(English Version)

PHYSICS (A)-2014

Instructions : i) *All* parts are compulsory.

ii) Answer without relevant diagram / figure / circuit wherever necessary will not carry any marks.

iii) Numerical problems solved without writing the relevant formulae carry no marks.

PART – A

I. Answer *all* the following questions : $10 \times 1 = 10$

1. Write the SI unit of charge.

2. Define mobility of electron.

3. What is the nature of force between two parallel conductors carrying currents in same direction ?

4. Draw the pattern of magnetic field lines for a bar magnet.

5. Give the expression for energy stored in an inductance coil carrying current.

6. How is r.m.s. voltage of a.c. related to peak value of a.c. voltage ?

7. What is wavefront of light waves ?

8. State the radioactive decay law.

9. Write the truth table of logic OR gate.

10. Give the bandwidth of TV signal for transmission.

PART – B

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

11. State and explain Coulomb's law in electrostatics.

12. Draw Wheatstone's bridge circuit and write the condition for its balance.

13. What is magnetic susceptibility ? For which material is it low and positive ?

14. Mention any two advantages of eddy currents in practical applications.

15. Who predicted the existence of electromagnetic waves ? Give the wavelength range of electromagnetic spectrum.

16. Explain 'Malus law' for polaroids.

17. Write any two types of electron emission.

18. Why there is need for modulation ?

PART – C

III. Answer any *five* of the following questions : -   5 × 3 = 15

19. Derive the expression for potential energy of a system of two charges in the absence of the external electric field.

20. Write three uses of cyclotron.

21. What are

    i)   magnetic declination

    ii)   magnetic dip

    iii) horizontal component of earth's magnetic field

at a place ?

22. State and explain Lenz's law for induced e.m.f.

23. Explain the construction of transformer. Mention its principle.

24. Mention three applications of total internal reflection of light.

25. Give three characteristics of photon.

26. How is Zener diode used as voltage regulator ?

PART – D

IV. Answer any *two* of the following questions :   2 × 5 = 10

27. State Gauss law in electrostatics. Using the law derive an expression

for electric field due to a uniformly charged thin spherical shell at a

point outside the shell.

28. With the help of a circuit diagram, obtain the expression for equivalent resistance of two resistors connected in parallel.

29. Derive the expression for magnetic field at a point on the axis of a circular current loop.

V. Answer any *two* of the following questions :   2 × 5 = 10

30. Obtain the expression for fringe width in the case of interference of light waves.

31. Write three postulates of Bohr. Mention two limitations of Bohr model.

32. Explain the formation of energy bands in solids. On the basis of energy bands distinguish between a metal, a semiconductor and an insulator.

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

33. In a parallel plate capacitor with air between the plates, each plate has an area of 6×10^{-3} m^2 and the distance between the plates is 3 mm. Calculate the capacitance of the capacitor. If this capacitor is connected to a 100 V supply, what is the charge on each plate of the capacitor ?

   [Absolute permittivity of free space $= 8 \cdot 85 \times 10^{-12}$ Fm^{-1}]

34. 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.

35. Calculate resonant frequency and Q-factor of a series L-C-R circuit containing a pure inductor of inductance 3 H, capacitor of capacitance 27 μF and resistor of resistance 7·4 Ω .

36. Two lenses of focal lengths 0·20 m and 0·30 m are kept in contact. Find the focal length of the combination. Calculate powers of two lenses and combination.

37. Calculate the binding energy and binding energy per nucleon (in MeV) of a nitrogen nucleus $\left(\begin{smallmatrix} 14 \\ 7 \end{smallmatrix} N\right)$ from the following data :

Mass of proton $= 1.00783$ u

Mass of neutron $= 1.00867$ u

Mass of nitrogen nucleus $= 14.00307$ u.

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PHYSICS (A)-2015

2015

33 (NS)

(English Version)

Instructions : a) **All** Parts are **compulsory**.

b) Answer without relevant diagram / figure / circuit **wherever** necessary will **not carry** any marks.

c) Numerical problems solved without writing the relevant formulae **carry no** marks.

PART – A

I. Answer **all** the following :

(10×1=10)

1. Define S.I. unit of charge.

2. A resistor is marked with colours red, red, orange and gold. Write the value of its resistance.

3. State Ampere's circuital law.

4. What is magnetic declination ?

5. Mention the significance of Lenz's law.

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

7. What is the conclusion of Davison and Germar experiment on the nature of electron ?

8. Name the spectral series of hydrogen which lies in the ultraviolet region of electromagnetic spectrum.

9. Define specific binding energy.

10. What is attenuation in communication system ?

PART – B

II. Answer **any five** of the following questions :

(5×2=10)

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

12. Mention two limitations of Ohm's law.

13. Write two properties of magnetic lines of force.

14. Current in a coil falls from 2.5 A to 0.0 A in 0.1 second inducing an emf of 200V. Calculate the value of self inductance.

15. Mention two applications of infrared radiation.

16. Draw the ray diagram of image formation in case of compound microscope.

17. What is photo diode ? Mention its one use.

18. Draw the block diagram of generalised communication system.

PART – C

III. Answer **any five** of the following questions :   (5×3=15)

19. Derive the expression for capacitance of parallel plate capacitor.

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

21. Write three difference between diamagnetic and paramagnetic substances.

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

23. Show that voltage leads current by $\frac{\pi}{2}$, when A.C. voltage applied to pure inductance.

24. What is interference ? Write the condition for path difference in case of constructive and destructive interference.

25. By assuming Bohr's postulates derive an expression for radius of nth orbit of electron, revolving round the nucleus of hydrogen atom.

26. Distinguish between conductor and semiconductor on the basis of band theory of solids.

PART – D

IV. Answer **any two** of the following questions :   (2×5=10)

27. Derive an expression for electric field due electric dipole at a point on an equatorial line.

28. What is equivalent resistance ? Derive the expression for effective resistance of two resistors connected in parallel.

29. Derive an expression for magnetic field strength at any point on the axis of a circular current loop using Biot-Savart's law.

V. Answer **any two** of the following questions :   (2×5=10)

30. Derive the expression for refractive index of the material of the prism in terms of angle of the prism and angle of minimum deviation.

31. Write Einstein's equation of photoelectric effect. Give Einsteins explanation of photoelectric effect.

32. With a neat circuit diagram, explain the working of an nPn transistor in CE mode as an amplifier with input and output waveform.

VI. Answer **any three** of the following questions :   (3×5=15)

33. Two point charges +1 nC and – 4 nC are 1m apart in air. Find the positions along the line joining the two charges at which resultant potential is zero.

34. Two cells of emf 2V and 4V and internal resistance $1\,\Omega$ and $2\,\Omega$ respectively are connected in parallel so as to send the current in the same direction through an external resistance of $10\,\Omega$. Find the potential difference across $10\,\Omega$ resistor.

35. A sinusoidal voltage of peak value 283 V and frequency 50Hz is applied to a series LCR circuit in which $R = 3\,\Omega$, $L = 25.48$ mH and $C = 786\ \mu F$.

    Find :

    a) Impedance of the circuit

    b) The phase difference between the voltage across the source and the current

    c) The power factor.

36. In a Young's double slit experiment distance between the slits is 1mm. The fringe width is found to be 0.6 mm. When the screen is moved through a distance of 0.25 m away from the plane of the slit, the fringe width becomes 0.75 mm. Find the wavelength of light used.

37. Determine the mass of Na^{22} which has an activity of 5 mCi. Half life of Na^{22} is 2.6 years. Avagadro number $= 6.023 \times 10^{23}$ atoms.

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2016 (A)
(NEW SYLLABUS)

PHYSICS
ಭೌತಶಾಸ್ತ್ರ

Instructions : This question paper has been sealed by reverse jacket. You have to cut to open the paper at the time of commencement of the examinations. Check whether all the pages of the question paper are intact.

ಸೂಚನೆಗಳು : ಈ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ರಿವರ್ಸ್ ಜಾಕೆಟ್ ಮೂಲಕ ಸೀಲ್ ಮಾಡಲಾಗಿದೆ. ಪರೀಕ್ಷೆ ಪ್ರಾರಂಭವಾಗುವ ಸಮಯಕ್ಕೆ ನಿಮ್ಮ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಬಲಬದಿ ಪಾರ್ಶ್ವವನ್ನು ಕತ್ತರಿಸಿ, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಎಲ್ಲಾ ಪುಟಗಳು ಇವೆಯೇ ಎಂದು ಪರೀಕ್ಷಿಸಿಕೊಳ್ಳಿ.

General Instructions to the Candidate :

ಪರೀಕ್ಷಾರ್ಥಿಗಾಗಿ ಸಾಮಾನ್ಯ ಸೂಚನೆಗಳು :

1. *Candidates are required to give their answers in their own words as far as practicable.*

   ಪರೀಕ್ಷಾರ್ಥಿಯು ಸಾಧ್ಯವಾದಷ್ಟು ತಮ್ಮ ಸ್ವಂತ ಪದಗಳಲ್ಲಿಯೇ ಉತ್ತರಿಸಬೇಕು.

2. *Figures in the right hand margin indicate full marks.*

   ಬಲ ಭಾಗದಲ್ಲಿ ಕೊಟ್ಟಿರುವ ಅಂಕಿಗಳು ಪೂರ್ಣಾಂಕಗಳನ್ನು ತೋರಿಸುತ್ತದೆ.

3. *While answering the candidate should adhere to the word limit as far as practicable.*

   ಪರೀಕ್ಷಾರ್ಥಿಯು ಉತ್ತರಿಸುವ ಸಮಯದಲ್ಲಿ ಸಾಧ್ಯವಾದಷ್ಟುಮಟ್ಟಿಗೆ ಉತ್ತರವು ಶಬ್ದಗಳ ಪರಿಮಿತಿಯೊಳಗೆ ಇರುವಂತೆ ಗಮನಿಸುವುದು.

4. *15 minutes of extra time have been allotted for the candidates to read the questions.*

   ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ಓದಿ ಅರ್ಥೈಸಿಕೊಳ್ಳಲು 15 ನಿಮಿಷಗಳ ಹೆಚ್ಚಿನ ಕಾಲಾವಕಾಶ ನೀಡಲಾಗಿದೆ.

5. *In case of any discrepancy or mis-match and factual error in English and Kannada versions, English version will prevail.*

   ಒಂದು ವೇಳೆ ಇಂಗ್ಲಿಷ್ ಮತ್ತು ಕನ್ನಡ ಆವೃತಿಗಳಲ್ಲಿ ನಡುವೆ ಯಾವುದೇ ವ್ಯತ್ಯಾಸ ಮತ್ತು ವಾಸ್ತವಿಕ ದೋಷಗಳು ಕಂಡುಬಂದಲ್ಲಿ, ಇಂಗ್ಲಿಷ್ ಆವೃತ್ತಿಯಲ್ಲಿರುವುದೇ ಅಂತಿಮವಾಗಿರುತ್ತದೆ.

Instructions :

ಸೂಚನೆಗಳು :

    i)   *All* parts are compulsory.

        ಎಲ್ಲಾ ಭಾಗಗಳು ಕಡ್ಡಾಯವಾಗಿರುತ್ತವೆ.

    ii)   Answer without relevant diagram / figure / circuit wherever necessary will not carry any marks.

        ಅವಶ್ಯವಿರುವ ಕಡೆ ಉತ್ತರಗಳನ್ನು ಸಂಬಂಧಿತ ಚಿತ್ರ / ರೇಖಾ ಚಿತ್ರ / ಮಂಡಲದೊಂದಿಗೆ ಬರೆಯದಿದ್ದಲ್ಲಿ ಯಾವುದೇ ಅಂಕಗಳನ್ನು ಕೊಡಲಾಗುವುದಿಲ್ಲ.

    iii) Numerical Problems solved without writing the relevant formulae carry no marks.

        ಸಾಂಖ್ಯಿಕ ಲೆಕ್ಕಗಳನ್ನು ಸಂಬಂಧಿಸಿದ ಸೂತ್ರದ ಸಹಾಯವಿಲ್ಲದೆ ಬಿಡಿಸಿದ್ದಲ್ಲಿ ಯಾವುದೇ ಅಂಕಗಳನ್ನು ಕೊಡಲಾಗುವುದಿಲ್ಲ.

PART – A

ಭಾಗ – A

I.   Answer *all* the following questions :   10 × 1 = 10

    ಈ ಕೆಳಕಂಡ ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :   10 × 1 = 10

1. State Faraday's law of electromagnetic induction.

    ಫ್ಯಾರಡೆಯ ವಿದ್ಯುತ್ಕಾಂತೀಯ ಪ್ರೇರಣೆಯ ನಿಯಮವನ್ನು ತಿಳಿಸಿ.

2. Write an expression for the displacement current.

    ಸ್ಥಾನಾಂತರ ವಿದ್ಯುತ್ತಿನ ಗಣಿತೋಕ್ತಿಯನ್ನು ಬರೆಯಿರಿ.

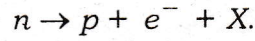3.   What is an electric dipole ?

ವಿದ್ಯುತ್ ದ್ವಿಧ್ರುವ ಎಂದರೇನು ?

4.   Draw the circuit symbol of *p-n-p* transistor.

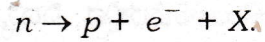*p-n-p* ಟ್ರಾನ್ಸಿಸ್ಟರ್‌ನ (transistor) ಮಂಡಲದ ಚಿಹ್ನೆಯನ್ನು ಚಿತ್ರಿಸಿ.

5.   How can the resolving power of a telescope be increased ?

ದೂರದರ್ಶಕದ ಪ್ರಥಕರಣ ಸಾಮರ್ಥ್ಯ ಹೆಚ್ಚಿಸುವ ಬಗೆ ಹೇಗೆ ?

6.   In the following nuclear reaction, identify the particle *X*.

$$n \rightarrow p + e^- + X.$$

ಈ ಕೆಳಗಿನ ಪರಮಾಣು (ನ್ಯೂಕ್ಲಿಯರ್) ಕ್ರಿಯೆಯಲ್ಲಿರುವ *X* ಕಣವನ್ನು ಗುರುತಿಸಿ.

$$n \rightarrow p + e^- + X.$$

7.   Define magnetisation of a sample.

ಒಂದು ನಮೂನೆಯ ಕಾಂತೀಕರಣದ ವ್ಯಾಖ್ಯೆ ನೀಡಿ.

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

ಮಸೂರ ಸಾಮರ್ಥ್ಯವು ಸಂಗಮದೂರದೊಂದಿಗೆ ಹೇಗೆ ಬದಲಾಗುವುದು ?

[Turn over

9. What is a cyclotron ?

ಸೈಕ್ಲೋಟ್ರಾನ್ ಎಂದರೇನು ?

10. Give the wavelength range of X-rays.

ಕ್ಷ–ಕಿರಣ (X-ray) ಗಳ ತರಂಗಾಂತರ ವ್ಯಾಪ್ತಿಯನ್ನು ನೀಡಿ.

PART – B

ಭಾಗ – B

II. Answer any *five* of the following questions :   5 × 2 = 10

ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದಾದರೂ ಐದು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :   5 × 2 = 10

11. The current in a coil of self inductance 5 mH changes from 2·5 A to 2·0 A in 0·01 second. Calculate the value of self induced *emf*.

5 mH ಸ್ವಯಂ ಪ್ರೇರಕತೆಯನ್ನು ಹೊಂದಿದ ಸುರುಳಿಯೊಂದರಲ್ಲಿನ ವಿದ್ಯುತ್ 0·01 ಸೆಕೆಂಡಿನಲ್ಲಿ 2·5 A ನಿಂದ 2·0 A ಗೆ ಬದಲಾವಣೆ ಹೊಂದಿದರೆ, ಸ್ವಯಂ ಪ್ರೇರಿತವಾದ ವಿದ್ಯುತ್ ಜಾಲದ ಬಲವನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

12. What is a toroid ? Mention an expression for magnetic field at a point inside a toroid.

ಟೊರಾಯ್ಡ್ ಎಂದರೇನು ? ಟೊರಾಯ್ಡ್‌ನ ಒಳಗಿರುವ ಒಂದು ಬಿಂದುವಿನಲ್ಲಿ ಉಂಟಾಗುವ ಕಾಂತಕ್ಷೇತ್ರದ ಗಣಿತೋಕ್ತಿಯನ್ನು ಬರೆಯಿರಿ.

13. What are isotopes and isobars ?

ಸಮಸ್ಥಾನಿ (ಐಸೋಟೋಪ್) ಗಳು ಮತ್ತು ಸಮಭಾರ ರೇಖೆ (ಐಸೋಬಾರ್) ಗಳು ಎಂದರೇನು ?

14. Draw the variation of magnetic field (B) with magnetic intensity (H) when a ferromagnetic material is subjected to a cycle of magnetisation.

ಒಂದು ಫೆರೋಕಾಂತೀಯ ವಸ್ತವನ್ನು ಕಾಂತೀಕರಣ ಆವೃತ್ತಿಗೆ ಒಳಪಡಿಸಿದಾಗ ಕಾಂತೀಕರಣ ತೀವ್ರತೆಯ (H) ಕಾಂತೀಯ ಕ್ಷೇತ್ರ (B) ದೊಂದಿಗೆ ಹೇಗೆ ಬದಲಾಗುತ್ತದೆಂಬುದನ್ನು ಚಿತ್ರಿಸಿ.

15. Mention two applications of polaroids.

ಪೋಲರಾಯ್ಡ್‌ನ ಎರಡು ಉಪಯೋಗಗಳನ್ನು ತಿಳಿಸಿ.

16. Write the logic symbol and truth table of NAND gate.

ನ್ಯಾಂಡ್ ತರ್ಕ ದ್ವಾರದ ಪ್ರತೀಕ ಮತ್ತು ನಿಜತನ ಕೋಷ್ಟಕವನ್ನು ಬರೆಯಿರಿ.

17. Write two properties of electric field lines.

ವಿದ್ಯುತ್ ಕ್ಷೇತ್ರದ ಬಲರೇಖೆಗಳ ಎರಡು ಗುಣಲಕ್ಷಣಗಳನ್ನು ಬರೆಯಿರಿ.

18. What is myopia ? How to correct it ?

ಸಮೀಪದೃಷ್ಟಿ (ಮಯೋಪಿಯಾ) ಎಂದರೇನು ? ಅದನ್ನು ಹೇಗೆ ಸರಿಪಡಿಸಬಹುದು ?

PART – C

ಭಾಗ – C

III. Answer any *five* of the following questions :   5 × 3 = 15

ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದಾದರೂ **ಐದು** ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :   5 × 3 = 15

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

    ಪರಿವರ್ತಕ ಎಂದರೇನು ? ಪರಿವರ್ತಕದಲ್ಲಿ ಉಂಟಾಗುವ ಎರಡು ಶಕ್ತಿ ನಷ್ಟದ ಮೂಲಗಳನ್ನು ತಿಳಿಸಿ.

20. Write three characteristics of nuclear forces.

    ನ್ಯೂಕ್ಲಿಯರ್ ಬಲಗಳ ಮೂರು ಗುಣಲಕ್ಷಣಗಳನ್ನು ತಿಳಿಸಿ.

21. Derive the expression for energy stored in a charged capacitor.

    ಆವೇಶಿತ ಧಾರಕ (charged capacitor) ದ ಶಕ್ತಿ ಸಂಗ್ರಹಕ್ಕೆ ಗಣಿತೋಕ್ತಿಯನ್ನು ನಿಷ್ಪತ್ತಿಸಿ.

22. What is an amplifier ? Draw the simple circuit of transistor amplifier in CE mode.

    ಪ್ರವರ್ಧಕ ಎಂದರೇನು ? CE ಮಾದರಿಯ ಟ್ರಾನ್ಸಿಸ್ಟರ್ ಪ್ರವರ್ಧಕದ ಸರಳ ಮಂಡಲವನ್ನು ಚಿತ್ರಿಸಿ.

23. Mention the types of transmission media.

    ಪ್ರಸರಣ ಮಾಧ್ಯಮದ ಬಗೆಗಳನ್ನು ತಿಳಿಸಿ.

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

ವಾಹಕಗಳಲ್ಲಿನ ಮುಕ್ತ ಎಲೆಕ್ಟ್ರಾನ್ (free electrons) ಗಳ ಮಂದವೇಗ (drift velocity) ಕ್ಕೆ ಗಣಿತೋಕ್ತಿಯನ್ನು ನಿಷ್ಪತ್ತಿಸಿ.

25. Explain briefly the coil and magnet experiment to demonstrate electromagnetic induction.

ವಿದ್ಯುತ್ಕಾಂತೀಯ ಪ್ರೇರಣೆಯನ್ನು ನಿರೂಪಿಸುವ ಸುರುಳಿ ಮತ್ತು ಕಾಂತ ಪ್ರಯೋಗವನ್ನು ಸಂಕ್ಷಿಪ್ತವಾಗಿ ವಿವರಿಸಿ.

26. Write three properties of ferromagnetic materials.

ಫೆರೋಕಾಂತೀಯ ವಸ್ತುಗಳ ಮೂರು ಲಕ್ಷಣಗಳನ್ನು ತಿಳಿಸಿ.

PART – D
ಭಾಗ – D

IV. Answer any *two* of the following questions :   2 × 5 = 10

ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದಾದರೂ **ಎರಡು** ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :   2 × 5 = 10

27. Deduce the condition for balance of a Wheatstone's bridge using Kirchhoff's rules.

ಕರ್ಖೋಫ್ ನಿಯಮಗಳನ್ನು ಉಪಯೋಗಿಸಿ ವ್ಹೀಟ್ಸ್ಟನ್ ಸೇತುವಿನ ಸಮತೋಲಿತ ಸ್ಥಿತಿಯನ್ನು ವ್ಯುತ್ಪತ್ತಿಸಿ.

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

ವಿದ್ಯುತ್ ಪ್ರವಹಿಸುತ್ತಿರುವ ಎರಡು ಸಮಾಂತರ ವಾಹಕಗಳ ನಡುವೆ ಇರುವ ಬಲದ ಗಣಿತೋಕ್ತಿಯನ್ನು ನಿಷ್ಪತ್ತಿಸಿ. ಈ ಮೂಲಕ ಆಂಪೇರನ್ನು ವ್ಯಾಖ್ಯಾಸಿ.

29. Derive an expression for Electric field due to an Electric dipole at a point on the axial line.

ಅಕ್ಷರೇಖೆಯ ಮೇಲೆ ಇರುವ ಒಂದು ಬಿಂದುವಿನಲ್ಲಿ ವಿದ್ಯುತ್ ದ್ವಿಧ್ರುವದಿಂದ ಉಂಟಾಗುವ ವಿದ್ಯುತ್ ಕ್ಷೇತ್ರದ ಗಣಿತೋಕ್ತಿಯನ್ನು ನಿಷ್ಪತ್ತಿಸಿ.

V. Answer any *two* of the following questions :   2 × 5 = 10

ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದಾದರೂ **ಎರಡು** ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :   2 × 5 = 10

30. Write the experimental observations of Photoelectric effect.

ದ್ಯುತಿವಿದ್ಯುತ್ ಪರಿಣಾಮದ ಪ್ರಯೋಗಾವಲೋಕನಗಳನ್ನು ತಿಳಿಸಿ.

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

ಋಜುಕಾರಕ ಕ್ರಿಯೆ ಎಂದರೇನು ? ಸೂಕ್ತ ಮಂಡಲ ರೇಖಾಚಿತ್ರ ಮತ್ತು ತರಂಗರೂಪಗಳೊಂದಿಗೆ *P-N* ಸಂಧಿ ಡಯೋಡ್ ಪೂರ್ಣ ತರಂಗ ಋಜುಕಾರಕವಾಗಿ ಕೆಲಸ ಮಾಡುವ ವಿಧಾನವನ್ನು ವಿವರಿಸಿ.

32. Derive an expression for equivalent focal length of two thin lenses kept in contact.

   ಸ್ಪರ್ಶಿಸುತ್ತಿರುವ ಎರಡು ತೆಳು ಮಸೂರಗಳ ಸಮಾನ ಸಂಗಮದೂರಕ್ಕೆ ಗಣಿತೋಕ್ತಿಯನ್ನು ನಿಷ್ಪತ್ತಿಸಿ.

VI. Answer any *three* of the following questions :　　　　3 × 5 = 15

   ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದಾದರೂ **ಮೂರು** ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ :　　　　3 × 5 = 15

33. In Young's double slit experiment, fringes of certain width are produced on the screen kept at a certain distance from the slits. When the screen is moved away from the slits by 0·1 m, fringe width increases by $6 × 10^{-5}$ m. The separation between the slits is 1 mm. Calculate the wavelength of the light used.

   ಯಂಗ್ಸನ ದ್ವಿಸೀಳು ಗಂಡಿ ಪ್ರಯೋಗದಲ್ಲಿ ನಿರ್ದಿಷ್ಟ ದೂರದಲ್ಲಿರುವ ತೆರೆಯ ಮೇಲೆ ನಿರ್ದಿಷ್ಟ ಆಗಲದ ವ್ಯತೀಕರಣ ಪಟ್ಟಿಯನ್ನು ಉಂಟು ಮಾಡಲಾಗಿದೆ. ತೆರೆಯನ್ನು ಸೀಳುಗಂಡಿಯಿಂದ 0·1 m ದೂರಕ್ಕೆ ಚಲಿಸಿದಾಗ ವ್ಯತೀಕರಣ ಪಟ್ಟಿಯ ಆಗಲವು $6 × 10^{-5}$ m ನಷ್ಟು ಹೆಚ್ಚಾಗುತ್ತದೆ. ಸೀಳುಗಂಡಿಗಳ ನಡುವಿನ ದೂರವು 1 mm ಆಗಿದೆ. ಉಪಯೋಗಿಸಿದ ಬೆಳಕಿನ ತರಂಗದೂರವನ್ನು ಲೆಕ್ಕಿಸಿ.

34. When two capacitors are connected in series and connected across 4 kV line, the energy stored in the system is 8 J. The same capacitors, if connected in parallel across the same line, the energy stored is 36 J. Find the individual capacitances.

4 kV ಆಕರದೊಂದಿಗೆ ಎರಡು ಧಾರಕಗಳನ್ನು ಶ್ರೇಣಿ ಜೋಡಣೆಯಲ್ಲಿ ಜೋಡಿಸಿದಾಗ 8 J ನಷ್ಟು ಶಕ್ತಿಯು ಆ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಶೇಖರಿಸಲ್ಪಡುತ್ತದೆ. ಅವೇ ಎರಡು ಧಾರಕಗಳನ್ನು ಅದೇ ಆಕರದೊಂದಿಗೆ ಸಮಾನಾಂತರ ಜೋಡಣೆಯಲ್ಲಿ ಜೋಡಿಸಿದಾಗ 36 J ನಷ್ಟು ಶಕ್ತಿಯು ಶೇಖರಿಸಲ್ಪಡುತ್ತದೆ. ಹಾಗಾದರೆ ಆ ಎರಡು ಧಾರಕಗಳ ವೈಯುಕ್ತಿಕ ಧಾರಣೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

35. Calculate the shortest and longest wavelengths of Balmer series of hydrogen atom. Given $R = 1.097 \times 10^7 \, \text{m}^{-1}$.

ಹೈಡ್ರೋಜನ್ ಪರಮಾಣುವಿನ ಬಾಮರ್ ಸರಣಿಯ ಅತ್ಯಂತ ಕಡಿಮೆ ಮತ್ತು ಅತ್ಯಂತ ಹೆಚ್ಚು ತರಂಗದೂರಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ. $R = 1.097 \times 10^7 \, \text{m}^{-1}$.

36. Calculate the resonant frequency and Q-factor (Quality factor) of a series L-C-R circuit containing a pure inductor of inductance 4 H, capacitor of capacitance 27 μF and resistor of resistance 8·4 Ω.

4 H ಪ್ರೇರಕತೆಯುಳ್ಳ ಶುದ್ಧ ಪ್ರೇರಕ, 27 μF ಧಾರಕತೆಯುಳ್ಳ ಧಾರಕ ಮತ್ತು 8·4 Ω ರೋಧವುಳ್ಳ ರೋಧಕಗಳನ್ನು ಶ್ರೇಣಿ ಬಂಧದಲ್ಲಿ ಒಳಗೊಂಡಿರುವ L-C-R ಮಂಡಲದ ಅನುರಣನೆಯ ಆವೃತ್ತಿ ಮತ್ತು ಗುಣಾಕಾರಕ (Q-factor) ಗಳನ್ನು ಲೆಕ್ಕಿಸಿ.

37. a) Three resistors of resistances 2 Ω, 3 Ω and 4 Ω are combined in series. What is the total resistance of the combination ?

2 Ω, 3 Ω ಮತ್ತು 4 Ω ರೋಧವುಳ್ಳ ಮೂರು ರೋಧಕಗಳನ್ನು ಶ್ರೇಣಿಬಂಧಿಯಲ್ಲಿ ಸೇರಿಸಿದಾಗ ಉಂಟಾಗುವ ಸಂಯೋಜನೆಯ ಒಟ್ಟು ರೋಧವೇನು ?

b) If this combination is connected to a battery of *emf* 10 V and negligible internal resistance, obtain the potential drop across each resistor.

ಈ ಸಂಯೋಜನೆಯನ್ನು 10 V ನ ವಿದ್ಯುತ್ ಚಾಲಕ ಬಲ (*emf*) ಮತ್ತು ನಿರ್ಲಕ್ಷಿಸಲ್ಪಟ್ಟ ಆವರ್ತಕ ರೋಧನವಿರುವ ಬ್ಯಾಟರಿಗೆ ಜೋಡಿಸಿದಾಗ, ಪ್ರತಿ ರೋಧಕವಲ್ಲಿ ಉಂಟಾಗುವ ಸಂಭಾವ್ಯ ಕ್ಷೀಣಿಸುವಿಕೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

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PHYSICS (A)-2017

(English Version)

33 (NS)

Instructions :
1. All Parts are compulsory.

2. Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.

3. Numerical problems solved without writing the relevant formulae carry no marks.

PART – A

I. Answer **all** the following questions : (10 × 1 = 10)

1) State Coulomb's law.

2) Define mobility of electron.

3) What is the significance of Lenz's law?

4) Define displacement current.

5) Write one application of microwave.

6) How the power of a lens is related to its focal length?

7) Write the expression for de-Broglie wavelength of a particle.

8) What is the conclusion of Davisson – Germer experiment on the nature of electron?

9) Write the SI unit of activity.

10) What is transducer in communication system?

PART – B

II. Answer **any five** of the following questions : (5 × 2 = 10)

11) Write any two properties of electric field lines.

12) On what factors does the capacitance of a parallel plate capacitors depends?

13) State and explain Ohm's law.

14) Define the terms :
    i)   Declination
    ii) Inclination or Dip.

15) State and explain Faraday's law of electromagnetic induction.

16) Name the type of lens which is used to correct
    i)   Myopia
    ii) Hypermetropia.

17) What is NAND gate? Give its logic symbol.

18) Draw the block diagram of a AM receiver.

PART – C

III. Answer **any five** of the following questions : (5 × 3 = 15)

19) Derive the relation between electric field and electric potential due a point charge.

20) Derive the expression for energy stored in a charged capacitor.

21) Explain with circuit diagram how to convert galvanometer into an voltmeter.

22) Derive the expression for motional emf induced in a conductor moving in a uniform magnetic field.

23) What is transformer? Mention two sources of energy loss in a transformer.

24) Mention any three applications of polaroids.

25) Write any three experimental observations of photoelectric effect.

26) Give any three differences between n-type and p-type semiconductors.

PART – D

IV. Answer **any two** of the following questions : **(2 × 5 = 10)**

27) Deduce the condition for balance of a Wheatstone's bridge using Kirchhoff's rules.

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

29) Write any five properties of ferromagnetic materials.

V. Answer **any two** of the following questions : **(2 × 5 = 10)**

30) Derive Lens Maker's formula for a convex lens.

31) State radioactive decay law. Derive $N = N_0 e^{-\lambda t}$ for a radioactive element.

32) 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 three** of the following questions : **(3 × 5 = 15)**

33) Two point charges $q_A = 3\mu c$ and $q_B = -3\mu c$ are located 20 cm apart in vacuum.

a) What is the electric field at the mid point O of the line AB joining the two charges?

b) If a negative test charge of magnitude $1.5 \times 10^{-9} C$ is placed at this point. What is the force experienced by the test charge?

34) When two resistors are connected in series with a cell of emf 2 V and negligible internal resistance, a current of $\frac{2}{5}$ A flows in the circuit. When the resistors are connected in parallel the main current is $\frac{5}{3}$ A. Calculate the resistances.

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

36) Light of wave length 6000 A° is used to obtain interference fringes of width 6 mm in a Young's double slit experiment. Calculate the wave length of light required to obtain fringe of width 4 mm when the distance between the screen and slits is reduced to half of its initial value.

37) The first member of the Balmer series of hydrogen atom has wavelength of 6563 A°. Calculate the wavelength and frequency of the second member of the same series. Given : $C = 3 \times 10^8 ms^{-1}$.

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PHYSICS(A)-2018

Instructions : 1. All Parts are compulsory.

2. Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.

3. Numerical problems solved without writing the relevant formulae carry no marks.

PART – A

I. Answer **all** the following questions : (10 × 1 = 10)

1) What is an equipotential surface?

2) Define 'drift velocity' of free electrons.

3) Give an application of cyclotron.

4) State Faraday's law of electro magnetic induction.

5) If the peak value of a.c. current is 4.24 A, what is its root mean square value?

6) Mention one power loss in transformer.

7) Two lenses of power +1.5D and –0.5D are kept in contact on their principal axis. What is the effective power of the combination?

8) The decay of proton to neutron is possible only inside the nucleus. Why?

9) What is 'depletion region' in a semi conductor diode?

10)
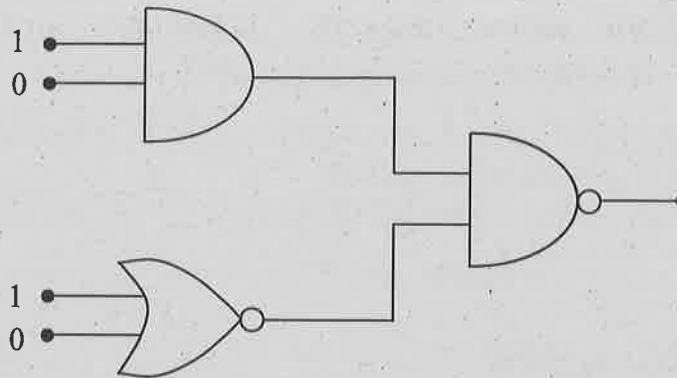
What is the output of this combination?

PART – B

II. Answer **any five** of the following questions : (5 × 2 = 10)

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

12) State Kirchhoff's laws of electrical network.

13) Define magnetic 'declination' and 'dip' at a place.

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

15) Give any two applications of X-rays.

16) What is 'myopia'? How to rectify it?

17) Draw the diagram representing the schematic arrangement of Geiger-Marsden experimental set up for the alpha particle scattering.

18) Write any two characteristics of nuclear forces.

PART – C

III. Answer **any five** of the following questions : (5 × 3 = 15)

19) Give three properties of electric charge.

20) State Ampere's circuital law and arrive at the expression for the magnetic field near a straight infinite current carrying wire.

21) What is hysterisis? Define the terms 'coercivity' and 'retentivity' of a ferromagnetic material.

22) Arrive at Snell's law of refraction, using Huygen's principle for refraction of a plane wave.

23) Write Bohr's postulates for the hydrogen atom model.

24) Derive the expression for the half-life of a radio active nuclide.

25) Write any three distinctions between p-type and n-type semi conductor.

26) Draw the block diagram of generalised communication system.

PART – D

IV. Answer **any two** of the following questions :   **(2 × 5 = 10)**

27) 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.

28) Obtain the expression for the effective emf and the effective internal resistance of two cells connected in parallel such that the currents are flowing in the same direction.

29) Derive the expression for the magnetic field on the axis of a circular current loop, using Biot-Savart's law.

V. Answer **any two** of the following questions :   **(2 × 5 = 10)**

30) Arrive at the expression for the impedance of a series LCR circuit using phasor diagram method and hence write the expression for the current through the circuit.

31) Deduce the relation between n, u, v, Q, R for refraction at a spherical surface, where the symbols have their usual meaning.

32) What is a rectifier? With suitable circuit describe the action of a full wave rectifier by drawing input and output waveforms.

VI. Answer **any three** of the following questions : (3 × 5 = 15)

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

34) 100 mg mass of nichrome metal is drawn into a wire of area of cross-section 0.05 mm^2. Calculate the resistance of this wire. Given density of nichrome 8.4×10^3 kgm^{-3} and resistivity of the material as 1.2×10^{-6} Ωm.

35) A circular coil of radius 10 cm and 25 turns is rotated about its vertical diameter with an angular speed of 40 rad S^{-1}, in a uniform horizontal magnetic field of magnitude 5×10^{-2}T. Calculate the emf induced in the coil. Also find the current in the coil if the resistance of the coil is 15 Ω.

36) In Young's double slit experiment the slits are separated by 0.28 mm and the 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 the light used. Also find the fringe width if the screen is moved 0.4 m towards the silts, for the same experimental set up.

37) Light of frequency 8.41×10^{14} Hz is incident on a metal surface. Electrons with their maximum speed of 7.5×10^5 ms^{-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 = 6.625×10^{-34} JS and mass of the electron 9.1×10^{-31} Kg.

(English Version)

Instructions : 1. *All Parts are compulsory.*

2. *Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.*

3. *Numerical problems solved without writing the relevant formulae carry no marks.*

PART – A

I. Answer **all** the following questions :   (10 × 1 = 10)

1) State Coulomb's Law.

2) Define electrical resistivity of material of a conductor.

3) Write the expression for force acting on a moving charge in a magnetic field.

4) What is magnetic susceptibility?

5) How the self inductance of a coil depends on number of turns in the coil?

6) For which position of the object magnification of convex lens is –1. (minus one)?

7)   For which angle of incidence reflected ray is completely polarised?

8)   Mention any one type of electron emission.

9)   Write the expression for energy of an electron in electron orbit of hydrogen atom.

10)   Write the relation between Half-Life and Mean-Life of radio active element.

PART – B

II.   Answer **any five** of the following questions : $(5 \times 2 = 10)$

11)   Write any two basic properties of charge.

12)   Write the expression for drift velocity interms of current, explain the terms used.

13)   Define magnetic 'dip' and 'declination' at a place.

14)   Write the expression for speed of light interms of "μ_0" and "ϵ_0", explain the terms used.

15)   Write the ray diagram for formation of image in the simple microscope.

16) . What is diffraction of light?

17)   Write the expression for de-Broglie wave length of electrons interms of electric potential and explain the terms used.

18)   Distinguish between n-type and p-type semi conductors.

PART – C

III.   Answer **any five** of the following questions :   **(5 × 3 = 15)**

19)   Derive an expression for potential energy of electric-di-pole placed in an uniform electric field.

20)   Write the expression for force per unit length between two straight parallel current carrying conductors of infinite length. Hence define SI unit of current 'ampere'.

21)   Distinguish between 'dia' and 'ferro' magnetic materials.

22)   Mention the three types energy loss in a transformer.

23) Write three experimental observations of photoelectric effect.

24) Write the three postulates of Bohr's atomic model.

25) Explain 'Conduction band' 'Valance band' and 'Energy gap', in semi conductors.

26) What is modulation? Write the block diagram of the receiver.

PART – D

IV. Answer **any two** of the following questions : (2 × 5 = 10)

27) State Gauss's law. Derive an expression for electric intensity at a point outside the uniformly charged shell.

28) Two cells of emf E_1 and E_2 and internal resistance r_1 and r_2 are connected in parallel such that they send current in same direction. Derive an expression for equivalent resistance and equivalent emf of the combination.

29) Derive an expression for the intensity of magnetic field at any point on the axis of a circular current loop.

V. Answer **any two** of the following questions :   (2 × 5 = 10)

30) Derive an expression for the impedance of a series LCR circuit, when an AC voltage is applied to it.

31) Derive " Lensmaker's " formula.

32) Explain the working of a n-p-n transistor in CE mode as an amplifier.

VI. Answer **any three** of the following questions :   (3 × 5 = 15)

33) In a circular parallel plate capacitor radius of each plate is 5 cm and they are separated by a distance of 2 mm. Calculate the capacitance and the energy stored, when it is charged by connecting the battery of 200 V (given $\epsilon_0 = 8.854 \times 10^{-12} Fm^{-1}$).

34) Two resistors are connected in series with 5V battery of negligible internal resistance. A current of 2A flows through each resistor. If they are connected in parallel with the same battery a current of $\frac{25}{3} A$ flows through combination. Calculate the value of each resistance.

35)   A conductor of length 3m moving in a uniform magnetic field of strength
       100 T. It covers a distance of 70 m in 5 sec. Its plane of motion makes an
       angle of 30° with direction of magnetic field. Calculate the emf induced
       in it.

36)   In a Young's double slit experiment wave length of light used is 5000 Å
       and distance between the slits is 2 mm, distance of screen from the slits
       is 1 m. Find fringe width and also calculate the distance of 7th dark fringe
       from central bright fringe.

37)   Half life of U-238 undergoing α - decay is 4.5×10^9 years. What is the
       activity of one gram of U-238 sample?

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PHYSICS - 2020

(English Version)

Instructions : 1. All Parts are compulsory.

2. Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.

3. Numerical problems solved without writing the relevant formulae carry no marks.

PART – A

I. Answer **all** the following questions : (10 × 1 = 10)

1) Write the SI unit of electric flux.

2) Graphically represent the variation of resistivity of a semiconductor with absolute temperature.

3) Give any one use of electromagnet.

4) What is the significance of Lenz's law?

5) How does capacitive reactance vary with frequency?

6) Arrange the following electromagnetic waves in ascending order of their wavelength :

   Radio waves, Gamma rays, Infrared waves, X-rays.

7) Why does sky appear blue?

8) Mention a method to increase the resolving power of a microscope.

9) Write the nuclear reaction equation for alpha decay of $^{238}_{92}U$.

10) Draw the logic symbol of NOR gate.

PART – B

II.   Answer **any five** of the following questions :   (5 × 2 = 10)

11)   State and explain Coulomb's law in electrostatics.

12)   A parallel plate capacitor with air between the plates has a capacitance C. What will be the capacitance if

   a)   the distance between the plates is doubled?

   b)   the space between the plates is filled with a substance of dielectric constant 5?

13)   Write two limitations of Ohm's law.

14)   In a region, an electric field $\vec{E} = 5 \times 10^3\, \hat{j}\, NC^{-1}$ and a magnetic field of $\vec{B} = 0.1\hat{k}T$ are applied. A beam of charged particles are projected along X-direction.

   Find the velocity of charged particles which move undeflected in this crossed fields.

15)   Define "retentivity" and "coercivity".

16)   Mention two sources of energy loss in transformer.

17)   What is displacement current? Give the expression for it.

18)   An alpha particle, a proton and an electron are moving with equal kinetic energy. Which one of these particles has the longest de Broglie wavelength? Give reason.

PART – C

III. Answer **any five** of the following questions : (5 × 3 = 15)

19) Establish the relation between electric field and electric potential.

20) Derive the expression for the energy stored in a charged capacitor.

21) Give the principle of cyclotron and draw the neat labelled schematic diagram of cyclotron.

22) Mention three properties of diamagnetic materials.

23) Arrive at the relation between focal length and radius of curvature of a spherical concave mirror.

24) Using Huygen's principle, show that the angle of incidence is equal to the angle of reflection when a plane wave front is reflected by a plane surface.

25) Define work function. Write Einstein's photoelectric equation and explain the terms.

26) Give three differences between intrinsic and extrinsic semiconductors.

PART – D

IV. Answer **any two** of the following questions : (2 × 5 = 10)

27) Derive the expression for conductivity of a material : $\sigma = \dfrac{ne^2\tau}{m}$; where the terms have their usual meaning.

28) Obtain the expression for the force between two straight long parallel conductors carrying current. Hence define "ampere".

29) With the help of a labelled diagram, derive the expression for instantaneous emf induced in an AC generator.

V. Answer **any two** of the following questions : (2 × 5 = 10)

30) Obtain the expression for the fringe width of interference fringes in Young's Double slit experiment.

31) Using Bohr's postulates, derive the expression for the radius of nth stationary orbit of electron in hydrogen atom. Hence write the expression for Bohr radius.

32) What is rectification? Explain the working of a p-n junction diode as a half wave rectifier. Draw the input and output wave forms.

VI. Answer **any three** of the following questions : (3 × 5 = 15)

33) Two point charges $q_A = 5\mu C$ and $q_B = -5\mu C$ are located at A and B separated by 0.2 m in vacuum.

   a) What is the electric field at the midpoint O of the line joining the charges?

   b) If a negative test charge of magnitude $2nC$ is placed at O, what is the force experienced by the test charge?

34) a) Three resistors 3Ω, 4Ω and 12Ω are connected in parallel. What is the effective resistance of the combination?

   b) If the combination is connected to a battery of emf 6 V and internal resistance 0.5Ω, find the current drawn from the battery and terminal potential difference across the battery.

35) A series LCR circuit contains a pure inductor of inductance 5.0 H, a capacitor of capacitance $20\mu F$ and a resistor of resistance 40Ω.

   a) Find the resonant frequency of the circuit.

   b) Calculate the Quality factor (Q-factor) of the circuit.

   c) What is the impedance at resonant condition?

36) At what angle should a ray of light be incident on the face of an equilateral prism, so that it just suffers total internal reflection at the other face? The refractive index of the material of the prism is 1.5.

37) A copper coin has a mass of 63.0 g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. The coin is entirely made of $^{63}_{29}Cu$ atoms.

Mass of $^{63}_{29}Cu$ atom = 62.92960 u

Mass of proton = 1.00727 u

Mass of neutron = 1.00866 u

Avogadro's number = 6.022×10^{23}.

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PHYSICS- M 2022

(English Version)

Instructions : 1. *All Parts are compulsory.*

2. *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*

3. *Direct answers to the numerical problems without writing the relevant formula and detailed solutions will not carry any marks.*

PART – A

I. Answer **any ten** of the following questions : $(10 \times 1 = 10)$

1) Name the apparatus used to detect electric charge on a body.

2) Define 'electric dipole moment'.

3) State ohm's law.

4) The resistance of a carbon resistor with four coloured rings is $(500 \pm 50)\Omega$. Identify the colour of fourth ring.

5) What is the magnitude of the magnetic force on a charged particle moving anti-parallel to a uniform magnetic field?

6) Define the magnetic declination at a place on the Earth.

7) Mention the significance of Lenz's law.

8) Write the expression for the natural frequency of oscillations in an LC circuit.

9) Write the relation between the magnitude of the electric and the magnetic fields in an electromagnetic wave.

10) Name the type of electromagnetic rays lying between ultraviolet and gamma rays.

11) What are coherent sources of light?

12) How does the resolving power of a telescope change on increasing the diameter of the objective lens?

13) What is meant by the ionisation energy of an atom?

14) Give an example for elemental semiconductor.

15) Draw the logic symbol of NOT-gate.

PART – B

II. Answer **any five** of the following questions :   (5 × 2 = 10)

16) What are polar and non-polar molecules?

17) Show with schematic graphs, variation of resistivity with absolute temperature for

a) Nichrome and

b) Silicon

18) The current in a coil falls from 25 mA to 0 mA in 1 ms and induces an emf of 10 V in it. Find the self-inductance of the coil.

19) Give the working principle of AC generator. Why the current generated by it is called alternating current?

20) What is displacement current? Write its expression.

21) Give the reasons for the following statements :

    a) The sun is visible a little before the actual sunrise and until a little after the actual sunset.

    b) The sky appears blue.

22) Write any two uses of polaroids.

23) What are de Broglie waves? Name an experiment which verified the wave nature of electrons.

24) Draw the labeled diagram representing the schematic arrangement of Geiger-Marsden experiment for alpha-particle scattering.

25) Give any two advantages of LEDs over conventional incandescent low power lamps.

PART – C

III. Answer **any five** of the following questions : (5 × 3 = 15)

26) Mention the three factors on which the capacitance of a dielectric parallel plate capacitor depends.

27) Derive the expression for the drift velocity of electrons in a conductor in terms of their relaxation time.

28) Write the two reasons to show that, 'the galvanometer as such can not be used as an ammeter'. Give the method of converting the galvanometer into an ammeter.

29) List any three properties of ferromagnetic substances.

30) Write any three applications in which advantage of eddy currents are used.

31) Mention any three sources of energy loss in an actual transformer.

32) Using Huygen's principle, show that the angle of incidence is equal to the angle of reflection, when a plane wavefront is reflected by a plane surface.

33) Write the three postulates of Bohr model of the hydrogen atom.

34) Define 'mass defect' and 'binding energy' of a nucleus. Write the relation between them.

35) Give any three differences between intrinsic and extrinsic semiconductors.

PART – D

IV. Answer **any two** of the following questions :   **(2 × 5 = 10)**

36) What is an electric field line? Write the four general properties of electric field lines.

37) Using Kirchhoff's rules, obtain the expression for the balancing condition of Wheatstone bridge.

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

39) Derive the expression for the magnitude of the magnetic field at a point on the axis of a current carrying solenoid. Hence show that it is equivalent to a bar magnet.

V. Answer **any two** of the following questions : **(2 × 5 = 10)**

40) Show that the current lags the voltage by $\dfrac{\pi}{2}$ in an AC circuit containing a pure inductor. Draw the phasor diagram for it.

41) Derive lens maker's formula for a convex lens.

42) Define photoelectric work function. Write the four experimental observations of photoelectric effect.

43) What is rectifier? With the suitable circuit diagram, explain the working of p-n junction diode as a full-wave rectifier. Draw the input and the output waveforms.

VI. Answer **any three** of the following questions : **(3 × 5 = 15)**

44) Two small charged spheres having charges of 2×10^{-7} C and 3×10^{-7} C are placed 3 cm apart in vacuum. Find the electrostatic force between them. Find the new force, when the distance between them is doubled.
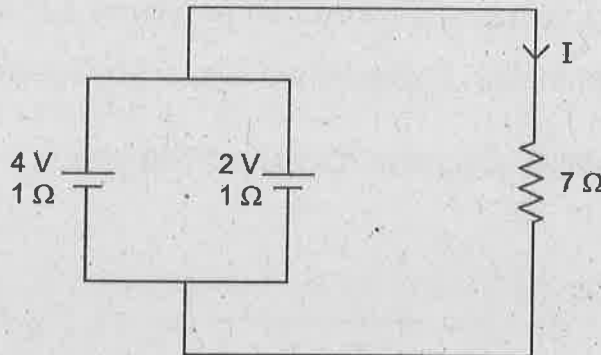
Given : $\dfrac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ Nm^{2}C^{-2}

45) A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of $-2 \times 10^{-8} C$ from a point $A(3\,cm, 0, 0)$ to a point $B(0, 4\,cm, 0)$ via a point $C(3\,cm, 4\,cm, 0)$.

Given : $\dfrac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \, Nm^2 C^{-2}$.

46) In the following circuit, find the current I.

47) A circular copper coil of mean radius 6.284 cm has 20 turns. If a current of 2A is passed through this coil, find the magnitude of the magnetic field at its centre. Also find the magnetic dipole moment of this current coil. Given : $\mu_0 = 4\pi \times 10^{-7} \, Hm^{-1}$.

48) A ray of light passes through an equilateral glass prism such that the refracted ray inside the prism is parallel to its base. Calculate the

a) angle of deviation of the ray and

b) speed of light ray inside the prism.

Given : the refractive index of glass = $\dfrac{3}{2}$ and the speed of light in vacuum = $3 \times 10^8 \, ms^{-1}$.

49) Two slits separated by 1 mm in Young's double slit experiment are illuminated by the violet light of the wavelength 400 nm. The interference fringes are obtained on the screen placed at 1 m from the slits. Find the fringe width. If the violet light is replaced by the red light of the wavelength 700 nm, find the percentage change in fringe width.

50) The normal activity of living carbon (C-14) containing matter is found to be about 15 decays per minute per gram of carbon. A specimen found in an archaeological excavation has an activity of 1.5 decays per minute per gram of carbon matter. Estimate the age of the specimen.

Given : the half-life of carbon (C-14) is 5730 years.