The resistor of 200 Ω and capacitor of 15μF are connected in series to a 220V, 50Hz ac source.
    a) Calculate current in the circuit.   b) Calculate voltage rms across the resistor.
48) A beam of light converges to a point P. A lens is placed in the path of the convergent beam 12 cm from P. At what point does the beam converge if the lens is
    a) a convex lens of focal length 20 cm.
    b) a concave lens of focal length 16 cm ?

PHYSICS (33)

Time: 3 hours 15 min.   **Max Marks: 70**

General Instructions:

1. *All parts are compulsory*
2. *For Part – A questions, first written-answer will be considered for awarding marks.*
3. *Answers without relevant diagram /figure /circuit wherever necessary will not carry any marks.*
4. *Direct answers to numerical problems without detailed solutions will not carry any marks.*

PART – A

I] **Pick the most appropriate option among the four given options for ALL of the following questions:**   **15 X 1 = 15**

1. The electric field at a point on the equatorial line of a dipole and the direction of the dipole moment:
   - (A) Will be in the same direction
   - ✓(B) Will be in opposite directions
   - (C) Will be perpendicular
   - (D) Are not related in any way

2. Identify the vector quantity among the following:
   - (A) Electric potential
   - ✓(B) Electrical field
   - (C) Electric potential difference
   - (D) Electric potential energy

3. Current density is defined as
   - (A) Current per unit volume of the conductor
   - (B) Current per unit length of the conductor
   - ✓(C) Current per unit area normal to the conductor
   - (D) Current per unit resistance of the conductor

4. The following are the sentences related to Oersted's experiment

   I] Current in a straight wire caused deflection in a nearby magnetic compass needle.

   II] On reversing the direction of the current, orientation of the magnetic compass needle remained unchanged.

   III] On increasing the current, the amount of deflection of the needle increased.

   IV] On bringing the compass needle closer to the wire, the deflection decreased.

   Choose the best alternative:
   - (A) Only I, II are correct and III, IV are incorrect
   - ✓(B) Only I, III are correct and II, IV are incorrect
   - (C) Only II, III are correct and I, IV are incorrect
   - (D) Only I, IV are correct and II, III are incorrect.

5. Magnetic field lines of a magnet:
   - (A) Form continuous closed loops
   - (B) Do not intersect with each other
   - (C) Do not form closed loops
   - ✓(D) Both (A) and (B) are correct

6. SI unit of magnetic flux is:
   - (A) $Wb\ m^{-1}$
   - (B) $T\ m^{-2}$
   - ✓(C) Wb
   - (D) $Wb\ m^{2}$

7. A coil of metal wire is kept stationary in a non-uniform magnetic field.
   - (A) An emf and current are both induced in the coil
   - (B) A current but no emf is induced in the coil
   - (C) An emf but no current is induced in the coil
   - (D) Neither current nor emf is induced in the coil

8. The relation between peak value of current i_m and rms value of current I is:
   (A) $I = i_m / \sqrt{2}$ (B) $I = i_m \sqrt{2}$
   (C) $I = 2 i_m$ (D) $I = i_m / 2$

9. Which of the following electromagnetic wave is the cause of Greenhouse effect?
   (A) Infra-Red rays   (B) Ultra Violet rays
   (C) X - rays   (D) Radio waves

10. A convex mirror produces virtual image when the object is placed:
    (A) At a distance of less than the focal length
    (B) At a distance more than the focal length
    (C) At any position
    (D) Never produces a virtual image

11. The colors that appear when we view a CD is due to:
    (A) Diffraction   (B) Interference
    (C) Polarisation   (D) Refraction

12. By suitably heating, sufficient thermal energy can be given to the free electrons to enable them to come out of the metal surface. This process is:
    (A) Photoelectric emission   (B) Field emission
    (C) Secondary emission   (D) Thermionic emission

13. Alpha particles are:
    (A) Nuclei of helium atoms and carry two units (2e) of negative charge
    (B) Nuclei of hydrogen atoms and carry one unit (e) of positive charge
    (C) Nuclei of helium atoms and carry two units (2e) of positive charge
    (D) Nuclei of helium atoms and are neutral in nature.

14. The process in which a heavy nucleus breaks into two fragments releasing great amount of energy is called
    (A) Nuclear fusion   (B) Nuclear fission
    (C) Beta decay   (D) Alpha decay

15. The voltage after which the diode current increases exponentially under forward bias is called
    (A) Reverse saturation voltage   (B) Dynamic voltage
    (C) Reverse voltage   (D) Threshold voltage

II] Fill in the blanks by choosing appropriate answer given in the bracket for ALL of the following questions.   5 X 1 = 5

(parallel, perpendicular, charge, self-inductance, density, transverse)

16. Significance of Kirchhoff's junction rule is conservation of _charge_.
17. When we move a charged particle _⊥ᵣ_ to the uniform magnetic field, it follows a circular path.
18. Electromagnetic analogue of mass is _self inductance_
19. Light waves can be polarized because they are _trans-verse_ in nature.
20. All nuclei have the same _density_

PART – B

III] Answer any FIVE of the following questions: 5 X 2 = 10

21. An electric dipole with dipole moment 4×10^{-9} C-m is aligned at 30^0 with the direction of a uniform electric field of magnitude 5×10^4 NC^{-1}. Calculate the magnitude of the torque acting on the dipole.

22. Draw the equipotential surfaces for (a) Negative point charge (b) Uniform electric field

23. Define the terms (i) mobility and (ii) relaxation time.

24. State and explain Ohm's law.

25. What is a long solenoid? Mention the expression for magnetic field at a point inside a long solenoid.

26. Define magnetic susceptibility. Mention the relation between magnetic susceptibility and relative magnetic permeability.

27. What is displacement current? Mention an expression for displacement current.

28. Mention any two applications of optical fibers.

29. What are intrinsic semiconductors? Name the type of elements used as dopant to obtain p-type semiconductors.

PART – C

IV] Answer any FIVE of the following questions: 5 X 3 = 15

30. Mention any three properties of electric field lines.

31. Derive an expression for effective capacitance of two capacitors connected in series.

32. Derive the expression for current in terms of drift velocity.

33. Explain with a circuit diagram, how to convert a galvanometer into a voltmeter?

34. Write any three properties of ferromagnetic materials.

35. What is a transformer? Mention any two sources of energy loss in a transformer.

36. Define critical angle. Write two conditions for total internal reflection.

37. State Bohr's postulates of hydrogen atom.

38. An element X has a mass number of 27. Its atomic number is 13. (i) How many protons and neutrons are there in the nucleus? (ii) If $R_0 = 1.2$ fm, calculate its nuclear radius.

PART – D

V] Answer any THREE of the following questions 3 X 5 = 15

39. State Gauss's law. Using Gauss's law, derive an expression for electric field due to an infinitely long straight uniformly charged conductor.

40. Derive an expression for the force between two parallel conductors carrying currents. Hence, define one ampere.

41. Derive an expression for instantaneous induced emf in an AC generator. Also represent the variation of emf with time graphically.

42. a) Give theory of interference by deriving an expression for amplitude of two light waves coming from two coherent sources. (3)

    b) Arrive at the condition for constructive and destructive interference. (2)

43. Explain Hallwachs and Lenard's observations on photoelectric effect.

44. a) What is rectification? (1)

    b) With a suitable circuit diagram, explain the working of p-n junction diode as a half-wave rectifier. (2)

    c) Draw the input and the output waveforms. (2)

2 X 5 = 10

VI] Answer any TWO of the following questions.

45. ABCD is a square of side 4 cm. Charges of +2nC, -2nC and +3nC are placed at corners A, B and C respectively. Calculate the work done in transferring a charge of +4 nC from point D to the centre of the square.

46. Two cells of emf 3V and 4V having internal resistances 1Ω and 2Ω respectively connected in parallel such that both the cells send the current in the same direction. A resistor of 10Ω is connected across the combination. Calculate the power dissipated in 10Ω resistor.

47. An AC source of 220V, 50Hz is connected in series with 100 Ω resistor, 0.5H inductor and 31.85µF capacitor. Find the phase angle between the current in the circuit and the source voltage. State whether the current leads or lags behind the voltage in the circuit.

48. A double convex lens made of glass of RI 1.5 has both radii of curvature of magnitude 20cm. Find its focal length. An object is placed at 10cm from lens. Determine the nature of the image by calculating the magnification

21] $p = 4 \times 10^{-9} \, Cm$

$\theta = 30^{\circ}$

$E = 5 \times 10^{4} \, N/C$

$T = pE \sin\theta$

$= 4 \times 10^{-9} \times 5 \times 10^{4} \times \sin 30 \quad (1/2)$

$= 10 \times 10^{-5} \, Nm$

38) $A = 27$

$Z = 13$

(i) $\boxed{13 \text{ protons}}$

$A - Z = 27 - 13 = \boxed{14 \text{ neutrons}}$

ii) $R = R_0 \sqrt[3]{A} = 1.2 \times \sqrt[3]{27} \, fm$

$= 1.2 \times 3 \, fm$

II PUC - PHYSICS (33)

Time: 3 hours 15 min.   Max Marks: 70

General Instructions:

1. All parts are compulsory.
2. For Part – A questions; ALL questions have to be answered in the first two pages of the answer-booklet and first written-answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to numerical problems without detailed solutions will not carry any marks.

PART – A

i. Pick the correct option among the four given options for **ALL** of the following questions:

                                                  15 × 1 = 15

1. The SI unit electric field is

    (A) NC   (B) NC^{-2}
    (C) NC^{-1} (D) Vm

2. An electron is accelerated through a potential difference of 1V. Energy gained by electron is

    (A) It doesn't possess any energy   (B) 1.6×10^{-19} J
    (C) 1.6×10^{-19} eV   (D) 1 eJ

3. The average time interval between two successive collisions of electrons inside a conductor is called

    (A) Relaxation time   (B) Mean life
    (C) Half life   (D) Excitation time

4. To convert galvanometer into voltmeter one should connect
    (A) High resistance in series with galvanometer
    (B) Low resistance in series with galvanometer
    (C) High resistance in parallel with galvanometer
    (D) Low resistance in series with galvanometer

5. Susceptibility of a material is -1.66×10^{-5}. The type of material is

    (A) Diamagnetic   (B) Nonmagnetic
    (C) ferromagnetic   (D) Paramagnetic

6. Lenz's law of electromagnetic induction is based on
    (A) Law of conservation of momentum
    (B) Law of conservation of energy
    (C) Law of conservation of charge
    (D) Law of conservation of both momentum and energy

7. An AC generator converts
    (A) Mechanical energy into electrical energy
    (B) Electrical energy into mechanical energy
    (C) Magnetic energy into mechanical energy
    (D) Magnetic energy into electrical energy

8. In series LCR circuit, at resonance

    (A) $X_L > X_C$ (B) $X_L < X_C$
    (C) $X_L = X_C$ (D) $X_L = X_C = 1$

9. Which of the following electromagnetic waves have the shortest wavelength?

   (A) X - rays
   (C) Gama rays

   (B) Radio waves
   (D) Microwaves

10. Focal length of a convex lens will be maximum for

   (A) Monochromatic green light
   (C) Blue light

   (B) Equal for all lights
   (D) Red light

11. In single slight diffraction pattern

   (A) Central fringe is dark
   (C) Central fringe has negligible width

   (B) All fringes are of same width
   (D) Central fringe is brightest

12. When green light is made incident on a metal, photoelectrons are emitted by it. But no photoelectrons are obtained by yellow light. If red light is incident on that metal, then

   (A) Less electrons will be emitted
   (C) More electrons will be emitted

   (B) No electrons will be emitted
   (D) Electron emission will be doubled

13. The minimum energy required to free an electron from ground state of hydrogen atom is

   (A) 0.85 eV
   (C) 13.6 eV

   (B) 3.4 eV
   (D) 1.51 eV

14. The radius of nucleus changes with mass number A of the nucleus as

   (A) $R \propto A^3$
   (C) $R \propto A$

   (B) $R \propto A^{-1}$
   (D) $R \propto A^{1/3}$

15. Pure or intrinsic semiconductor at absolute zero is a

   (A) Perfect insulator
   (C) Good conductor

   (B) Super conductor
   (D) Semiconductor

ii. **Fill in the blanks by choosing appropriate answer given in the bracket for <u>ALL</u> the questions:**   <u>5 × 1 = 5</u>

   (Transverse, Magnetic dipole, Free electrons, Mechanical, Self-inductance, Fusion)

16. Current carrying circular coil is equivalent to a _____

17. The Physical quantity which is measured in the unit of WbA^{-1} is _____

18. The phenomenon of polarization proves the _____. nature of light.

19. Hydrogen bomb is based on the principle of _____

20. Minority charge carriers in P-type semiconductors are _____

PART – B

iii. **Answer any FIVE of the following questions:**   5 × 2 = 10

21. State and explain Guass's law in electrostatics.

22. Calculate potential energy possessed by a positive charge of 19 nC placed at a point where electric potential is measured to be 1.6 V.

23. Write expression for magnetic potential energy of a magnetic dipole kept in uniform magnetic field and explain the terms.

24. Distinguish between diamagnetism and ferromagnetism based on relative permeability and susceptibility.

25. What is self-inductance of a coil. Write its SI unit.

26. Mention two sources of power loss in a transformer.

27. What is displacement current? Write the expression for displacement current.

28. State laws of refraction.

29. Write any two differences between intrinsic and extrinsic semiconductors.

PART – C

iv. **Answer any FIVE of the following questions:**   5 × 3 = 15

30. Write any three properties of electric field lines.

31. Derive the relation between electric field and electric potential.

32. Derive the expression for current in terms of drift velocity.

33. State Ampere's circuital law. Using it, obtain an expression for magnetic field at a point due to infinitely long straight current carrying conductor.

34. Define the terms: a) Magnetization b) Magnetic intensity and c) Magnetic Susceptibility.

35. Derive an expression for motional EMF induced in a conductor moving in a uniform magnetic field.

36. Derive the relation f=R/2 in case of concave mirror.

37. Write three postulates of Bohr's theory of hydrogen atom.

38. Find the binding energy of an α-particle from the following data and express it in MeV.

    Mass of helium nucleus = 4.00126 amu, Mass of proton = 1.007277 amu, Mass of neutron = 1.00866 amu

PART – D

v. **Answer any THREE of the following questions:**   3 × 5 = 15

39. Define electric potential due to a point charge and arrive at the expression for the electrical potential at a point due to a point charge.

40. Derive the condition for balance of Wheastone's bridge using kirchoff's rules.

41. With the help of diagram, derive the expression for the torque on a rectangular loop placed in a uniform magnetic field.

42. (a) Write the conditions on path difference under which constructive and destructive interference occur.   (2)

    (b) Write any three differences between interference and diffraction.   (3)

43. (a) How does the de-Broglie wavelength of a charged particle vary when accelerating potential increases? (1)

(b) Define stopping potential. (1)

(c) Write experimental observations of Photo electric effect. (3)

44. What is rectification? Describe with circuit diagram, the working of a p-n junction diode as a half wave rectifier with input and output waveforms.

PART – E

vi. **Answer any TWO of the following questions:** 2 × 5 = 10

45. Three charges each equal to +4nC are placed at three corners of a square of side 2 cm. Find the electric field at the fourth corner.

46. A wire having length 2.0 m, diameter 1.0 mm and resistivity 1.963×10^{-8} Ωm is connected in series with a battery of emf 3 V and internal resistance 1 Ω. Calculate the resistance of the wire and current in the circuit.

47. A series LCR circuit containing an inductor of 1.5 H, a capacitor of 35 µF and a resistor of 50 Ω is connected to an ac source of 200 V and 50 Hz. Calculate impedance and power factor of the circuit.

48. A small bulb is placed at the bottom of a tank containing water to a depth of 1 m. Find the critical angle for water air interface. Also calculate the diameter of the circular path of light formed on the surface of water. (Given: Refractive index of water = 4/3)

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GOVERNMENT OF KARNATAKA

DEPUTY DIRECTOR, DEPT. OF SCHOOL EDUCATION (PRE-UNIVERSITY)

PUC-II YEAR PREPARATORY EXAMINATION-2024

Time : 3 Hours 15 Minutes   SUBJECT : PHYSICS (33)   MARKS : 70

Instructions :
1) All parts are compulsory.
2) For Part-A questions, first written answer will be considered for awarding marks.
3) Answers without relevant diagram/ figure/ circuit diagram wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I. **Pick the correct option among the four given options.**   15X1=15

1) When a body is charged positively, then its mass,
   A) slightly increases
   B) slightly decreases
   C) it may increase or decrease
   D) remains same

2) When a conductor is placed inside uniform electric field. Then
   A) At the surface of conductor, electrostatic field is normal to the surface at every point
   B) Inside the conductor, electrostatic field is zero
   C) Electrostatic potential is constant throughout the volume of conductor and has the same value on its surface
   D) All of the above are correct

3) Resistance of a conductor depends on
   A) length of the conductor
   B) Area of cross section of the conductor
   C) temperature of the conductor
   D) all the above

4) A charge in motion has
   A) Only electric field around it
   B) Only magnetic field around it
   C) Both (a) and (b)
   D) Neither (a) and (b)

5) A magnetic needle is placed in an external magnetic field at an angle θ with the field. Needle is in most stable position if the value θ of is
   A) $0°$ B) $90°$ C) $60°$ D) $180°$

6) Direction of current induced in a wire by moving in a uniform magnetic field is found using
   A) Newton's laws
   B) Lenz's law
   C) Ampere's rule
   D) Right hand grip rule

7) The self inductance L of a solenoid of length 'l' and area of cross-section 'A' with fixed number of turns per unit length increases as
   A) 'l' and 'A' increases
   B) 'l' decreases and 'A' increases
   C) Both 'l' and 'A' decreases
   D) 'l' increases and 'A' decreases

8) In series LCR circuit, the power dissipated at resonance is
   A) $\dfrac{V^2}{X_L - X_C}$ B) $I^2 \omega L$ C) $I^2(X_L - X_C)$ D) $I^2_{rms} R$

9) The electromagnetic radiations used in radar system is
   A) gamma rays   B) radio waves   C) infrared rays   D) microwaves

10) Which of the following concept is used in optical fibre ?
    A) Refraction of light
    B) Scattering of light
    C) dispersion of light
    D) Total internal reflection of light

11) Phenomenon of diffraction takes place in
    A) Sound waves only
    B) Light waves only
    C) Matter waves only
    D) All types of waves

12) For a certain metal, incident frequency υ is five times of threshold frequency υ_0 and maximum speed of photoelectrons is $8\times10^6 ms^{-1}$. If $\upsilon = 2\upsilon_0$, the maximum speed of photoelectrons will be
    A) $4\times10^6 ms^{-1}$ B) $6\times10^6 ms^{-1}$ C) $3\times10^6 ms^{-1}$ D) $1\times10^6 ms^{-1}$

13) Thickness of gold foil used in α-particle scattering experiment was
    A) $2.1\times10^{-7}m$ B) $2.1\times10^{-3}m$ C) $2.1\times10^{-10}m$ D) $2.1\times10^{-12}m$

14) Density of nuclear matter
    A) increases with mass number
    B) decreases with mass number
    C) independent of mass number
    D) increases with upto mass number 56 then decreases

15) A sample of semiconductor material having hole as minority carriers is of
    A) P-type   B) n-type   C) intrinsic   D) data insufficient

II. Fill in the blanks by choosing appropriate answers : 5X1=5

(half, henry, neutrons, insulators, velocity, weber)

16) When charged particle enters perpendicular in a uniform magnetic field, magnitude of its angular velocity will be independent of ....

17) SI unit of magnetic flux is ....

18) Intensity of unpolarised light coming through a single polaroid is .... of the intensity of incident light

19) Isotones are the nuclides which contains same number of ....

20) At zero kelvin, semiconductor behave like an ....

PART-B

III. Answer ANY FIVE of the following questions. 5X2=10

21) Write any two basic properties of electric charge.

22) Three capacitors of capacitance $2\mu F$, $3\mu F$ and $4\mu F$ are connected in parallel. What is the total capacitance of the combination ?

23) How do you convert a galvanometer into voltmeter ? Mention the expression for resistance connected to the galvanometer for conversion.

24) State and explain Gauss law in magnetism.

25) State i) Faraday's law of electromagnetic induction   ii) Lenz's law

26) Mention any two types of energy losses in transformer.

27) What is displacement current ? Give expression for the same.

28) What are the conditions required for total internal reflection of light ?

29) Classify the conductors, semi-conductors and insulators on the basis of band theory of solid.

PART-C

IV. Answer ANY FIVE of the following questions. 5X3=15

30) Write any three properties of electric field lines.

31) What are equi-potential surfaces ? Mention any two properties of the same.

32) Derive an expression for equivalent capacitance of two capacitors connected in series.

33) Derive an expression for magnitude of magnetic field at a point around a long straight conductor using ampere's circuital law.

34) Mention any three properties of paramagnetic substance.

35) What are the factors on which self inductance of a coil depends ?

36) Write the Cartesian sign conventions used analysing reflection of light by spherical surface.

37) Write three postulates of Bohr's theory of hydrogen atom.

38) Obtain the binding energy of the nuclei in $_{26}^{56}Fe$ units of MeV from the following data Mass of $_{26}^{56}Fe$=55.934939u, Mass of proton=1.007825u and Mass of neutron=1.008665u.

PART-D

V. Answer ANY THREE of the following questions : 3X5=15

39) Derive an expression for electric potential at a point due to isolated point charge.

40) Obtain the balancing condition for the Wheatstone bridge.

41) Derive an expression for force per unit length between two parallel current carrying conductors. And hence define one ampere.

42) a) State Huygen's principle.
    b) Using Huygen's principle, arrive at snell's law of refraction of plane wavefont.

43) a) Define work function of photosensitive material. 2
    b) Write Einstein's photoelectric equation and explain experimental observations of photo electric effect. 3

44) Explain working of full wave rectifier and draw input and output waveforms.

VI. Answer ANY TWO of the following questions. 2X5=10

45) Two point charges $4\mu C$ and $-4\mu C$ are placed at two corners of an equilateral triangle of side 3m. Calculate the resultant electric intensity at third corner of the triangle.

46) A heating element using nichrome connected to a 230V supply draws an initial current of 3.2A which settles after few seconds to a steady value of 2.8A. What is the steady temperature of the heating element if the room temperature is 27.0 °C ? Temperature co-efficient of resistance of nichrome averaged over the temperature range involved is 1.7×10^{-4} °C-1.

47) A resistor of 200Ω and capacitor of $15.0\mu F$ are connected in series to a 220V, 50Hz ac source.
    a) calculate the current in the circuit
    b) calculate the voltage (rms) across the resistor and capacitor.

48) A prism is made of glass of unknown refractive index. A parallel beam of light is incident on a face of the prism. The angle of minimum deviation measured to be 40°. What is the refractive index of the prism ? The refracting angle of prism is 60°. If prism is placed in water (refractive index 1.33) predict new angle of minimum deviation of a parallel beam of light.
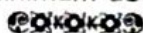
K   SECOND PUC PREPARATORY EXAMINATION – JANUARY 2024
Sub: PHYSICS (33)

Time: 3 Hrs. 15 Min.   Total Marks: 70

General Instructions:

(i)   All parts are compulsory.

(ii)   For Part – A questions, first written-answer will be considered for awarding marks.

(iii)   Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

(iv)   Direct answers to the numerical problems without detailed solutions will not carry any marks.

<div align="center">PART – A</div>

Pick the correct option among the four given options for ALL the following questions. $15 \times 1 = 15$

1. A body can be negatively charged by
   (a) Giving excess of electrons to it   (b) Removing some electrons from it
   (c) Giving some protons to it   (d) Removing some neutrons from it

2. Three capacitors of capacitance $3\ \mu F$ are connected in a circuit. Then their maximum and minimum capacitances will be
   (a) $9\ \mu F, 1\ \mu F$ (b) $8\mu F, 2\mu F$ (c) $9\ \mu F, 0\mu F$ (d) $3\mu F, 2\mu F$

3. The resistivity of a wire
   (a) Increases with the length of the wire
   (b) Decreases with the area of cross-section
   (c) Decreases with the length and increases with the cross-section of wire
   (d) Independent of dimensions like length and area of cross section

4. The magnetic field B within the solenoid having n turns per metre length and carrying a current of i ampere is given by
   (a) $\dfrac{\mu_0 ni}{2}$ (b) $\mu_0 ni$ (c) $4\pi\mu_0 ni$ (d) ni

5. The magnetic field lines due to a bar magnet are correctly shown in
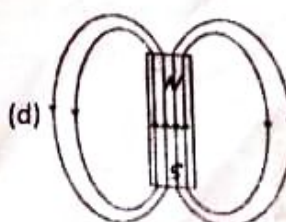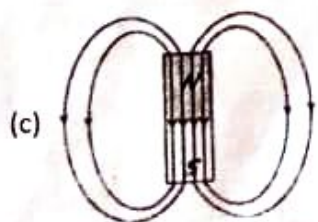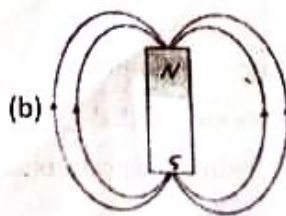
6. Lenz's law is consequence of the law of conservation of

    (a) charge   (b) momentum   (c) mass   (d) energy

7. A coil of N turns and mean cross-sectional area A is rotating with uniform angular velocity ω about an axis at right angle to uniform magnetic field B. The induced e.m.f. E in the coil will be

    (a) NBA sin ωt   (b) NBωsin ωt   (c) NB/A sinωt   (d) NBA ωsin ωt

8. An ac source is connected to a resistive circuits. Which of the following is true

    (a) Current leads the voltage and both are in same phase

    (b) Current lags behind the voltage and both are in same phase

    (c) Current and voltage are in same phase

    (d) Any of the above may be true depending upon the value of resistance

9. The electromagnetic waves with highest frequency among the following are

    (a) Gamma rays   (b) UV rays   (c) X rays   (d) Radio waves

10. Total internal reflection of a ray of light is possible when the (i_c = critical angle, i = angle of incidence)

    (a) Ray goes from denser medium to rarer medium and $i < i_c$

    (b) Ray goes from denser medium to rarer medium and $i > i_c$

    (c) Ray goes from rarer medium to denser medium and $i > i_c$

    (d) Ray goes from rarer medium to denser medium and $i < i_c$

11. Two sources of waves are called coherent if

    (a) Both have the same amplitude of vibrations

    (b) Both produce waves of the same wavelength

    (c) Both produce waves of the same wavelength having constant phase difference

    (d) Both produce waves having the same velocity

12. When yellow light is incident on a surface, no electrons are emitted while green light can emit. If red light is incident on the surface, then

    (a) No electrons are emitted

    (b) Photons are emitted

    (c) Electrons of higher energy are emitted

    (d) Electrons of lower energy are emitted

13. Which one of the series of hydrogen spectrum is in the visible region

    (a) Lyman series   (b) Balmer series

    (c) Paschen series   (d) Bracket series

14. Which of the following pairs is an isobars

    (a) $_1H^1$ and $_1H^2$ (b) $_1H^2$ and $_1H^3$

    (c) $_6C^{12}$ and $_6C^{13}$ (d) $_{15}P^{30}$ and $_4Si^{30}$

15. Which statement is correct

(a) N-type germanium is negatively charged and P-type germanium is positively charged

(b) Both N-type and P-type germanium are neutral

(c) N-type germanium is positively charged and P-type germanium is negatively charged

(d) Both N-type and P-type germanium are negatively charged

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions. (independent, circular, wavelength, decreases, radial, distance between the slits)

$5 \times 1 = 5$

16. The path traced by charged particle moving perpendicular to uniform magnetic field is _____.

17. To make the field _____ the magnetic pole pieces are made curved in ac generator.

18. The fringe width in Young's experiment is directly proportional to _____

19. Nuclear forces are charge _____

20. Width of depletion region in a semiconductor _____ with increasing forward bias voltage.

PART – B

III. Answer any FIVE of the following questions:

$5 \times 2 = 10$

21. Sketch the electric field lines of

(a) two equal and opposite charges   (b) two equal positive charges

22. A parallel plate capacitor has a capacity C. The separation between the plates is doubled and a dielectric medium is introduced between the plates. If the capacity now becomes 2C, find the dielectric constant of the medium.

23. What is Lorentz force? Write the Lorentz equation.

24. State and explain Gauss law in magnetism.

25. Write an expression for mutual inductance of two long coaxial solenoids of same length and explain the terms.

26. What is a transformer? On what principle does it work?

27. Mention any two uses of infrared rays.

28. Write the two conditions for total internal reflection.

29. Distinguish between p type and n type semiconductors.

PART – C

IV. Answer any FIVE of the following questions:

$5 \times 3 = 15$

30. Mention three basic properties of electric charges.

31. Derive an expression for potential energy of an electric dipole placed in a uniform electric field.

32. State and explain Ohms law. Mention any one its limitation.

33. Explain with a diagram how a galvanometer is converted into ammeter.

34. Bring out any three differences between paramagnetic and diamagnetic materials.

35. What is an ac generator? Draw a neat labelled diagram of ac generator.

36. Obtain an expression for equivalent focal length of two thin lenses kept in contact.

37. State Bohr's three postulates.

38. Obtain the binding energy of $^{56}_{26}$Fe in MeV. Assume rest mass of Fe-56 = 55.93494 u, rest mass of proton is 1.00783 u and rest mass of neutron is 1.00867 u.

PART – D

3 × 5 = 15

V. Answer any THREE of the following questions:

39. Define electric potential at a point. Obtain an expression for electric potential at a point due to an isolated positive point charge.

40. Obtain the expressions for equivalent emf and equivalent internal resistance of two dissimilar cells connected in parallel.

41. Obtain an expression for force per unit length between two straight parallel conductors carrying current with a diagram and hence define ampere.

42. (a) What is a wavefront? (1)

    (b) Mention the expression for fringe width in Young's experiment and explain the terms. (2)

    (c) Write any two uses of polaroids. (2)

43. (a) Define work function and stopping potential. (2)

    (b) Represent in graphs the effect of (3)

    (i) Intensity of light on photo current.

    (ii) Potential on photoelectric current

    (iii) Frequency of incident radiation on stopping potential

44. What is rectification? With a neat circuit diagram explain the working of full wave rectifier. Draw input and output waveform.

VI. Answer any TWO of the following:

2 × 5 = 10

45. Four point charges 1 nC, 2 nC, 3 nC and 4 nC are placed respectively at the corners of a square ABCD of side 2m. Find the magnitude and direction of resultant electric field at the intersection of diagonals.

46. In the following wheatstone network if P = 2Ω, Q = 3Ω, R = 4Ω, S = 5Ω and emf of battery E = 2V, find the current through galvanometer.
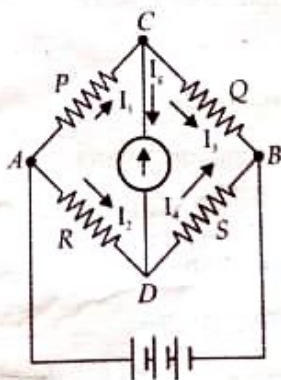
47. An inductance of 200 mH, capacitance of 20 μF and resistance of 80 Ω are connected in series across an AC source of 220 V, 50 Hz. Find the average value of current (mean current).

48. A ray of light is incident on one face of an equilateral prism of RI 1.5 at an angle of 30°. Find the angle of deviation produced by the prism. Find what other angle of incidence deviation is same.

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DEPUTY DIRECTOR DEPARTMENT OF SCHOOL EDUCATION (PRE-UNIVERSITY)

DISTRICT LEVEL P.U.C. SECOND YEAR PREPARATORY EXAM. JAN-2024

Time: **3.15 Hours** Subject: **PHYSICS (33)** Max. Marks: **70**

General Instructions:

1. All parts are compulsory.

2. PART-A questions, first written-answer will be considered for awarding marks.

3. Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks

4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I Pick the correct option among the four given options for ALL of the following questions: 15×1=15

1. In case of Coulomb's law, the proportionality constant k is

   A) always a constant   B) depends on the medium between the charges

   C) independent on the medium between the charges   D) depends on the distance between the charges

2. One example for non-polar molecules is

   A) O_2 B) H_2O C) HCl D) all the above

3. Below are the two statements related to equipotential surfaces.

   Statement 1 : Electric field is always directed perpendicular to an equipotential surface.

   Statement II : Equipotential surface is a surface on which at each point potential is same.

   A) Both the statements I and II are true and II is the correct explanation of statement I.

   B) Both the statements I and II are true and II is not the correct explanation of statement I.

   C) Statement I is true but statement II is false.

   D) Statement I is false but statement II is true.

4. Force on a charged particle moving in a magnetic field is maximum when the angle between the velocity of the charge and the magnetic field is

   A) 180°, B) 90°, C) 45° D) 0°

5. Superconductors are

   A) diamagnetic materials B) paramagnetic materialsC) ferromagnetic materials D) non-magnetic materials

6. North Pole of a magnet is moved along the axis towards a circular coil Direction of current flowing in the side of the coil facing the magnet is

   A) anticlockwise·

   B) clock wise

   C) normal to the plane of the coil towards the coil

   D) normal to the plane of the coil away from the coil

7. A coil of copper wire of radius 'r' and self-inductance L is bent in two concentric turns each having radius r/2. The new self-inductance of this coil is

   A) 2L , B) L C) 4L D) L/2

8. Capacitive reactance is

   A) inversely proportional to the frequency of ac source.

   B) directly proportional to the capacitance of the capacitor.

   C) independent of the frequency of ac source

   D) independent of capacitance of the capacitor

9. Electromagnetic waves are

A) transverse waves   B) longitudinal waves   C) mechanical waves   D) one dimensional waves

10. The negative sign of the linear magnification of image formed by a spherical mirror indicates that the

A) image is virtual and erect   B) image is real and inverted

C) image is real and erect   D) image is virtual and inverted

11. Which one of the following does not use polaroid

A) sunglasses to reduce the intensity of light   B) window panes to reduce the intensity of light

C) 3D movie cameras   D) thin coating on reading lenses

12. The minimum frequency of the incident radiation below which there is no photo emission is called as

A) work function   B) threshold wavelength   C) threshold frequency D) angular frequency

13. Total energy of an electron revolving round in a stationary orbit around hydrogen nucleus is

A) always positive   B) always negative C) independent of quantum number n. D) independent of velocity

14. The output of a full wave rectifier is

A) pure AC   B) pure DC   C) pulsating DC   D) pulsating AC

15. The p-n junction diode is used as a i) rectifier ii) switch iii) power indicator

Choose the correct option of the following

A) (i), (ii) and (iii) are correct   B) Only (i) is correct

C) (i) and (iii) are correct and (ii) is wrong D) (i) and (ii) are correct and (iii) is wrong

II Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: 5×1=5

(infinity, transverse, electrostatic shielding, conventional current, longitudinal, inertia)

16. The electric field inside the cavity of a charged conductor is zero, this is known as............

17. The current which is assumed to be flowing in a circuit from positive terminal to negative is called ....

18. Resistance of an ideal voltmeter is ....

19. Self-inductance plays the role of ....

20. Phenomenon of polarisation proves the nature of light waves ....

PART-B

5×2=10

III. Answer any FIVE of the following questions:

21. Mention any two basic properties of electric charge.

22. Write the expression for energy stored in a charged capacitor and explain the terms.

23. State right hand thumb rule. What is the direction of the magnetic field at the center of a circular current loop.

24. Obtain the relation between magnetic permeability and magnetic susceptibility.

25. State and explain Faraday's law of electromagnetic induction.

26. What is a transformer? Mention the principle on which it works.

27. Mention any two uses of infrared rays.

28. Two nuclei have mass numbers in the ratio 8:125. What is the ratio of their nuclear radii?

29. What happens to the width of depletion layer of a p-n junction diode when it is (i) forward biased and

(ii) reverse biased?

-2-

PART-C

IV Answer any FIVE of the following questions:

5×3=15

30. Derive an expression for the electric field at a point due to a uniformly charged, infinitely long, thin conducting wire using Gauss's law.

31. Derive an expression for the potential energy of a system of two point charges in the absence of external electric field.

32. Charges 2μC, 4μC and 6μC are placed at the three corners. A,B and C respectively of a square ABCD of side x meter. Find,what charge must be placed at the fourth corner so that the total potential at the centre of the square is zero.

33. Write any three factors on which the resistance of a conductor depends.

34. Mention any three differences between ammeter and voltmeter.

35. Write any three properties of paramagnetic substances.

36. With a neat labelled diagram, explain the construction of an AC generator.

37. Mention the three postulates of Bohr's atomic model.

38. a) Define the terms: (i) Mass defect and (ii) nuclear binding energy.   (2 marks)

    b) Give the relation between nuclear binding energy and mass defect.   (1 mark)

PART-D

V Answer any THREE of the following questions.

3x5=15

39. Derive an expression for the electric field at any point on the axial line of a short electric dipole.

40. a) Define mobility of free electron. Give its SI unit.   (2 marks)

    b) Derive an expression for electric current in terms of drift velocity and number density of free electrons. (3 marks)

41. What is a solenoid? Derive an expression for the magnetic field at a point insidethe air cored long current carrying solenoid by using Ampere's circuital law.

42. Derive Lens maker's formula.

43. Show that for a prism $n = \dfrac{Sin\frac{A+D}{2}}{sin\frac{A}{2}}$ where the symbols have their usual meaning.

44. a) What are valence bands and conduction bands?   (2 marks)

    b) Classify conductors, semiconductors and insulators on the basis of energy bands. (3 marks)

VI Answer any TWO of the following questions:

2 X 5 = 10

45. Two cells A and B are connected in series, each having an emf of 1.5V. The internal resistances of A and B are 0.5Ω and 0.25Ω respectively.The combination is connected across a resistance of 2.25Ω . Calculate (i) the current in the circuit. (ii) the p.d. across the terminals of each cell.

46. An alternating potential of 110 volts and 50 Hz is applied to a circuit having resistance of 200 Ω , inductance of 5H and a capacitance of 2 μF Calculate the impedance and the maximum current in the circuit.

47. In Young's double slit experiment the slits are separated by 0.28 mm and screen is placed at a distance of 1.4 m away from the slits. The distance between the central bright fringe and the fifth dark fringe is measured to be 1.35 cm. calculate the wavelength of light used.

48. Light of frequency 8.41×10^{14} Hz is incident on a metal surface. Electrons with their maximum speed of 7.5×10^5 m s^{-1} are ejected from the surface. Calculate the threshold frequency for photo emission of electrons. Also find the work function of the metal in electron volt (eV).Given: Planck's Constant, $h = 6.625 \times 10^{-34}$ Js, Mass of the electron = 9.1×10^{-31} kg.

-3-

MD | **II PUC PREPARATORY EXAMINATION, JANUARY - 2024** | **II**

Time : 3:15 Hours | PHYSICS - 33 | Max. Marks : 70

General Instructions:
* All parts are compulsory.
* Part - A questions have to be answered in the first two pages of the answer booklet. For Part-A questions, first written answer will be considered for awarding marks.
* Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
* Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART A

I. Pick the correct option among the four given options for ALL of the following questions: 15×1=15

1. If an electric dipole is placed in a non-uniform electric field, it experiences
   (a) only torque   (b) only force   (c) both (a) and (b)   (d) neither (a) nor (b)

2. In bringing an electron towards another electron, the electrostatic potential energy of the system
   (a) increases   (b) decreases   (c) remains unchanged   (d) becomes zero

3. Which of the following is TRUE for equipotential surface for uniform electric field?
   (a) equipotential surface is cylindrical
   (b) electric field lines are perpendicular to equipotential surface
   (c) electric field lines are parallel to equipotential surface
   (d) equipotential surface is spherical

4. The electric field E, current density J and conductivity σ of a conductor are related as
   (a) $\sigma = E/J$ (b) $\sigma = J/E$ (c) $\sigma = J^2E$ (d) $\sigma = \dfrac{1}{JE}$

5. Magnetic field at a distance r from an infinitely long straight conductor carrying a steady current varies as
   (a) $\dfrac{1}{r^2}$ (b) $\dfrac{1}{r}$ (c) $\dfrac{1}{r^3}$ (d) $\dfrac{1}{\sqrt{r}}$

6. The magnetic susceptibility of an ideal diamagnetic substance is
   (a) +1   (b) 0   (c) -1   (d) ∞

7. Below are the two statements related to Transformer
   Statement I : A transformer cannot work on dc supply.
   Statement II : dc changes neither in magnitude nor in direction.
   (a) Both statement I and II are correct and II is the correct explanation for I
   (b) Both statement I and II are correct and II is not the correct explanation for I
   (c) Statement I wrong but the statement II is correct
   (d) Statement I correct but the statement II is wrong

8. Which of the following does not obey the phenomenon of mutual induction?
   (a) transformer   (b) dynamo   (c) induction coil   (d) electric heater ✗

9. For a series LCR circuit at resonance, the statement which is NOT TRUE is
   (a) Wattless current is zero   (b) Power factor is zero
   (c) Peak energy stored by a capacitor = Peak energy stored by an inductor
   (d) Average power = Apparent power

10. Electromagnetic waves having shortest wavelength among the following are
    (a) radio waves   (b) ultraviolet rays   (c) infrared waves   (d) gamma rays

11. The first image formed in compound microscope is
    (a) real and diminished ✓   (b) real and enlarged   (c) virtual and diminished   (d) virtual and enlarged

12. When a plane wavefront passes through a convex lens, the type of emergent wavefront is
    (a) Plane   (b) Spherical   (c) Cylindrical   (d) None of these

(P.T.O.)

— 2 —

13. For a given photosensitive material (above threshold frequency), the photoelectric current is directly proportional to the
    (a) frequency of incident light
    (b) intensity of incident light
    (c) wavelength of incident light
    (d) stopping potential

14. If R_1 and R_2 are the radii of the atomic nuclei of mass numbers 64 and 125 respectively, then the ratio R_1/R_2 is
    (a) 64/125
    (b) $\sqrt{64/125}$
    (c) 5/4
    (d) 4/5

15. The majority charge carriers in P-type semiconductor are
    (a) electrons
    (b) protons
    (c) holes
    (d) neutrons

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: 5×1=5

[200 MeV, 3 eV, Malus law, Gauss's law, Lenz's law, 3D movie cameras]

16. According to _____ The net magnetic flux through any closed surface is zero.

17. _____ states that "The polarity of induced emf is such that it tends to produce a current which opposes the change in magnetic flux".

18. Polaroids can be used in _____ .

19. The energy released per fission reaction of nuclei like uranium is of the order of _____ .

20. The energy band gap in the case of insulators is greater than _____ .

PART B

III Answer any FIVE of the following questions: 5×2=10

21. Mention any two basic properties of electric charges.

22. When does a dipole placed in an uniform electric field is said to be in (i) Stable and (ii) Unstable equilibrium.

23. A solenoid made of 1000 turns per unit length carries a current of 5 A. what is the magnitude of the magnetic field inside the solenoid?

24. Write any two differences between paramagnetic and diamagnetic substances.

25. Mention any two factors on which self-inductance of a coil depends.

26. Name any one source of energy loss in a transformer and explain how to minimize it.

27. What is displacement current? Give the expression for it.

28. Define the terms magnification and magnifying power of an optical instrument.

29. Distinguish between intrinsic and extrinsic semiconductors.

PART C

IV. Answer any FIVE of the following questions: 5×3=15

30. Obtain an expression for the electric field due to uniformly charged infinite plane sheet by using Gauss's law.

31. Derive the relation between electric field and electric potential due to a point charge.

32. State and explain Ohm's law. Mention it's any one limitation.

33. Explain with circuit diagram how to convert a galvanometer into a voltmeter.

34. Mention any three properties of magnetic field lines.

35. Describe the coil-magnet experiment of Faraday's and Henry to study electromagnetic induction.

36. Derive the relation between focal length and radius of curvature of spherical mirror.

37. State Bohr's postulates of Hydrogen atom.

38. Obtain the binding energy of the nucleus $^{238}_{92}U$.

    Given: $m\left[^{238}_{92}u\right] = 238.05079u$, $m_n = 1.008665u$, $m_p = 1.007825\ u$

3×5=15

— 1 —
PART D

V. Answer any THREE of the following questions:

39. Obtain an expression for the electric field at a point along the axis of an electric dipole.

40. Derive an expression for equivalent emf and internal resistance of two cells connected in parallel.

41. Arrive at the expression for the force between two parallel conductors carrying current and hence define 'ampere'.

42. (a) State Huygen's principle. (2)
    (b) Using Huygen's principle arrive at Snell's law of refraction for a plane wave. (3)

43. (a) Write Einstein's photoelectric equation and explain the terms. (2)
    (b) Write any three characteristics of photon. (3)

44. What is rectification? With relevant circuit diagram and waveforms explain the working of p-n junction diode as a full wave rectifier.

2×5=10

VI. Answer any TWO of the following questions:

45. A 900 pF capacitor is charged by 100 V battery. How much electrostatic energy is stored by the capacitor? If the capacitor is disconnected from the battery and connected to another 900 pF capacitor. What is the electrostatic energy stored by the system?

46. Determine the current in each branch of the network shown in the figure.
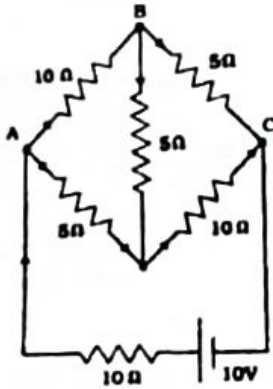
47. A resistor of 200 Ω and a capacitor of 15 µF are connected in series to a 220 V, 50 Hz ac supply.
    (a) Calculate the current in the circuit.
    (b) Calculate the voltage (rms) across the resistor and the capacitor.

48. A Small bulb is placed at the bottom of a tank containing water to a depth of 80 cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33 (Consider the bulb to be a point source.)

SECOND PUC PREPARATORY EXAMINATION, JANUARY 2024
SUB: PHYSICS (33)

Time: 3.15 Hrs]   [Max. Marks: 70

Instructions:
   a) *All parts are compulsory.*
   b) *For Part – A, first written answer will be considered for awarding marks.*
   c) *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*
   d) *Direct answers to the numerical problems without detailed. Solutions will not carry any marks.*

PART – A

I.   Pick the correct option among four given for ALL of the following questions: 15 x 1 = 15

1) Charge on a body may be

   a) $+\frac{2}{3}e$ b) $-\frac{2}{3}e$ c) $+\frac{10}{2}e$ d) $-\frac{2}{10}e$

2) S.I unit of dielectric strength is.

   a) Vm^{-1} b) NC^{-1} c) Nm^2C^{-2} d) both (a) & (b)

3) Current per unit area of crossection of a conductor is

   a) Resistivity   b) Current density   c) Conductivity   d) Mobility

4) If the number of turns of the coil is doubled then voltage sensitivity of galvanometer will be

   a) doubled   b) unchanged   c) halved   d) 4 times

5) The relation connecting between magnetic susceptibility (x) and relative permeability (μr) is given by

   a) $x_m = \mu_r + 1$ b) $x_m \mu_r = 1$ c) $x_m = \mu_r - 1$ d) $\mu_r = x - 1$

6) In a coil-coil experiment when a iron rod is inserted into their axis, the deflection in the galvanometer.

   a) increases   b) decreases   c) remains the same   d) none of these

7) Self inductance plays a role of

   a) Inertia   b) Impedence   c) Mutual inductance   d) None of the above

8) For step down transformer

   a) Ns < Np   b) Ns > NP   c) Ns = Np   d) Ns Np = 1

9) The wavelength range of Infra Red rays is

   a) 700 mm 400nm   b) 400 nm – 1 nm   c) 1nm – 10^{-3} nm   d) 1 mm – 700 nm

10) When the length of microscope tube increases, its magnifying power

   a) Decreases b) increases c) does not change d) may decrease or increase

11) Transverse wave nature of light is established by

   a) Interference b) Diffraction c) Polarisation   d) All the above

12) The stopping potential depends on

   a) frequency of incident light   b) Intensity of incident light
   c) No. of incident photons   d) No. of emitted electrons

13) In Bohr's atomic model of hydrogen, which of the following is wrong

   a) $r_n \alpha n^2$ b) $v_n \alpha \frac{1}{n}$ c) $E_n \alpha n^2$ d) $L_n \alpha n$

14) Density of nucleus
   a) decreases with increase in its mass number
   b) decreases with decrease in its mass number
   c) increases with increase in its mass number
   d) Independent of mass number

15) Pick out the wrong statement
   a) electrons are majority carriers and holes are minority in *n* type semiconductor
   b) holes are majority and electrons are minority in *p* type semiconductor
   c) at T-OK an intrinsic semiconductor behaves as a good conductor
   d) In an intrinsic semiconductor current is equally due to electrons and holes

Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: 5 x 1 = 05

(opposes, charge on nucleon, decreases, remains unchanged, directly, frequency)

16) Magnetisation of a magnetic material is _____ proportional to the magnetic intensity.
17) Induced emf always _____ change in magnetic flux.
18) When a wave front travels from rarer medium to denser medium the _____ remains constant.
19) Nuclear force does not depend upon _____.
20) When the pn junction is forward biased the width of the depletion region _____.

PART – B

Answer any FIVE of the following questions: 5 x 2 = 10

21) State and Explain Gauss's Law in electrostatics
22) Calculate the capacitance of parallel plate capacitor having cross section area of $6 \times 10^{-3} m^2$ separated by distance of 3mm filled with air.
23) Write the expression for Force acting on a current carrying conductor in a uniform magnetic field and explain the terms.
24) Draw the Field lines due to an external magnetic field near a
   (a) Diamagnetic substance (b) Paramagnetic Substance.
25) What is an ac Generator ? On what principle does it work ?
26) What is the power factor of a pure resistive circuit and a pure inductive circuit?
27) Mention any two uses of radio waves.
28) Mention Lens Maker's formula and explain the terms.
29) Write a neat circuit diagram of full - wave, rectifier and draw its Input and Output waveforms.

PART – C

Answer any FIVE of the following questions: 5 x 3 = 15

30) State and explain super position theorem for force due to multiple point charges.
31) Derive the Expression for equivalent capacitance when two Capacitors connected in series combination.
32) Derive the Expression for drift velocity of free electron in a conductor.
33) Differentiate between Volt meter and Ammeter.
34) Write the expression for Potential Energy of a magnetic dipole in a uniform magnetic field and explain the terms.
35) With a neat diagram Breifly explain Lenz's Law in emi.
36) Describe the phenomenon of T.I.R with a neat diagram.
37) Name the region of em-spectrum of Lyman, Balmer and Paschen series.
38) Calculate the energy equivalent of one amu.

PART – D

V. *Answer any THREE of the following questions:* 3 x 5 = 15

39) Derive an expression for electric potential due to an electric dipole.

40) Derive the expression for equivalent emf and equivalent internal resistance when two different cells are connected in parallel combination.

41) Derive the expression for magnetic field at a point on the axis of a circular current loop.

42) a) Prove law of reflection of a plane wave by a plane surface using Huygen's principle.

b) Write the condition for constructive and destructive Interference interms of path difference between 2 waves.

43) a) Using Einstein's photo electric equation; explain the experimental results of photo electric effect.

b) Mention any two chactrestics of photons.

44) Explain the working of p-n-Junction diode when it is (a) forwad bias (b) reverse bias with neat circuit diagram and its characteristics.

I. *Answer any TWO of the following questions:* 2 x 5 = 10

45) Two point charges $4\mu C$ and $2\mu C$ placed at the vertices A and B of a right angled triangle ABC respectively. The angle B is right angled. AB is $\sqrt{3} \times 10^{-2}m$, AC is $2 \times 10^{-2}m$ and BC is $1 \times 10^{-2}m$. Find the magnitude and direction of resultant Electric field at C.

46) In a wheatstone network four resistor 1Ω, 2Ω, 3Ω and 4Ω are connected in cyclic order of square ABCD. A battery of $3V$, 1Ω is connected between A and C. A Galvanometer of resistance 5Ω is connected across B and D. Calculate the current through the Galvanometer.

47) A resistance of 200Ω and a capacitor of $15\mu F$ are connected in series to a 220V, 50 Hz ac source. (a) Calculate the current in the circuit

(b) Calculate the rms voltage across the resistor and capacitor.

48) A Glass sphere of radius 0.15m contains a small air bubble at a distance 0.06m from its center. When viewed along its diameter from its nearest side the bubble appears to be at 0.075m. Calculate the R.I of glass and apparent distance of the bubble from the farthest side.

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Department Of School Education (Pre-University)

SECOND PU PREPARATORY EXAMINATION, JANUARY-2024
SUBJECT: PHYSICS (33)

TIME: 3 hours 15 min.   Max Marks: 70

General Instruction:

1. All parts are compulsory.
2. Part -A questions have to be answered in the first two pages of the answer –booklet. For part-A questions, first written –answer will be considered for awarding marks.
3. Answer without relevant diagram /figure/circuit wherever necessary will not carry any marks.
4. Direct answer to the numerical problems without detailed solutions will not carry any marks.

PART - A

I. Pick the correct option among the four given option for ALL of the following questions
                                                                    15 x 1=15

1. Which of the following figures represents the electric field lines due to a single positive charge?

   a)   b)   c)   d)
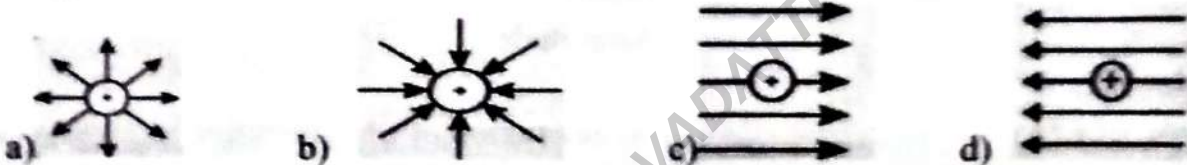
2. Two capacitors of capacity 2 μF and 3 μF are connected in series the effective capacitance of the capacitors is

   a) $\frac{5}{6}\mu F$ b) $\frac{6}{5}\mu F$ c) $\frac{2}{3}\mu F$ d) $\frac{3}{2}\mu F$

3. The Kirchhoff's junction rule obeys
   a) conservation of charge.   b) conservation of energy.
   c) conservation of momentum.   d) conservation of torque.

4. A charged particle experiences magnetic force in the presence of magnetic field. Which of the following statement is correct?
   a) The particle is stationary and magnetic field is perpendicular to the velocity.
   b) The particle is moving and magnetic field is perpendicular to the velocity.
   c) The particle is stationary and magnetic field is parallel to the velocity.
   d) The particle is moving and magnetic field is parallel to the velocity

5. Of the following statements:
   Statement-A: At high temperature , a ferromagnetic becomes a paramagnet
   Statement-B: The ferromagnetic property depends on temperature.
   a) Statement A is correct but statement B is incorrect.
   b) Statement A is incorrect but statement B is correct.
   c) Both statements are correct.
   d) Both statements are incorrect.

6. The working of generator is based upon
   a) Lenz's law   b) Faraday's law   c) Ampere's law   d) Coulomb's law

7. If N is the number of turns in a coil the value of self-inductance varies as
   a) N^0 b) N   c) N^2 d) N^{-2}

8. In LCR circuit at resonance the phase difference between the current and voltage is
   a) 0   b) π c) $\frac{\pi}{2}$ d) 2π

9. The electromagnetic waves with highest frequency among the following is
   a) X – rays   b) γ- rays   c) Infrared rays   d) Radio waves

10. The relation between focal length and radius of curvature of spherical mirror is
    a) $f = \frac{2}{R}$ b) $f = \frac{R^2}{2}$ c) $f = \frac{R}{2}$ d) $f = \frac{R}{3}$

11. A ray of light is incident on a medium of RI $\frac{1}{\sqrt{3}}$, then the polarising angle for the given surface is
    a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) π

12. Photoelectric emission occurs only when the incident light has more than a certain minimum
    a) Wavelength   c) Frequency
    b) Intensity   d) Amplitude

13. Paschen series falls in
    a) UV- region of EM spectrum.   b) X- ray region of EM spectrum.
    c) IR - region of EM spectrum.   d) visible region of EM spectrum.

14. The energy generation in stars is mainly due to
    a) Chemical reaction   b) Fusion of light nuclei
    c) Fission of heavy of heavy nuclei   d) Fusion of heavy nuclei

15. In an intrinsic semiconductor
    a) Only electrons are responsible for flow of current.
    b) Both holes and electrons are carry current.
    c) Both holes and electrons are carry current with electrons being majority carriers.
    d) Only holes are responsible for flow of current.

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the
following questions: 5 x 1 =5
(Zero, Infinity, p –type, nuclear force, opposite)

16. The resistance of ideal voltmeter is _____

17. According to Lenz's law the direction of induced emf is _____ to the cause.

18. When the polariser and analyser are in the crossed position, the intensity of the out coming light is _____

19. All nucleons in an atom are held by _____

20. When boron is added to silicon semiconductor, then the resulting material is _____

PART –B

III. Answer any FIVE of the following questions.   **5 x 2 =10**

21. State and explain ohm's law.

22. A dipole of dipole moment 2×10^{-4} Cm. makes an angle 60^0 with an electric field of intensity 2×10^4 N/C. Find the torque acting on the dipole.

23. What is Lorentz force? Write an expression for Lorentz force.

24. Write any two properties of magnetic field lines.

25. What is the meant by mutual inductance? Mention any one device that works on the principle of mutual inductance.

26. What is a transformer ? Mention any one transformer loss.

27. What is an electromagnetic wave ?Write an expression for the speed of EM wave.

28. Write any two conditions for total internal reflection of light.

29. On the basis of band theory of solids write any two differences between conductors and semiconductors.

PART –C

IV. Answer any FIVE of the following questions.   **5 x 3=15**

30. Derive the expression for electric field at a point due to uniformly charged thin long wire.

31. Obtain an expression for potential energy of two point charges in absence of an electric field.

32. Derive an expression for drift velocity of electrons in a conductor.

33. State and Explain Bio-Savart's law.

34. Write any three differences between dia and paramagnetic substances.

35. Obtain an expression for motional emf.

36. Write Cartesian sign conventions used while studying image formation in spherical Mirrors.

37. Write Bohr's postulates for hydrogen atom.

38. Obtain the binding energy of Fe_{26}^{56} in units of MeV from the following data.

Rest mass of Fe_{26}^{56} = 55.934939U, Rest mass of $_0^1n$ = 1.009U, Rest mass of p_1^1 = 1.00783U

PART –D

V. Answer any THREE of the following.   **3 x 5 =15**

39. Derive an expression for electric field at a point on the axis of an electric dipole.

40. Obtain an expression for effective emf and internal resistance of two cells connected in Parallel.

41. Derive the expression for magnetic force between two parallel current carrying conductors and define ampere. $I = I$

42. a) Write any two differences between interference and diffraction of light.

    b) Using Huygens's principle show that angle of incidence is equal to angle of reflection of light, when a plane wave front incident on a plane surface.

43. a) Define the terms threshold frequency and work function.

    b) Write any three experimental observations of photoelectric effect.

44. What is a rectifier? With a neat circuit diagram, Explain the working of full wave rectifier write input and out put wave forms of voltage.

VI. Answer any TWO of the following.   **2 x 5 =10**

45. A uniformly charged conducting sphere of 1.8 m diameter has a surface charge density of of 60μ Cm^{-2} a) find the charge on the sphere. B) What is the total flux leaving the surface of the sphere?

46. A battery of emf 12V and internal resistance 2Ω is connected to a resistor . If the current In the circuit is 2A, what is the resistance of the resistor ? what is the terminal voltage of the battery when the circuit is closed?

47. A 25mH inductor is connected to a 220V, 50Hz ac supply . Determine the rms value and the peak value of the current in the circuit.

48. A small bulb is placed at the bottom of tank containing water to a depth of 80 cm. what is the area of the surface of water through which light from the bulb can emerge out? RI of water is 1.33.(consider the bulb to be a point source.)

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TUMAKURU DISTRICT P.U. COLLEGES PRINCIPALS' ASSOCIATION (R.)
II PUC PREPARATORY EXAMINATION JANUARY- 2024

Subject Code : 33
Time : 3-15 hours

Total No.of Ques.48
Max Marks : 70

PHYSICS

General Instructions:

1. All parts are compulsory.
2. For Part-A questions, first written-answer will be considered for awarding marks.
3. Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
4. Direct answers to numerical problems without detailed solutions will not carry any marks

PART-A

I. **Pick the correct option among the four given options for ALL of the following questions:**   15x1=15

1. A simple apparatus used to detect electric charge on a body is_____
   - (A) microscope
   - (B) gold-leaf electroscope
   - (C) magnetometer
   - (D) micrometer

2. A parallel plate capacitor with air between its plates has a capacitance of c.
   Its new capacitance when the separation between the plates is doubled is_____
   - (A) 2C
   - (B) C
   - (C) C/2
   - (D) C/4

3. The SI unit of current density is_____
   - (A) A
   - (B) A/m^2
   - (C) $m\Omega$
   - (D) Cm

4. A charged particle moving perpendicular to a uniform magnetic field describes a
   - (A) circle
   - (B) ellipse
   - (C) straight line
   - (D) helix

5. Below are the two statements related to magnetic field lines:
   Statement-I: Magnetic field lines do not intersect
   Statement-II: Magnetic field lines do not form closed loops
   - (A) Both statements I and II are correct and II is the correct explanation for I
   - (B) Both statements I and II are correct and II is not the correct explanation for I
   - (C) Statement I is wrong but the statement-II is correct
   - (D) Statement I is correct but the statement-II is wrong

6. The law which gives the polarity of the induced emf in electromagnetic induction is
   - (A) Lenz's law
   - (B) Ampere's law
   - (C) Faraday's law
   - (D) Maxwell's law

7. In an AC generator a coil of N turns and area A is rotated at an angular speed of ω in uniform magnetic field B. The maximum value of emf produced is_____
   - (A) NBA
   - (B) NBAω
   - (C) NBA/ω
   - (D) NB/Aω

P.T.O.

8. The power dissipated over a complete cycle in a purely inductive or purely capacitive circuit is zero. Such current is called____
   (A) stead current   (B) varying current   (C) wattless current   (D) direct current

9. The expression for speed of light in vacuum in terms of permittivity and permeability is
   (A) $1/\sqrt{\mu_0\epsilon_0}$ (B) $1/\mu_0\epsilon_0$ (C) $1/\sqrt{\mu_0+\epsilon_0}$ (D) $\mu_0\epsilon_0$

10. Snell's law of refraction is not valid for angle incidence____
    (A) 0^0 (B) 30^0 (C) 60^0 (D) 90^0

11. The phenomenon of redistribution of light energy due to superposition of two or more light waves is____
    (A) Diffraction   (B) Refraction   (C) Interference   (D) Polarisation

12. The following are the statements related to photo emission:
    (i) Photoelectric effect is instantaneous
    (ii) Photocurrent depends on frequency of incident radiation.
    (iii) Stopping potential depends on intensity incident radiation.
    (iv) The collision between photon and electron is elastic.
    (A) Only (i) and (iv) are correct   (B) Only (i) and (ii) are correct
    (C) Only (iii) and (iv) are correct   (D) Only (ii) and (iii) are correct

13. In the case of hydrogen atom, the energy required to excite an electron from first orbit to second orbit is____
    (A) 13.6eV   (B) -13.6eV   (C) -3.4 eV   (D) 10.2 eV

14. The nuclei having same atomic number but different mass number are called____
    (A) isobars   (B) isomers   (C) isotopes   (D) isotones

15. A pn junction conducts current under____
    (A) reverse bias   (B) forward bias   (C) both A and B   (D) neither A nor B

II. **Fill in the blanks by choosing appropriate answer given in the bracket for ALL of the following questions:**   5x1=5
   [displacement current, magnetic moment, greater, diffraction, lesser, unidirectional]

16. The product of current in a loop and the area of the loop gives____

17. The current due to time varying electric field is called____

18. The phenomenon of bending of light around the corners of the obstacle is called____

19. The rest mass of a neutron is slightly____ than that of a proton.

20. The output of a rectifier is pulsating but____   Cont

PART-B

III **Answer any FIVE of the following questions:** 5x2=10

21. Draw the electric field lines for (a) a single point charge and (b) a dipole

22. Calculate the potential energy of a system of two charges 2μF and 3μF separated by a distance of 0.2m.

23. Write the expression for torque experienced by a current loop placed in a magnetic field and explain the terms.

24. Define the terms: (a) magnetisation and (b) magnetic susceptibility.

25. State and explain Faraday's law of electromagnetic induction.

26. Mention any two sources of energy loss in transformers.

27. List any two uses of microwaves.

28. Draw the ray diagram of a simple microscope for image formation at least distance of distinct vision.

29. Give any two differences between intrinsic and extrinsic semiconductors.

PART-C

IV. **Answer any FIVE of the following questions:** 5x3=15

30. Mention the basic properties of electric charge.

31. Obtain the relation between electric field and electric potential.

32. Derive an expression for drift velocity of free electrons in a conductor.

33. Explain with circuit diagram how to convert a galvanometer into voltmeter.

34. Write any differences between diamagnetic and ferromagnetic substances.

35. Explain briefly the magnet and coil experiment to demonstrate the phenomenon of electromagnetic induction.

36. What is refraction of light? State the laws of refraction of light.

37. State the Bohr's postulates of a hydrogen atom.

38. Calculate the nuclear density of iron nucleus given mass of iron nucleus is 55.85u 56. and atomic mass of iron is 56. Take $R_0 = 1.2 \times 10^{-15}$m and $1u = 1.66 \times 10^{-27}$Kg

PART-D

V. **Answer any THREE of the following questions:** 3x5=15

39. Derive the expression for electrostatic potential due to an isolated point charge.

40. Obtain the condition for balance of a Wheatstone bridge using Kirchhoff's rules.

41. Derive an expression for magnetic field at any point on the axis of a circular current loop using Biot-Savart law.

42. (a) State Huygens' principle.
    (b) using Huygens' principle arrive Snell's law of refraction for a plane wave.

P.T.O.

43. (a) Write Einstein's photoelectric equation and explain the terms.

(b) Give Einstein's explanation of observations on photoelectric effect.

44. What is rectification? Explain the working of a full wave rectifier with a circuit diagram. Also draw input and output waveforms.

VI. Answer any TWO of the following questions: **2x5=10**

45. Two point charges $q_A = 3\mu C$ and $q_B = -3\mu C$ are located 20cm apart in vacuum. What is the magnitude of electric field at the mid-point O of the line AB joining the two charges? If a negative test charge of magnitude $1.5 \times 10^{-9}C$ is placed at this point, what is the magnitude of force experienced by the test charge?

46. Two identical cells both in series and a parallel combination, give the same current of 0.5A through an external resistance of 4Ω Find the emf and internal resistance of each cell.

47. An ac source of 220V, 50Hz is connected to a series combination of 20Ω resistor, $5\mu F$ capacitor and 2mH inductor respectively. Calculate the current through the combination.

48. Two thin lenses of focal lengths 0.2m and 0.3m are kept in contact. Find the focal length of the combination. Calculate the powers of the two lenses and the combination.

✦✦✦✦✦✦✦

II PUC PREPARATORY EXAMINATION JANUARY 2024

PHYSICS (33)

Total No. of Questions : 48

Date : 19-01-2024

Time : 10.00 AM to 01.15 PM

Total No. of printed pages : 4

Max Marks : 70

Duration : 3 Hours 15 Minutes

<u>General Instructions:</u>

1. *All parts are compulsory.*
2. *For Part – A questions, first written-answer will be considered for awarding marks.*
3. *Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.*
4. *Direct answers to numerical problems without detailed solutions will not carry any marks.*

PART – A

I. Pick the correct option among the four given options for **ALL** of the following questions: 15X1=15

1. When the distance between the two stationary point charges is halved, the electrostatic force between them becomes

   (A) One-fourth (B) Half (C) Double (D) Four times

2. Charge Q on a capacitor varies with voltage V as shown in the figure, where Q is taken along the X-axis and V along the Y-axis. The area of triangle OAB represents

   (A) Capacitance

   (B) Capacitive reactance

   (C) Magnetic field between the plates

   (D) Energy stored in the capacitor
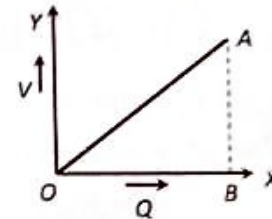
3. For which of the following the resistivity decreases on increasing the temperature .

   (A) Copper (B) Tungsten (C) Germanium (D) Aluminium

4. Below are the two statements related to magnetic force acting on the charged particle.

   Statement I: An electron and proton enters a magnetic field with equal velocities, then, magnetic force experienced by the proton will be more than electron.

   Statement II : The mass of proton is 1837 times more than electron.

   (A) Both the statements I and II are correct and II is the correct explanation for I

   (B) Both the statements I and II are correct and II is not the correct explanation for I

   (C) Statement I is wrong but the statement II is correct

   (D) Statement I is correct but the statement II is wrong

5. A bar magnet is placed in iron powder and taken out, then maximum iron powder is at

   (A) some away from north pole (B) some away from south pole

   (C) the middle of the magnet (D) the ends of the magnet

6. The S.I unit of magnetic flux is,

   A) coulomb meter

   B) tesla meter squared

   C) newton/coulomb meter squared

   D) becquerel

7. Magnetic potential energy stored in a self inductance L when a current i flows through it, is

   (A) Li^2

   (B) $2Li^2$

   (C) $\dfrac{Li^2}{4}$

   (D) $\dfrac{Li^2}{2}$

8. Amount of opposition offered by LCR Circuit to the flow of alternating current is known as

   (A) impedance

   (B) resistance

   (C) capacitance

   (D) inductance

9. The maximum frequency wave in the electromagnetic spectrum is

   (A) Gamma ray

   (B) X-ray

   (C) UV- rays

   (D) IR-rays

10. The nature of the image produced by concave lens is

    (A) Virtual and diminished

    (B) Real and diminished

    (C) Virtual and enlarged

    (D) Real and enlarged

11. The intensity of the emergent light beam will be zero if the pass axis of two polaroids are

    (A) perpendicular to each other

    (B) Parallel to each other

    (C) At an angle of 45^0 between them

    (D) At an angle of 60^0 between them

12. Which of the following statements is correct?

    (A) The photocurrent decreases with increasing intensity of incident light

    (B) The stopping potential decreases with increasing intensity of incident light

    (C) The photocurrent increases with increasing intensity of incident light

    (D) The stopping potential increases with increasing intensity of incident light

13. According to Bohr's theory the orbital angular momentum of an electron revolving in second orbit of hydrogen atom will be

    (A) $2\pi h$

    (B) πh

    (C) $\dfrac{h}{\pi}$

    D) $\dfrac{2h}{\pi}$

14. Order of magnitude of density of Uranium nucleus is

    (A) $10^{20} kgm^{-3}$

    (B) $10^{17} kgm^{-3}$

    (C) $10^{-17} kgm^{-3}$

    (D) $10^{11} kgm^{-3}$

15. Of the diodes shown in the following diagrams, which one is reverse biased?
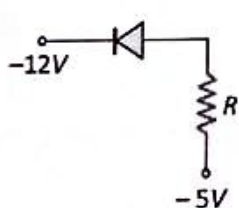
    (A)
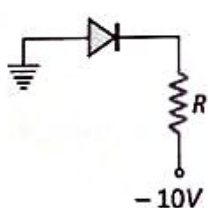
    (B)
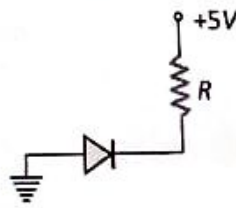
    (C)
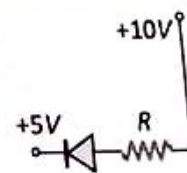
    (D)

(2)

P. T. O.

II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL the
following questions: 5x1=5
(zero, electric charge, electric current, magnetic field, spherical, electric field)

16. Oersted concluded that moving charges or currents produced a_____ in the
surrounding space.
17. Inductance is the ratio of magnetic flux linkage to _____.
18. The nature of the reflected plane wave front from a concave mirror is a _____
wave front.
19. Nuclear force does not depend on the _____.
20. The gap between the top of valance band and bottom of the conduction band in
case of conductor is _____.

PART – B

III. Answer any FIVE of the following questions: 5X2=10
21. A glass rod is rubbed with silk. Name the type of charges acquired by each of them.
22. Calculate the potential at a point due to a charge of $4\mu C$ located at 9cm away.
23. Name a simple rule to determine the direction of magnetic field due to a long wire
carrying current. Give its statement.
24. What is magnetic susceptibility? Give its significance.
25. State Lenz's law. Give its significance.
26. Why ac voltage is preferred over dc voltage?
27. Write the expression for displacement current and explain the terms.
28. State the laws of refraction of light.
29. List the two important processes occurring during the formation of p-n junction.

PART – C

. Answer any FIVE of the following questions: 5X3=15
30. State Gauss's law in electrostatics. Give two applications of Gauss's law in
electrostatics.
31. List any three important results regarding electrostatics of conductors.
32. Define drift velocity. Derive its expression.
33. How do you convert galvanometer into voltmeter? Explain.
34. Mention three distinguishing properties of diamagnetic and ferromagnetic
materials.
35. Deduce the expression for motional electromotive force.
36. Draw the ray diagram for the formation of image by a compound microscope.
37. Derive the expression for total energy of an electron in a stable orbit of a hydrogen
atom in terms of radius.
38. Obtain the binding energy of ($_{26}Fe^{56}$) nucleus in units of **MeV**. Given that mass of
$_{26}Fe^{56}$ nucleus = **55.93494u**, mass of proton =**1.00727u** and mass of neutron
=**1.00866u**.

P. T. O.

(3)

PART – D

V. Answer any THREE of the following questions: 3x5=15

39. What is capacitor? Derive the expression for capacitance of parallel plate capacitor.

40. State Kirchhoff's rules. Apply these rules to derive the balancing condition of Wheatstone bridge.

41. Derive the expression for magnetic field at a point on the axis of a circular current loop using Biot –Savart law.

42. a) List any three characteristics of interference fringes obtained in Young's double slit experiment. (3)

    b) What is diffraction of light? (1)

    c) Which phenomenon of light confirms the transverse nature of light. (1)

43. a) Name the three types of electron emission (3)

    b) What are matter waves? Write the expression for wavelength of matter wave. (2)

44. What is rectification? Explain the working of half wave rectifier using circuit diagram. Draw input and output wave forms.

VI. Answer any TWO of the following questions: 2x5=10

45. Two point charges 16nC and 8nC are situated at the corners **B** and **C** of an equilateral triangle **ABC** of side **0.03m**. Find the magnitude and direction of resultant electric field at the vertex A.

46. A cell of emf **E** and internal resistance **r** gives a current of **0.4A** with an external resistor **12Ω**, and a current of **0.25A** with an external resistor of **20Ω**. Calculate the emf and internal resistance of the cell.

47. A series **LCR** circuit is connected to an ac source of **220V, 50Hz**. If the readings of voltmeter across resistor, capacitor and inductor are **65V, 415V** and **204V** respectively, and **R=100 Ω**, calculate the current in the circuit. Also find the values of inductive reactance and capacitive reactance.

48. The angle of minimum deviation produced by a glass prism of angle 60^0 is 30^0. Find the refractive index of glass. If the speed of light in vacuum is $3 \times 10^8 m/s$, calculate the speed of light in glass.

IKDPUCPA **II PUC PREPARATORY EXAMINATION JANUARY- 2024**

PHYSICS (33)

Time 3.15 Hours

Max Marks 70

General instructions:
1) All parts are compulsory.
2) For Part-A questions, first written-answer will be considered for awarding marks.
3) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4) Direct answers to the Numerical problems without detailed solutions will not carry any marks.

PART - A

I **Pick the correct option among the four given options for ALL of the following questions:** $15 \times 1 = 15$

1. When 10^{13} electrons are removed from a neutral metal sphere, then the electric charge on it will be
   a) $+ 1.6 \, \mu C$ b) $+ 1.6 \, C$
   c) $- 1.6 \, C$ d) $- 1.6 \, \mu C$

2. The electric field inside the cavity of a conductor is zero. This is known as
   a) electrostatic shielding   b) polarisation
   c) earthing   d) capacitance

3. Average time between any two successive collisions is called.
   a) conductivity   b) relaxation time
   c) mobility   d) drift velocity

4. If the direction of initial velocity of charged particle makes on angle of 30° with the direction of magnetic field, then the path followed by the charge in the field will be
   a) a circle   b) an ellipse
   c) a helix   d) a straight line

5. For paramagnetic substances relative permeability will be
   a) less than 1 (one)   b) equal to 0 (zero)
   c) greater than 1 (one)   d) infinite

6. A small piece of metal wire is dragged across a gap between the pole pieces of a magnet in 0.5 second. The magnetic flux between the pole pieces is 8×10^{-4} Wb. The emf induced in the wire is
   a) 16 mV   b) 1.6 V
   c) 1.6 mV   d) 16 V

7. Average energy stored in a pure inductor of inductance L when a current I flow through it is,
   a) $L I^2$ b) $2 L I^2$
   c) $L I^2 / 2$ d) $L I^2 / 4$

8. The average power supplied to a pure inductor over one complete cycle of ac is
   a) $i_m v_m$ b) $i_m v_m / \sqrt{2}$
   c) $\frac{1}{2} i_m v_m$ d) zero

9. Which of the following electromagnetic wave is used for treatment of cancer.
   a) X – rays   b) Radio waves
   c) Micro waves   d) Infrared waves

10. For a given pair of media, if angle of incidence is increased then refractive index
    a) linearly increases   b) linearly decreases
    c) remains the same   d) exponentially increases

11. The nature of the refracted wavefront from a convex lens when the incident wavefront is plane is
   a) plane wave
   b) spherical wave
   c) cylindrical wave
   d) plane wave making angle with incident wave

12. λ_e, λ_p and λ_α are the de Broglie wavelengths of electron, proton and α particle. If all are accelerated by the same potential, then
   a) $\lambda_e < \lambda_p < \lambda_\alpha$
   b) $\lambda_e > \lambda_p < \lambda_\alpha$
   c) $\lambda_e = \lambda_p < \lambda_\alpha$
   d) $\lambda_e > \lambda_p > \lambda_\alpha$

13. Ionisation energy for the hydrogen atom is equal to
   a) 13.6 J
   b) 13.6 eV
   c) -13.6 J
   d) -13.6 eV

14. Deuterium and tritium are example for
   a) isotopes
   b) isobars
   c) isotones
   d) isomers

15. When p-n junction is forward biased, the current across the junction is mainly due to
   a) diffusion of charges
   b) drifting of charges
   c) both diffusion and drift of charges
   d) motion of holes only

II Fill in the blanks by choosing appropriate answer given in the bracket for all the following questions: 5 × 1 = 5

(polarity, large, parallel, impure, zero, fusion)

16. To convert a galvanometer into voltmeter resistance connected to it in series is _large_.
17. Lenz's law gives the _polarity_ of the induced emf.
18. Huygen argued that amplitude of the secondary wavelets is _____ in backward direction.
19. The source of energy in the star is nuclear _fusion_ reaction.
20. Extrinsic semiconductors are _impure_ form of semiconductors.

PART – B

III Answer any FIVE of the following questions.   5 × 2 = 10

21. Write any two properties of electric field lines.
22. A point charge $+4$ nC is placed in free space. Determine the electric potential at a distance of 9 m from the point charge.
23. Mention the expression for magnetic force experienced by a current carrying straight conductor placed in uniform (external) magnetic field.
24. State and explain Gauss's law in magnetism.
25. Draw a neat labelled diagram of ac generator.
26. Mention any two types of energy losses in a transformer.
27. What is displacement current? Mention the need of displacement current.
28. Give the conditions for occurrence of total internal reflection.
29. Draw the energy band diagram for (a) conductor (b) semiconductor

PART – C

IV Answer any FIVE of the following questions.   5 × 3 = 15

30. Using Gauss's law, obtain the expression for electric field at a point due to an infinitely long, charged straight conductor.

31. Deduce an expression for electric potential energy of system of two point charges in the absence of any external electric field.
32. Mention any three limitations of Ohm's law.
33. Arrive at the expression for the torque on a rectangular current carrying loop kept in a uniform magnetic field.
34. Distinguish between diamagnetic and ferromagnetic materials.
35. Derive an expression for motional emf induced in a conductor moving in a uniform magnetic field.
36. With the help of ray diagram, obtain the expression for focal length of equivalent lens when two thin lenses are kept in contact.
37. Write three postulates of Bohr's atomic model.
38. Calculate the energy equivalent to 1 atomic mass unit in Mev. Given: speed of light is 2.9979×10^8 m/s and charge of the electron is 1.602×10^{-19} C.

PART – D

V Answer any THREE of the following questions. $3 \times 5 = 15$

39. Derive the expression for the effective capacitance when two capacitors are connected in series.
40. Show that $\sigma = \dfrac{n e^2 \tau}{m}$, where the symbols have their usual meaning.
41. Using Biot-Savart law, deduce an expression for the magnetic field at a point on the axis of a circular current loop.
42. What is interference? Obtain the condition for constructive interference in terms of phase difference.
43. Define photoelectric effect. Summarise the experimental observations of photo electric effect.
44. With neat labelled diagram, explain the working of PN junction diode as a full wave rectifier. Also draw input and output wave forms for the same.

VI Answer any TWO of the following questions. $2 \times 5 = 10$

45. Two point charges $+3\,\mu C$ and $-3\,\mu C$ are located 20 cm apart in vacuum. What is the electric field at the midpoint of the line joining these two point charges? Also find the force experienced by a negative test charge of magnitude 1.5 nC placed at midpoint of the line joining the two point charges.
46. A battery of internal resistance 3 Ω is connected to 20 Ω resistor and potential difference across the resistor is 10 V. If another resistor of 30 Ω is connected in series with the first resistor and battery is again connected to the combination, calculate the e.m.f. and terminal potential difference across the combination.
47. Calculate the resonant frequency of a series LCR circuit containing a pure inductor of inductance 4H, capacitor of capacitance 27 µF and resistor of resistance 6.3 Ω.
48. The radii of curvature of two surfaces of a convex lens are 0.2 m and 0.22 m. Find the focal length of the lens if the refractive index of the material of the lens is 1.5. Also find the change in focal length, if it is immersed in water of refractive index 1.33.

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GOVERNMENT OF KARNATAKA

DEPUTY DIRECTOR, DEPT. OF SCHOOL EDUCATION (PRE-UNIVERSITY)

PUC-II YEAR PREPARATORY EXAMINATION-2024

Time : 3 Hours 15 Minutes   SUBJECT : PHYSICS (33)   MARKS : 70

Instructions :   1) All parts are compulsory.

     2) For Part-A questions, first written answer will be considered for awarding marks.

     3) Answers without relevant diagram/ figure/ circuit wherever necessary will not carry any marks.

     4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I.   **Pick the correct option among the four options for ALL of the following questions :**   15X1=15

1) Physical quantity measured in terms of Coulomb is
   A) electric charge   B) electric current   C) electric flux   D) electric field

2) A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure. Let V_A, V_B, V_C be the potentials at point A, B and C respectively. Then
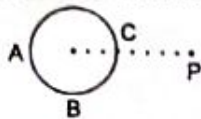
   A) $V_C > V_B = V_A$ B) $V_B > V_C = V_A$

   C) $V_A > V_B = V_C$ D) $V_A = V_B = V_C$

3) At a junction, Kirchoff's first law deals with the conservation of
   A) Charge   B) energy   C) momentum   D) angular momentum

4) In a circular coil of radius r, the magnetic field at the centre is proportional to
   A) r^2 B) r   C) $\frac{1}{r}$ D) $\frac{1}{r^2}$

5) The relation between relative permeability and magnetic susceptibility is given by
   A) $\mu_r + 1 = X$ B) $\mu_r = X$ C) $\mu_r = \frac{1}{x}$ D) $\mu_r = 1 + X$

6) Energy stored in an inductor of self-inductance L when current increases from 0 to I is
   A) $U = \frac{1}{2}LI^2$ B) $U = \frac{1}{2L}$ C) $U = \frac{1}{2}LI$ D) $U = \frac{1}{2}L^2I$

7) The measure of the number of magnetic field lines passing through given surface normally is
   A) magnetic flux   B) magnetic intensity
   C) magnetic induction   D) magnetisation

8) The phase difference between voltage and current in purely capacitive circuit is
   A) Zero   B) π C) $\frac{\pi}{2}$ D) $\frac{\pi}{4}$

9) Inconsistency in Ampere's circuital law was identified by
   A) J. C Maxwell   B) Gauss   C) Faraday   D) Hertz

10) The final image formed by compound microscope is
    A) inverted and diminished   B) erect and diminished
    C) inverted and enlarged   D) erect and enlarged

11) Which of the following does not use polaroid ?
    A) Sunglasses to reduce the intensity of light   B) Window pans to reduce intensity of light
    C) 3D movie cameras   D) thin coating on reading lenses

12) When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is
    A) 3λ B) 4λ C) 5λ D) $\frac{5}{2}\lambda$

13) Rutherford atom model failed to explain
    A) the distribution of positive and negative charge inside the atom
    B) Size of the nucleus   C) Size of the atom   D) Stability of the atom

14) Among the following, which set of nuclei are isotopes ?
    A) $^{14}_{6}C$ and $^{14}_{7}N$ B) $^{3}_{2}He$ and $^{3}_{1}H$ C) $^{235}_{92}U$ and $^{238}_{92}U$ D) $^{28}_{14}Si$ and $^{78}_{32}Ge$

15) Energy gap (Eg) between the valence band and the conduction band for conductor is

           (P.T.O)

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions : 5X1=5
[Positron, Zero, Electrons, Electromagnetic Induction Infinity, Plane]

16) Resistance of an ideal ammeter is ....
17) The principle behind working of AC generator is ....
18) When a point source of light is placed at the principle focus of a convex lens, the shape of the emergent wavefront is ....
19) The antiparticle of electron is ....
20) The majority carrier in n-type semiconductor is ....

PART-B

III. Answer ANY FIVE of the following questions. 5X2=10

21) Define electric flux through a surface. Mention the SI unit of electric flux.
22) The amount of work done in bringing a point charge of a 3mc from infinity to a point P is 0.06J. Find the electric potential at P.
23) Write the expression for magnetic force on a charge moving in uniform magnetic field. Explain the terms.
24) Mention any two distinguish properties between diamagnetic and paramagnetic materials.
25) Mention the condition for resonance and hence write an expression for the resonant frequency.
26) What are the factors on which mutual inductance between pair of coils depends?
27) What is displacement current ? Give expression for the same.
28) Write the two conditions required for total internal reflection.
29) Distinguish between intrinsic and extrinsic semiconductors.

PART-C

IV. Answer ANY FIVE of the following questions. 5X3=15

30) Obtain an expression for torque acting on an electric dipole in a uniform magnetic field.
31) What is electrostatic sheilding ? Mention two uses of electrostatic sheilding.
32) a) Define electrical resistivity of a conductor.
b) How does the resistance of the conductor vary with its i) length and ii) area of cross-section ?
33) With a circuit diagram, explain how a galvanometer is converted into an ammeter ?
34) Write any three properties of magnetic field lines.
35) Obtain the expression for emf induced (motional emf) in a rod moving in a magnetic field.
36) Write any three uses of optical fibres.
37) State the postulates of Bohr's theory of hydrogen atom.
38) Calculate the binding energy of an alpha (α) particle (Helium nucleus ${}_{2}^{4}$He) from the following data and express it in MeV. Mass of helium atom = 4.00260 u
Mass of neutron = 1.008665 u
Mass of proton = 1.007825 u

PART-D

V. Answer ANY THREE of the following questions : 3X5=15

39) Derive an expression for electric potential at a point due to an isolated point charge.
40) Derive an expression for electrical conductivity of the material interms of number density and relaxation time.
41) Derive the expression for the force between two long straight parallel conductors carrying current and hence define ampere.
42) a) What is interference of light ?
b) Describe Youngs double slit experiment for producing interference fringes.
43) a) What is photoelectric emission ?
b) Write the experimental observations of photoelectric emission.
44) What is rectifier ? Describe with a circuit diagram, the working of a semiconductor diode as a half wave rectifier. Draw input and output waveforms.

VI. Answer ANY TWO of the following questions. 2X5=10

45) Two point charges 4×10^{-6}C and 2×10^{-6}C are placed at the vertices A and B of a right angled triangle ABC respectively. B is the right angle. AB=$\sqrt{3}\times10^{-2}$m, AC=2×10^{-2}m and BC=1×10^{-2}m. Find the magnitude and direction of the resultant electric field at C.
46) Two cells A and B are connected in series, each having emf of 1.5V. The internal resistances of A and B are 0.5Ω and 0.25Ω respectively. The combination is connected across a resistance of 2.25Ω. Calculate i) the current in the circuit ii) the p.d across the terminals of cell.
47) A sinusoidal voltage of peak value 283V and frequency 50Hz is applied to a series LCR circuit in which R=3Ω, L=25.48mH C=786μF Find i) Impedance of the circuit ii) The phase difference between the voltage across the source and current iii) Power factor
48) The refractive index of an equilateral prism is 1.532. Calculate the angle of minimum deviation when it is immersed in water of refractive index 1.33.

IIEII IIEII

MODEL QUESTION PAPER 2023-24
II PUC - PHYSICS (33)

Time: 3 hours 15 min.   **Max Marks: 70**

General Instructions:

1. *All parts are compulsory.*

2. For Part – A questions, first written-answer will be considered for awarding marks.

3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

4. Direct answers to numerical problems without detailed solutions will not carry any marks.

PART – A

I. Pick the correct option among the four given options for ALL of the following questions: **15 × 1 = 15**

1. A glass rod is rubbed with silk cloth. The charge acquired by glass rod is _____ .

   (A) negative   (B) positive

   (C) zero   (D) positive on one end and negative on the opposite end

2. A spherical conductor of radius R is carrying a charge of +Q. The ratio of the electric potentials corresponding to a point on the surface of the conductor and a point at a distance $\frac{R}{2}$ from the centre of the conductor are in the ratio

   (A) 1: 2   (B) 2: 1   (C) 1:1   (D) 4:1

3. The resistivity of a metallic conductor _____ with decrease in temperature.

   (A) increases   (B) decreases

   (C) first increases and then decreases   (D) first decreases and then increases

4. The Lorentz force is the force on a charged particle moving in a region containing _____ .

   (A) only electric field   (B) only magnetic field

   (C) both electric and magnetic fields   (D) only crossed electric and magnetic fields

5. Below are the two statements related to magnetic field lines:

Statement-I : The magnetic field lines do not intersect.

Statement-II: The direction of magnetic field at a point is unique.

   (A) Both the statements I and II are correct and II is the correct explanation for I

   (B) Both the statements I and II are correct and II is not the correct explanation for I

   (C) Statement I is wrong but the statement II is correct

   (D) Statement I is correct but the statement II is wrong

6. A straight conductor of length '*l*' is moving with a velocity 'v' in the direction of uniform magnetic field of strength 'B'. The magnitude of emf induced between the ends of the conductor is

   (A) *Bl*v   (B) $\frac{\mathrm{B}l\mathrm{v}}{2}$ (C) 0   (D) 2B*l*v

7. The SI unit of magnetic flux is:

(A) Wb m^{-1} (B) T m^{-2} (C) weber   (D) Wb m^{-2}

8. The average power dissipated in an ac circuit is maximum if the ac source is connected :

(A) only to pure resistor   (B) only to pure inductor

(C) only to pure capacitor   (D) to a series combination of capacitor and inductor

9. The electromagnetic waves with lowest frequency among the following are :

(A) gamma rays   (B) UV rays   (C) microwaves   (D) radio waves

10. A ray of light coming from an object which is incident parallel to the principal axis of a convex lens placed in air after refraction _____.

(A) appears to diverge from first principal focus   (B) emerges without any deviation

(C) appears to diverge from second principal focus   (D) passes through second principal focus

11. If unpolarised light of intensity 'I_0' is passed through a polaroid, the intensity of emergent light is

(A) $\dfrac{I_0}{4}$ (B) $\dfrac{2I_0}{3}$ (C) $\dfrac{I_0}{3}$ (D) $\dfrac{I_0}{2}$

12. The following are the statements related to photo emission:

(i) Photoelectric current is independent of intensity of incident radiation.

(ii) Stopping potential is different for different photosensitive metal surfaces for a radiation of particular frequency ($v > v_o$).

(iii) Maximum speed of photoelectrons is independent of frequency of incident radiation.

(iv) Saturation current is different for radiations of different intensities having same frequency.

(A) Only (i) and (iii) are correct   (B) Only (i) and (ii) are correct

(C) Only (iii) and (iv) are correct   (D) Only (ii) and (iv) are correct

13. The minimum energy required to free the electron from the ground state of a hydrogen atom is

(A) 0.85 eV   (B) 3.4 eV   (C) 13.6 eV   (D) 1.51 eV

14. The radioactive decay in which a helium nucleus is emitted is called _____.

(A) gamma decay   (B) alpha decay   (C) negative β decay   (D) positive β decay

15. In the figure, E_V and E_C are the valence band and conduction band corresponding to an extrinsic semiconductor. E is the energy state corresponding to the impurity present in it. The impurity present in it can be

(A) arsenic

(B) indium

(C) phosphorous

(D) antimony
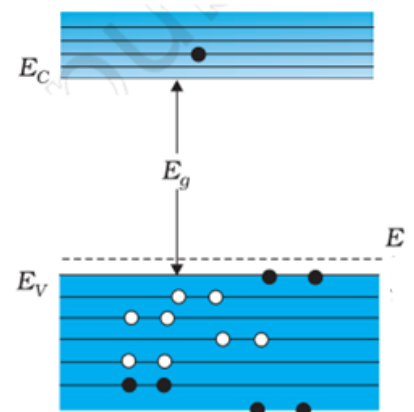
II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL the following questions: $5 \times 1 = 5$

(**maximum, decrease, thermonuclear fusion, generator, increase, cell**)

16. A convenient way to increase the current sensitivity of a galvanometer is to _____ the number of turns of the coil.

17. The device used to convert mechanical energy into electrical energy is called a _____.

18. If two waves coming from two coherent sources superpose at a point in phase, then the intensity of light at that point is _____ .

19. The source of energy output in the interior of stars is _____.

20. The width of depletion region of a pn-junction diode will_____ on increasing the forward bias voltage**.**

PART – B

III. Answer any FIVE of the following questions: $5 \times 2 = 10$

21. Mention any two basic properties of electric charges.

22. The amount of work done in bringing a point charge of 3 mC from infinity to a point P is 0.06 J. Find the electric potential at the point P.

23. Write the expression for magnetic force per unit length between two long straight parallel conductors carrying current. Give the nature of force between two parallel conductors carrying current in same direction.

24. State and explain Gauss's law in magnetism.

25. Mention any two factors on which self inductance of a long solenoid depends.

26. Briefly explain the construction of a transformer.

27. What is displacement current? Give expression for the same.

28. Write the two conditions required for total internal reflection.

29. Differentiate conductors from insulators on the basis of band theory of solids.

PART – C

IV. Answer any FIVE of the following questions: $5 \times 3 = 15$

30. State and explain Coulomb's law. Define '1 çoulomb'.

31. Obtain the expression for potential energy of an electric dipole placed in a uniform electric field.

32. Mention three limitations of Ohm's law.

33. Obtain an expression for the radius of circular path taken by a charged particle moving perpendicular to a uniform magnetic field.

34. Mention any three differences between paramagnetic and diamagnetic materials.

35. Explain briefly the coil and magnet experiment to demonstrate electromagnetic induction.

36. Write the Cartesian sign conventions used in analyzing reflection of light by spherical mirrors.

37. Give de Broglie's explanation of Bohr's second postulate of quantisation of angular momentum.

38. Calculate the mass defect and binding energy of $_7N^{14}$, given that the rest mass of nitrogen nucleus is 14.00307 u, rest mass of proton is 1.00783 u and rest mass of neutron is 1.00867 u.

PART – D

V. Answer any THREE of the following questions: $3 \times 5 = 15$

39. Derive the expression for capacitance of a parallel plate capacitor with air as dielectric. Write the expression for capacitance of a parallel plate capacitor with some dielectric medium introduced between the plates.

40. Obtain the condition for balance of Wheatstone bridge using Kirchhoff's rules.

41. Derive an expression for the magnetic field at a point on the axis of a circular current loop.

42. a) State Huygens principle. **(2)**

   b) Using Huygens principle arrive at Snell's law of refraction for a plane wave. **(3)**

43. a) Define work function of a photosensitive material. **(1)**

   b) What is meant by photoelectric effect? Give Einstein's explanation of photoelectric effect. **(4)**

44. What is rectification? Explain the working of a full wave rectifier using the circuit diagram. Also draw input-output waveforms.

VI. Answer any TWO of the following questions: $2 \times 5 = 10$

45. Two point charges each of +2 μ C are placed at the two corners A and B of an equilateral triangle ABC of side 0.2 m. Find the magnitude and direction of the resultant electric field at C.

46. The number density of free electrons in copper is estimated to be 8.5 x 10^{28} m^{-3}. A copper wire of length 3.0 m and area of cross-section 2.0 mm^2 is carrying a current of 3.0 A. Calculate the drift velocity of electrons. How long does an electron take to drift from one end of the wire to its other end?

47. A sinusoidal voltage of rms value 200 V and frequency 50 Hz is applied to a series RC circuit in which R = 5 Ω and C = 800 μF.

   Calculate: a) impedance of the circuit and b) the current through the circuit.

48. A parallel beam of light is incident on one face of an equilateral prism. By rotating the prism, the angle of minimum deviation is measured to be 40°. Determine the refractive index of the material of the prism. If the prism is immersed completely in water (refractive index = 1.33), calculate the new angle of minimum deviation.

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II PUC PHYSICS(33) BLUE PRINT / DESIGN / WEIGHTAGE FOR THE MODEL QUESTION PAPER - 2023-24

QP Part	Question type	Number of questions to be set	Marks alloted	Number of questions to be answered	Marks alloted
A	MCQ	15	15	15	15
	Fill in the blank(FIB)	05	05	05	05
B	SA (2 Marks)	09	18	05	10
C	SA (3 Marks)	09	27	05	15
D	LA (5 Marks)	06	30	03	15
	Numerical Problem(NP) (5 Marks)	04	20	02	10
Total		**48**	**115**	**30**	**70**

Unit	Sr No	Chapter/ Content domain/ Unit/ Theme	No. of periods	Marks	Remember — MCQ 1 mark	Remember — FIB 1 Mark	Remember — SA 2 Marks	Remember — SA 3 Marks	Remember — LA	Understand — SA 2 Marks	Understand — NP 2 Marks	Understand — SA 3 Marks	Understand — LA 5 mark	Apply — SA 2 Marks	Apply — NP 3 Marks	Apply — LA 5 mark	Apply — NP 5 mark	Apply — MCQ 1 mark	HOTS — SA 1 mark	HOTS — NP 5 mark
I	1	Electric charges & Fields	12	11	1		1					1					1			
II	2	Electrostatic potential and Capacitance	12	11		1					1	1	1							
III	3	Current electricity	15	14	1		1	1				1				1				
IV	4	Moving Charges and Magnetism	13	12	1		1	1					1					1		
V	5	Magnetism and Matter	6	6	1			1		1										
	6	Electromagnetic Induction	8	8	2	1								1	1					
	7	Alternating Current	8	8	1		1			1		1								
VI	8	Electromagnetic Waves	3	3				1												
VII	9	Ray Optics and Optical Instruments	11	11	1	1	1											1	1	1
VIII	10	Wave Optics	8	7			1						1(ST)							
IX	11	Dual nature of Radiation and Matter	6	6	1											1(ST)				
	12	Atoms	4	4	1							1								
	13	Nuclei	5	5			1					1								
X	14	Semiconductor Electronics	9	9	1							1			1			1	1	
Total			**120**	**115**	**12**	**5**	**12**	**12**	**-**	**4**	**2**	**12**	**15**	**-**	**3**	**2**	**15**	**3**	**3**	**15**

Remember(41 marks) Understand(33 marks) Apply(23 marks) HOTS(18 marks)

Weightage to objectives:

Objectives	Weightage	Marks
Knowledge	35%	41
Understanding	29%	33
Application	20%	23
HOTS	16%	18

Weightage to level of difficulty:

Level	Weightage	Marks
Easy	40%	46
Average	40%	46
Difficult	20%	23

GENERAL GUIDELINES FOR SETTING THE QUESTION PAPER

1. Variation of 1 mark in each chapter or unit weightage is permitted while preparing the blue print and the total marks should not exceed 115.

2. The question paper should be prepared on the basis of blueprint following the weightage of marks fixed for each chapter. The questions must be framed to check the specific cognitive level as mentioned in the blueprint.

3. Questions should be clear, unambiguous, understandable and free from grammatical errors.

4. Questions which are based on same concept, law, fact etc. and which generate the same answer should not be repeated under different forms (MCQ, FIB, VSA, LA and NP).

5. The answers for the questions should be available in the prescribed text book or can be derived from the same concept or different concepts of text book for application/reasoning/analytical/HOTS questions.

6. When a question carrying 3 or 5 marks is split, the sub questions should be derived from the same concept or different concepts of same chapter.

7. Only one 5 mark numerical problem has to be set from chapters corresponding to a pair of consecutive units like I & II, III & IV, V & VI, VII & VIII, IX & X.

8. In part A (1 main) 3 MCQ and in part D (VI main) 3 numerical problems of same difficulty level must be framed to check Higher Order Thinking Skills.

9. Only one simple numerical problem can be included in each of the part B (2 mark) and part C (3 mark).