SUB: PHYSICS

(VOLUME – I)
1. ELECTROSTATICS

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Short Answer:

1. What is meant by quantisation of charges?
2. Write down Coulomb's law in vector form and mention what each term represents.
3. What are the differences between Coulomb force and gravitational force?
4. Write a short note on superposition principle.
5. Define 'Electric field'.
6. What is mean by 'Electric field lines'?
7. The electric field lines never intersect. Justify.
8. Define 'Electric dipole'.
9. What is the general definition of electric dipole moment?
10. Define 'electrostatic potential".
11. What is an equipotential surface?
12. What are the properties of an equipotential surface?
13. Give the relation between electric field and electric potential.
14. Define 'electrostatic potential energy'.
15. Define 'electric flux'
16. What is meant by electrostatic energy density?
17. Write a short note on 'electrostatic shielding'.
18. What is Polarisation?
19. What is dielectric strength?
20. Define 'capacitance'. Give its unit.
21. What is corona discharge?
22. State Gauss law.
23. Write short note on Microwave Oven.
24. Polar & Non – Polar molecule.

Long Answer:

1. Discuss the basic properties of electric charges.
2. Calculate the electric field due to a dipole on its axial line and equatorial plane.
3. Derive an expression for the torque experienced by a dipole due to a uniform electric field.
4. Derive an expression for electrostatic potential due to an electric dipole.
5. Obtain the expression for electric field due to an infinitely long charged wire.
6. Obtain the expression for electric field due to an charged infinite plane sheet.
7. Obtain the expression for electric field due to an uniformly charged spherical shell.
8. Obtain the expression for energy stored in the parallel plate capacitor.
9. Derive the expression for resultant capacitance, when capacitors are connected in series and in parallel.
10. Explain in detail the construction and working of a Van de Graaff generator.

2. CURRENT ELECTRICITY

Short Answers:

1. Why current is a scalar?
2. Distinguish between drift velocity and mobility.
3. State microscopic form of Ohm's law.
4. State macroscopic form of Ohm's law.
5. What are ohmic and non ohmic devices?
6. Define electrical resistivity.
7. Define temperature coefficient of resistance.
8. What is superconductivity?
9. What is electric power and electric energy?
10. Define current density.
11. Derive the expression for power P=VI in electrical circuit.
12. Write down the various forms of expression for power in electrical circuit.
13. State Kirchhoff's current rule.
14. State Kirchhoff's voltage rule.
15. State the principle of potentiometer.
16. What do you mean by internal resistance of a cell?
17. State Joule's law of heating.
18. What is Seebeck effect?
19. What is Thomson effect?
20. What is Peltier effect?
21. State the applications of Seebeck effect.

Long Answer:

1. Explain the equivalent resistance of a series and parallel resistor network.
2. Explain the determination of the internal resistance of a cell using voltmeter.
3. State and explain Kirchhoff's rules. 4. Obtain the condition for bridge balance in Wheatstone's bridge.
5. Explain the determination of unknown resistance using meter bridge.
6. How the emf of two cells are compared using potentiometer?

3. MAGNETISM AND MAGNETIC EFFECTS OF ELECTRIC CURRENT

Short answer:

1. What is meant by magnetic induction?
2. Define magnetic flux.
3. Define magnetic dipole moment.
4. State Coulomb's inverse law.
5. What is magnetic susceptibility?
6. State Biot-Savart's law.
7. What is magnetic permeability?
8. State Ampere's circuital law.
9. Compare dia, para and ferro-magnetism.
10. What is meant by hysteresis?

Long answer:

1. Deduce the relation for the magnetic induction at a point due to an infinitely long straight conductor carrying current.
2. Obtain a relation for the magnetic induction at a point along the axis of a circular coil carrying current.
3. Calculate the magnetic induction at a point on the axial line of a bar magnet.
4. Obtain the magnetic induction at a point on the equatorial line of a bar magnet.
5. Discuss the working of cyclotron in detail.
6. Explain the principle and working of a moving coil galvanometer.
7. Discuss the conversion of galvanometer into an ammeter and also a voltmeter.

4. ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

Short answer:

1. What is meant by electromagnetic induction?
2. State Faraday's laws of electromagnetic induction.
3. State Lenz's law.
4. State Fleming's right hand rule.
5. How is Eddy current produced? How do they flow in a conductor?
6. Mention the ways of producing induced emf.
7. What for an inductor is used? Give some examples.
8. What do you mean by self-induction?
9. What is meant by mutual induction?
10. Give the principle of AC generator.
11. What are step-up and step-down transformers?
12. Define average value of an alternating current.
13. How will you define RMS value of an alternating current?
14. What are phasors?
15. Define electric resonance.
16. What do you mean by resonant frequency?
17. How will you define Q-factor?
18. What is meant by wattles current?
19. Give any one definition of power factor.
20. What are LC oscillations?

Long answer:

1. Show that the mutual inductance between a pair of coils (co – axial solenoid) is same ($M_{12} = M_{21}$).
2. Explain the working of a single-phase AC generator with necessary diagram.
3. Explain the construction and working of transformer.
4. Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.
5. Magnetic field due to long straight conductor carrying current.
6. M.F. axis of the current carrying circular coil.
7. Energy stored in an inductor.

5. ELECTROMAGTIC WAVES

Short answer:

1. What is displacement current?
2. What are electromagnetic waves?
3. Write down the integral form of modified Ampere's circuital law.
4. Explain the concept of intensity of electromagnetic waves.
5. What is meant by Fraunhofer lines?

Long answer:

1. Write down Maxwell equations in integral form.
2. Write short notes on (a) microwave (b) X-ray (c) radio waves (d) visible spectrum.
3. Write down the properties of electromagnetic waves.
4. What is emission spectra? Give their types.
5. What is absorption spectra? Give their types.

VOLUME – II
6. OPTICS

Short answer:

1. State the laws of reflection.
2. Give the characteristics of image formed by a plane mirror.
3. What are the Cartesian sign conventions for a spherical mirror?
4. State the laws of refraction.
5. Why do stars twinkle?
6. Explain the reason for glittering of diamond.
7. What are mirage and looming?
8. What is Snell's window?
9. Write a note on optical fibre.
10. What is power of a lens?
11. What is dispersion?
12. How are rainbows formed?
13. What is Rayleigh's scattering?
14. Why does sky appear blue?
15. What is the reason for reddish appearance of sky during sunset and sunrise?
16. Why do clouds appear white?
17. What is Huygens' principle?
18. What is diffraction?
19. Differentiate between Fresnel and Fraunhofer diffraction.

20. Mention the differences between interference and diffraction.
21. What is polarisation? 22. Differentiate between polarised and unpolarised light
23. What are polariser and analyser?
24. State and obtain Malus' law. 25. List the uses of polaroids. 26. State Brewster's law.
27. Discuss about pile of plates. 28. Discuss about Nicol prism.
29. What is myopia? What is its remedy? 30. What is astigmatism?

Long answer:

1. Derive the mirror equation and the equation for lateral magnification.
2. Describe the Fizeau's method to determine speed of light.
3. Obtain lens maker's formula and mention its significance.
4. Derive the equation for angle of deviation produced by a prism and thus obtain the equation for refractive index of material of the prism.
5. What is dispersion? Obtain the equation for dispersive power of a medium.
6. Prove laws of reflection using Huygens' principle. 7. Prove laws of refraction using Huygens' principle.
8. Obtain the equation for bandwidth in Young's double slit experiment.
9. Explain about compound microscope and obtain the equation for magnification.
10. Nicol Prism and its uses & drawbacks. 11. Polarisation by reflection in Brewster's law.

7. DUAL NATURE OF RADIATION AND MATTER

Short answer:

1. Why do metals have a large number of free electrons?
2. Define work function of a metal. Give its unit. 3. What is photoelectric effect?
4. How does photocurrent vary with the intensity of the incident light?
5. Give the definition of intensity of light and its unit. 6. How will you define threshold frequency?
7. What is a photo cell? Mention the different types of photocells.
8. State de Broglie hypothesis. 9. Why we do not see the wave properties of a baseball?
10. A proton and an electron have same kinetic energy. Which one has greater de Broglie wavelength. Justify.
11. Write the relationship of de Broglie wavelength λ associated with a particle of mass m in terms of its kinetic energy K.

Long answer:

1. List out the laws of photoelectric effect.
2. Obtain Einstein's photoelectric equation with necessary explanation.
3. Give the construction and working of photo emissive cell.
4. Derive an expression for de Broglie wavelength of electrons.
5. Briefly explain the principle and working of electron microscope.
6. Describe briefly Davisson – Germer experiment which demonstrated the wave nature of electrons.

8. ATOMIC AND NUCLEAR PHYSICS

Short answer:

1. What are cathode rays? 2. Write the properties of cathode rays.
3. Give the results of Rutherford alpha scattering experiment.
4. Write down the postulates of Bohr atom model. 5. What is meant by excitation energy.
6. Define the ionization energy and ionization potential.
7. Write down the draw backs of Bohr atom model. 8. What is distance of closest approach?
9. Define impact parameter.
10. Write a general notation of nucleus of element X. What each term denotes?
11. What is isotope? Give an example. 12. What is isotone? Give an example.
13. What is isobar? Give an example. 14. Define atomic mass unit u.
15. Show that nuclear density is almost constant for nuclei with $Z > 10$. 16. What is mass defect?
17. What is binding energy of a nucleus? Give its expression.
18. Calculate the energy equivalent of 1 atomic mass unit.
19. Give the physical meaning of binding energy per nucleon. 20. What is meant by radioactivity?
21. Give the symbolic representation of alpha decay, beta decay and gamma decay.
22. In alpha decay, why the unstable nucleus emits ^4_2He nucleus? Why it does not emit four separate nucleons? 23. What is mean life of nucleus? Give the expression.
24. What is half-life of nucleus? Give the expression.
25. What is meant by activity or decay rate? Give its unit. 26. Define curie.
27. What are the constituent particles of neutron and proton?

Long answer:

1. Explain the J.J. Thomson experiment to determine the specific charge of electron.
2. Discuss the Millikan's oil drop experiment to determine the charge of an electron.
3. Derive the energy expression for hydrogen atom using Bohr atom model.
4. Discuss the spectral series of hydrogen atom.
5. Describe the working of nuclear reactor with a block diagram.

9. SEMICONDUCTOR ELECTRONICS

Short Answers:

1. Define electron motion in a semiconductor.
2. Distinguish between intrinsic and extrinsic semiconductors. 3. What do you mean by doping?
4. How electron-hole pairs are created in a semiconductor material?
5. A diode is called as a unidirectional device. Explain
6. What do you mean by leakage current in a diode?
7. Draw the output waveform of a full wave rectifier.
8. Distinguish between avalanche and zener breakdown.
9. Discuss the biasing polarities in an NPN and PNP transistors.
10. Give circuit symbol, logical operation, truth table, and Boolean expression of AND, OR, NOT, NAND, NOR, and EX-OR gates. 11. State De Morgan's first and second theorems.

Long Answer:

1. Draw the circuit diagram of a half wave rectifier and explain its working
2. Explain the construction and working of a full wave rectifier.
3. Explain the working principle of a solar cell. Mention its applications.
4. Transistor functions as a switch. Explain.
5. State and prove De Morgan's First and Second theorems.

10. COMMUNICATION SYSTEMS

Short answers:

1. Give the factors that are responsible for transmission impairments.
2. Distinguish between wireline and wireless communication? Specify the range of electromagnetic waves in which it is used.
3. Explain centre frequency or resting frequency in frequency modulation.
4. What does RADAR stand for and application? 5. What do you mean by Internet of Things?

Long Answers:

1. What is modulation? Explain the types of modulation with necessary diagrams.
2. Elaborate on the basic elements of communication system with the necessary block diagram.
3. Explain the three modes of propagation of electromagnetic waves through space.
4. Give the applications of ICT in mining and agriculture sectors.
5. Fiber optic communication is gaining popularity among the various transmission media - justify.

11. RECENT DEVELOPMENTS IN PHYSICS

Short answers:

1. Distinguish between Nanoscience and Nanotechnology.
2. What is the difference between Nano materials and Bulk materials?
3. Give any two examples for "Nano" in nature.
4. Mention any two advantages and disadvantages of Robotics.
5. Why steel is preferred in making Robots? 6. What are black holes?
7. What are sub atomic particles? 8. What is Robotics? 9. What is Cosmology?

Long Answers:

1. Discuss the applications of Nanomaterials in various fields.
2. What are the possible harmful effects of usage of Nanoparticles? Why?
3. Application of Nanotechnology.
4. Comment on the recent advancement in medical diagnosis and therapy.