PHYSICS

II PUC

QUESTION BANK

PHYSICS

List of the lecturers selected for preparation of **II PU Physics** question bank

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CHAPTER-1

ELECTRIC CHARGES AND FIELDS

One mark questions

1. What is the cause for seeing the spark or hearing the crackle when, we take off our synthetic clothes particularly in dry weather? (K)
2. Which phenomenon is responsible for lightning in the sky during thunder storm? (K)
3. We experience a sensation of electric shock while opening the door of a car or while holding the iron bar of a bus after sliding from our seat. Why? (K)
4. Who discovered the fact that amber rubbed with wool or silk attracts light objects? (K)
5. What happens when insulating surfaces are rubbed with each other? (K)
6. When amber is rubbed with wool or silk, it attracts light objects. Who is credited as the discoverer of this phenomenon? (K)
7. How the name electricity is coined? (U)
8. How many kinds of electrification are there in nature? (K)
9. What is the meaning of the Greek word 'elektron' form which the name 'electricity' is coined? (K)
10. How many types of charges exist in nature? (K)
11. What is the nature of force between like charges? (K)
12. What is the nature of force between unlike charges? (K)
13. What is meant by polarity of charges? (U)
14. What would happen when two oppositely charged objects are brought in contact? (K)
15. Who has named two types of charges as positive and negative? (K)
16. Why does a pair of objects get electrified on rubbing on each other? (U)
17. What is the cause of electrification of an object? (U)
18. When do we say that an object is charged or electrified? (U)
19. Name the instrument which detects the charge on an object. (K)
20. Name the instrument which detects the nature of the charge of the object. (K)
21. What is gold leaf electroscope? (K)
22. What does the degree of divergence of gold leaves in gold leaf electroscope indicate? (U)
23. How an object does acquire positive charge? (U)
24. How an object does acquire negative charge? (U)
25. When glass rod is rubbed with silk, glass rod acquires positive charge. Give reason. (U)
26. When plastic rod is rubbed with cat's fur it acquires negative charge. Give reason. (U)
27. Why do electrostatic experiments not work well on humid days? (U)
28. When we walk briskly on the carpet in dry whether we are electrically charged. What type of charge accumulates on us? (K)
29. Why can we not charge metal rod when held in hand and rubbed with wool? (U)

30. What are electric conductors? (K)
31. What are electric insulators? (K)
32. Electric charge can be transferred from one object to the other object using copper wire but not with nylon thread. Give reason. (U)
33. Give an example of electric conductor. (K)
34. Given an example of electric insulator. (K)
35. What is meant by grounding/earthing? (K)
36. Name the three wires in household electrical wire systems (K)
37. Why do we connect the metal parts of the electrical appliances to the earthing wire? (U)
38. Why is it recommended that you touch the metal frame of your personal computer before installing any internal accessories? (U)
39. If we rub a coin briskly between your fingers, it will not seem to become charged by friction. Why? (U)
40. The number of electrons in an insulator is of the same order as the number of electrons in a conductor. What is then the basic difference between a conductor and an insulator? (U)
41. Is pure water a conductor or insulator? (U)
42. What is charging by induction? (K)
43. When a charged comb is brought near a small piece of paper, it attracts the piece. Does the paper become charged when the comb is brought near it? (K)
44. When do we treat a charged object as a point charge? (U)
45. What is meant by additive property of charge? (K)
46. What is meant by quantization property of charge? (K)
47. State the conservation property of charge. (K)
48. Why a charge on an object is said to be quantized? (U)
49. Write the expression for quantization property of charge. (K)
50. What is the nature of charge on an electron? (K)
51. What is the nature of charge on a proton? (K)
52. Name the scientist who suggested the quantization property of charge. (K)
53. Name the scientist who experimentally proved the quantitation nature of charge. (K)
54. Name the SI unit of charge. (K)
55. Give the value of the basic unit of charge. (K)
56. How many electrons make -1 C of charge? (A)
57. A glass rod rubbed with silk loses 108 electrons. What is the charge on glass rod? (K)
58. What is the least possible value of charge that an object can have? (K)
59. When do we neglect the quantization property of charge? (U)
60. How many electrons make -1 μC charge? (A)
61. What is the lower limit of the electric force between two charged particles placed at a separation of 1 cm in vacuum? (A)
62. Initially sphere A has a charge of -50e and sphere B has a charge of +20e. The spheres are made of conducting material and are identical in size. If the spheres are then touch, what is the resulting charge on sphere A? (A)
63. State Coulomb's law in electrostatics. (K)

64. Give the mathematical expression of Coulomb's law in electrostatics. (U)
65. Name the device used by Coulomb to measure the electric force between two charged spheres.(K)
66. How does the Coulomb force between the two point charges vary with the distance of separation between them? (U)
67. What is the value of proportionality constant k, in Coulomb's law in SI unit? (U)
68. What is the physical significance of proportionality constant k in Coulomb's law? (U)
69. Define 1 C of charge. (U)
70. Express the proportionality constant k in terms of permittivity of free space in Coulomb's law. (U)
71. Write the value of permittivity of free space in SI system. (K)
72. Two point charges of unknown magnitude and sign are at a distance d apart. The electric field is zero between them at a point on the line joining the two charges. What can you conclude about the charges? (A)
73. If the electrons in a metal plate such as copper are free to move about, they must often find themselves headed toward the metal surface. Why do they not keep on going and leave the metal? (A)
74. An electron (charge =$-e$) circulates around a helium nucleus (charge =+2e) in a helium atom. Which particle excerts the larger force on the other? (U)
75. Charges of 10 μC and 15 μC are separated by a certain distance. Which charge repels the other with greater force? (A)
76. State the principle of superposition of Coulomb's force. (U)
77. Write the expression for electric field at a point due to point charge. (U)
78. Define intensity of electric field. (U)
79. How does the electric field at a point vary with distance from a point electric charge? (U)
80. How electric field at a point does vary with the magnitude of source charge? (U)
81. Write the SI unit of intensity of electric field. (K)
82. What is source charge? (K)
83. What is test charge? (K)
84. What is the direction of electric field due to a positive point charge? (K)
85. What is the direction of electric field due to a negative point charge? (K)
86. Who first introduced the concept of electric field? (K)
87. An electron is located in the uniform electric field established between two parallel plates. Where would the electron experience greatest force? (U)
88. A positively charged ball hangs from a long silk thread. We wish to measure E the electric field at a point in the same horizontal plane as that of the hanging charge. To do so, we put a positive test charge q_0 at that point and measure F/q_0. Will F/q_0 be less than, equal to, or greater than E at the point in question? (U)
89. Represent the variation of electric field with the distance from a point charge graphically. (S)
90. A point charge is taken from a point A to a point B in an electric field. Does the work done by the electric field depend on the path of the charge? (U)
91. What is an electric field line? (K)

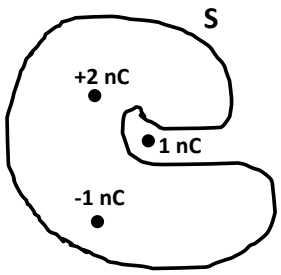
92. Draw electric field lines due to a point positive charge. (S)
93. Draw electric field lines due to a point negative charge. (S)
94. Draw electric field lines due to two equal but unlike charges. (S)
95. Draw electric field lines due to two equal but like charges. (S)
96. Draw electric field lines due to two like but unequal charges. (S)
97. Draw electric field lines due to two unlike but unequal charges. (S)
98. Draw electric filed lines of a uniform electric field. (S)
99. What is the polarity of test charge which is used to draw electric field lines? (K)
100. What does the relative density of electric field lines represent? (U)
101. Who invented picture of electric field lines? (K)
102. A point charge is moving in an electric field at right angles to the electric field lines. Does any force act on it? (U)
103. Define electric flux through a surface. (U)
104. Write the SI unit of electric flux. (K)
105. Write the expression for electric flux. (U)
106. Is electric flux a vector or a scalar quantity? (K)
107. What is an electric dipole? (K)
108. Define electric dipole moment. (U)
109. Give the SI unit of electric dipole moment. (K)
110. What is the net charge on an electric dipole? (U)
111. How does the electric field at a point due to a short dipole vary with distance? (U)
112. What is meant by electric dipole axis? (K)
113. What is meant by equatorial plane of the electric dipole? (U)
114. What is the direction of electric dipole moment? (K)
115. Write the expression for the electric field at a point on its axial line due to an electric dipole. (U)
116. Write the expression for the electric field at a point on the equatorial plane of an electric dipole. (U)
117. In the equatorial plane of an electric dipole, is the electric field parallel or antiparallel to the electric dipole moment $\vec{p}$? (U)
118. Write the expression for torque experienced by a dipole when placed in a uniform electric field.(U)
119. An electric dipole is placed antiparallel to the uniform electric field. What is the magnitude of the torque on it? (U)
120. An electric dipole is placed parallel to the uniform electric field. What is the magnitude of the torque on it? (U)
121. Write the expression for electric field at a point due to continuous charge distribution over a small volume element with charge density ρ. (U)
122. State Gauss law in electrostatics. (K)
123. What is Gaussian surface? (K)
124. Write the mathematical expression for Gauss law in electrostatics. (U)
125. What is the electric flux through a cubicle Gaussian surface enclosed on an electric dipole? (U)

126. Write the expression for the electric field due to a uniformly charged, infinitely long straight wire. (U)
127. Write the expression for the electric field due to a uniformly charged, infinite plane sheet. (U)
128. Write the expression for the electric field due to a uniformly charged thin spherical shell. (U)
129. Does the electric field exist inside a charged spherical shell? (U)

Two mark questions

1. Explain what happens when long thin strips of paper lightly ironed brought near a TV screen or Computer monitor which is switched on. (U)
2. Name the two types of electric charge. (K)
3. A glass rod is rubbed with silk. Name the type of charges acquired by each of them. (K)
4. A cat fur is rubbed with plastic rod. Name the type of charges acquired by each of them. (K)
5. Which type of charge is acquired by a plastic rod and wool when they are rubbed with each other? (K)
6. Which are the two types of charges named by Benjamin Franklin? (K)
7. Draw the neat, labeled diagram of gold leaf electroscope. (S)
8. A charged rod attracts bits of dry cork dust which after touching the rod, often jump violently away from it. Explain. (U)
9. What are electric conductors? Give an example. (K)
10. What are electric insulators? Give an example. (K)
11. Distinguish between electric conductors and electric insulators. (U)
12. Explain the additive property of electric charge. (U)
13. Explain the conservation property of electric charge. (U)
14. Explain the quantization property of electric charge. (U)
15. Justify with an example to prove the conservation property of charge. (U)
16. A plastic rod rubbed with cat's fur gains 10^{13} electrons. Find the charge on plastic rod. (A)
17. An ion contains 12 electrons and 18 protons on. Find the net charge on the object. (A)
18. Find the electric charge in coulomb, contributed by 12.5×10^{8} electrons. (A)
19. A glass is rubbed by silk cloth acquires a charge of 1.6×10^{-13} C. What is the charge on silk cloth? (A)
20. How many electrons enter in an ordinary 100 W, 230 V bulb per second when it is connected to DC supply? (A)
21. Write Coulomb's law in vector form and explain the terms.(U)
22. The force between two point charges is F. What is the new force when the distance between them is halved? (U)
23. In Coulomb's law $F = k\frac{q_1 q_2}{r^2}$, what are the factors on which k depends? (U)
24. Write the expression for intensity of the electric field in vector form and explain the terms. (U)
25. Find the electric field at a point located at 2 cm from a charge of 1 nC. (A)
26. What are the factors on which electric field at a point due to a point source charge depend? (U)
27. Write the physical significance of electric field. (U)
28. Two field lines never intersect each other. Give reason. (U)

29. Charge of 1 μC, -2 μC, 1 μC, -2 μC is placed at A, B, C and D respectively of a square of side 1.234 cm. What is the electric field intensity at the center of the square? (A)
30. The electric field $\boldsymbol{E}$ due to a point charge at any point near it is defined as $\vec{E} = \lim_{q\to 0} \frac{\vec{F}}{q}$ where q is the test charge and $\vec{F}$ is the force acting on it. What is the physical significance of limit as $q \to 0$ in this expression? (U)
31. When do we say that electric flux is either positive or negative? (U)
32. Define electric flux through an area element. Mention the SI unit of electric flux. (U)
33. Write the physical significance of electric dipole moment. (U)
34. An electric dipole of 2×10^{-9} Cm is placed at an angle of 30° with uniform electric field of 4 N/C. Find the magnitude of torque experienced by it. (A)
35. When does an electric dipole placed in a uniform electric field experiences a) maximum b) minimum torque? (U)
36. What happens to a free electric dipole when placed in a non-uniform electric field? Explain. (U)
37. Define linear charge density. Write its SI unit. (U)
38. Define surface charge density. Write its SI unit. (U)
39. Define volume charge density. Write its SI unit. (U)
40. Find the electric flux through a parallelepiped Gaussian surface which encloses one micro coulomb charge. (A)
41. Find the electric flux through a closed surface, S in the following diagram. (A)



42. A charge of 1 μC is distributed on a circular ring of radius 5 cm. Find the linear charge density. (A)
43. A charge of 1 μC is distributed over a metallic spherical shell whose radius is 5 cm. Find the surface charge density. (A)
44. 1 μC of charge is placed at one corner of a cube of side 1 cm. Find the electric flux through the cube. (A)

Three mark questions

1. Describe an experiment to demonstrate that there are two types of charges using glass rod and plastic rod. (U)
2. Describe an experiment to demonstrate there are two types of charges using pith balls. (K)
3. Describe how we use gold leaf electroscope to detect the presence of charge on an object. (U)
4. Describe how we can use gold leaf electroscope to detect the nature of charges on a charged object. (U)

5. Explain how we can construct a simple electroscope? (K)
6. Explain the working of electroscope using paper strip experiment. (K)
7. Describe how two metal spheres can be oppositely charged by method of induction. (K)
8. How can we charge a metal sphere positively without touching it? (U)
9. Write the three basic properties of electric charge. (K)
10. If 10^9 electrons move out of an object to another object every second, how much time is required to get a total charge of 1C on the other object? (A)
11. Obtain the expression for the force on a point charge due to multiple charges using principle of superposition. (U)
12. Obtain the expression for electric field at a point due to system of charges. (U)
13. Write three properties of electric field lines. (K)
14. Derive the expression for the torque experienced by an electric dipole placed in a uniform electric field. (U)
15. Find the electric flux though cylindrical Gaussian surface placed parallel to uniform electric field. (U)

Five mark questions

1. Obtain the expression for electric field at a point on the axial line of an electric dipole. (U)
2. Derive the expression for electric field at a point on the equatorial plane of an electric dipole. (U)
3. Using Gauss law derive the expression for the electric field due to an infinitely long straight uniformly charged wire. (U)
4. Obtain the expression for electric field due to a uniformly charged infinite plane sheet using Gauss law. (U)
5. Arrive at the expression for the electric field due to a thin spherical shell at a point outside the sphere using Gauss law and write the expression for electric field on its surface. (U)

Numerical problems

1. Two point charges 20 μC and 10μC are separated by 0.05m in free space. Find the force between them. Also calculate the force when a dielectric medium of dielectric constant 3 is introduced between them. (A) **[720N, 240N]**

2. Two point charges 16nC and 8nC are situated at the corners B and C of an equilateral triangle of side 0.03m. Find the magnitude and direction of the resultant electric field at the vertex A of the triangle. (A) **[$21.2X10^4 NC^{-1}$, $40^0 53'$ angle with E_1]**

3. Two pith balls of mass 10mg each are suspended by two threads from the same support are charged identically. They move apart by 0.08m and threads make an angle 60^0 with each other. Find the charge on each pith ball. (A) **[6.33nC]**

4. Two identically oppositely charged metallic spheres placed 0.5m apart attract each other with a force of 0.108N., when they are connected to each other by a copper wire for a short while, they begin to repel with a force of 0.036N. Calculate the initial charges on the spheres. (A) **[+3μC, -1μC]**

5. Two positively charged particles each of mass $1.7X10^{-27}$Kg, carrying a charge of $1.6X10^{-19}$C are kept at a certain distance in air. If each charge experiences a repulsive force equal to its weight, find the distance of separation between the charges. (A) **[0.117m]**

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CHAPTER-2

ELECTROSTATIC POTENTIAL AND CAPACITANCE

One mark questions

1. Is Coulomb force between two stationary charges a conservative or non-conservative force? (K)
2. Write the expression for the work done by an external force in moving a charge q through a distance 'dr' (U)
3. Define electric potential energy. (U)
4. Is the work done by electrostatic field in moving a charge from one point to another depend on the path that it moves? (K)
5. While defining the electrostatic potential due to a point charge, the reference of unit positive charge moving from infinity is considered. Why? (U)
6. Define electrostatic potential at a point. (U)
7. Mention SI unit of electric potential. (K)
8. Write the expression for work done in moving a charge from one point to another in an electric field. (K)
9. Write the expression for electric potential due to a point charge. (K)
10. How does electric potential due to a point charge vary with distance from it? (U)
11. Write the expression for electric potential due to a short electric dipole. (K)
12. How does electric potential due to a short electric dipole vary with distance? (U)
13. What is the potential at a point which is at a distance of 9 cm from a point charge 1nC? (A)
14. What is the work done in bringing a charge of 3mC through a potential difference of 4000 V? (A)
15. Write the expression for electric potential at a point outside a uniformly charged spherical shell. (K)
16. What is the electric potential inside a uniformly charged spherical shell? (K)
17. Write the expression for electric potential due to system of charges. (K)
18. What is an equipotential surface? (U)
19. Draw equipotential surfaces for a uniform electric field. (S)
20. Draw equipotential surfaces for a dipole. (S)
21. Draw equipotential surfaces for two identical positive charges. (S)
22. What is the work done to move a charge from one point to another point on an equipotential surface? (K)
23. Write the relation between the electric field and potential. (U)
24. Write the expression for potential energy of system of three charges. (U)
25. Define potential energy of a point charge 'q' kept in an external electric field. (U)
26. Define electron volt. (U)
27. Write the energy equivalence between electron volt and joule. (U)
28. Write the expression for potential energy of system of two charges in an external electric field. (U)
29. What are the mobile charges in a metallic conductor? (K)
30. Which electrons are free to move in metallic conductor? (K)

31. What are the charge carriers in electrolytic conductors? (K)
32. What is the value of electrostatic field inside a charged conductor? (K)
33. What is the direction of electric field on the surface of a charged conductor? (U)
34. If V is the electric potential on the surface of a spherical conductor, what is the value of electric potential inside it? (U)
35. What is electrostatic shielding? (U)
36. Where electrostatic shielding is made use of? (U)
37. What is a dielectric? (K)
38. What is polarization of a dielectric? (U)
39. What happens when a dielectric is placed in an external electric field? (U)
40. What is the direction of induced electric field in the dielectric medium when it is placed in a uniform electric field? (U)
41. What are polar molecules? (K)
42. What are non-polar molecules? (K)
43. Give an example of non-polar molecule. (K)
44. Give an example of polar molecule. (K)
45. What are linear isotropic dielectrics? (K)
46. Define electric polarization for linear isotropic dielectrics. (U)
47. Define electric susceptibility of a dielectric medium. (U)
48. What is the effect of external electric field on a dielectric? (K)
49. Define electric capacitance of a capacitor. (U)
50. What is a capacitor? (K)
51. Draw the circuit symbol of a capacitor. (S)
52. Draw the circuit symbol of a variable capacitor. (S)
53. Give SI unit of electrical capacitance. (K)
54. Define dielectric strength of a dielectric medium. (U)
55. Mention the SI unit of dielectric strength. (K)
56. What is the value of dielectric strength of air? (K)
57. Define farad, the unit of capacitance. (U)
58. Write the expression for electric field between the two plates of parallel plate capacitor. (U)
59. What is the value of electric field outside the charged parallel plate capacitor? (K)
60. What is 'fringing of the field' in case of parallel plate capacitor? (U)
61. Mention the expression for the capacitance of a parallel plate capacitor. (K)
62. Express dielectric constant in terms of permittivity of free space. (U)
63. When do we say that the two capacitors are in series? (U)
64. When do we say that the two capacitors are in parallel? (U)
65. Write the expression for equivalent of capacitance of two capacitors connected in series combination. (U)
66. Write the expression for equivalent capacitance of two capacitors connected in parallel combination. (K)
67. Write the expression for energy stored in a capacitor. (U)
68. Which form of energy is stored in the capacitor? (K)

69. Write the expression for energy stored in the capacitor in terms of electric field. (U)
70. What is energy density? (K)
71. What is Van de Graaff generator? (K)
72. What is the approximate order of the voltage that can be built using Van de Graaff generator? (K)
73. Write an application of Van de Graaff generator. (K)

Two mark questions

1. Draw the curves representing the variation of electrostatic potential and field with the distance from a point charge. (S)
2. Find the potential at a point P due to a charge of 4×10-9 C located 9 cm away from it. (A)
3. Write the expression for the potential at any point due to an electric dipole and explain the terms. (U)
4. Why the electrostatic field is zero inside a conductor? (U)
5. What work is done in moving any charge from the center of a charged spherical shell to any point inside it? Justify your answer. (U)
6. In the expression for the relation between electric field and potential which are the two important conclusions we arrive at? (U)
7. Write the expression for potential energy of system of two charges and generalize it for a system of three charges. (U)
8. Show that the work done to move a charge on an equipotential surface is zero. (U)
9. Justify that the electric field is normal to the equipotential surface at every point. (U)
10. What are the two important conclusions we can draw by the relation, $\vec{E} = -\delta V/\delta l$ (U)
11. Justify that the electric field lines on the surface of a conductor are always normal. (U)
12. Justify the statement, "There is no net charge at any point inside the conductor and any excess charge must reside at the surface." (U)
13. What are the two main factors on which the extent of polarization of a dielectric medium depends? (K)
14. Distinguish between polar and non-polar dielectrics. (U)
15. What are the factors on which capacitance of a capacitor depend? (K)
16. Write the expression for capacitance of a parallel plate capacitor and explain the terms. (K)
17. Mention any two factors on which the capacitance of a parallel plate capacitor depends? (K)
18. A material of dielectric constant 2 is inserted between the plates of a capacitor 3 micro F. calculate the new value of the capacitance. (A)
19. Find the energy stored in a capacitor of capacitance 5nF when connected to a potential of 6V source. (A)
20. Write the expression for energy density in case of a charged capacitor and explain the symbols used. (K)
21. What are two principles used to construct the Van de Graff generator? (K)
22. Draw the neat schematic labeled diagram of Van de Graaff generator. (S)

Three mark questions

1. Derive the expression for potential due to a system of charges. (U)
2. Obtain the expression for the relation between electric field and electric potential. (U)
3. Arrive at the expression for the potential energy of a system of two charges in the absence of an external electric field.(U)
4. Obtain the expression for the potential energy of a system of two charges in the presence of an external electric field. (U)
5. Obtain an expression for electric field at the surface of a charged conductor of arbitrary shape. (U)
6. Explain how a dielectric develops a net dipole moment in an external electric field. (U)
7. Mention any three factors on which the capacitance of a parallel plate capacitor depends? (K)
8. Capacitance of a parallel plate capacitor is 1 F and the plates are separated by 1 cm. Find the area of each plate of the capacitor. (A)
9. Obtain an expression for the capacitance of a parallel plate capacitor. (U)
10. Derive the expression for the effective capacitance of a series combination of two capacitors. (U)
11. Arrive at the expression for the effective capacitance of a parallel combination of two capacitors. (U)
12. Derive the expression for the energy stored in a capacitor. (U)
13. Explain how Van de Graaff generator is charged. (U)
14. What is Van de Graaff generator? Explain its working with a neat diagram. (S)

Five mark questions

1. Define electrostatic potential due to a point charge and arrive at the expression for electric potential at a point due to a point source charge. (U)
2. Obtain the expression for electrostatic potential at any point due to a short electric dipole. (U)
3. List out the important results regarding the (static charges) electrostatics of a conductor. (K)
4. Arrive at the expression for the capacitance of a parallel plate capacitor when a dielectric is introduced between its plates. (U)
5. Describe the construction and working of Van-de-Graaff generator with schematic diagram (S)

Numerical problems

1. PQRS is a square of side 1m. Four charges +10nC, -20nC, +30nC & +20nC are placed at the corners PQRS respectively. Calculate the electric potential at the intersection of the diagonals. (A) **[509V]**
2. Charges +2nC, +4nC, and +8nC are placed at the corners ABC respectively of a square of side 0.2m. Calculate the work done to transfer a charge of +2nC from the corner D to the center of the square. (A) **[627.4×10^{-9}J]**
3. A battery of 10V is connected to a capacitor of capacitance 0.1F. The battery is now removed and this capacitor is connected to a second uncharged capacitor. If the charge distributes equally on these two capacitors, find the total energy stored in each capacitor, and compare with the initial energy of the first capacitor. (A) **[2.5J, 0.5 times]**

4. A spherical drop of water carrying a charge of 3 $X10^{-10}$C has a potential of 500V at its surface. Find the radius of the drop. If two such drops of the same charge and radius combine to form a single spherical drop, calculate the potential at the surface of the new drop. (A) **[$5.4X10^{-3}$m, 794V]**
5. Two capacitors of capacitances 2μF and 8μF are connected in series and the resulting combination is connected across a 300V battery. Calculate the charge, potential difference and the energy stored in each capacitor**. (A) [charge=$4.8X10^{-4}$C, potential=240V, 60V, energy=$5.76X10^{-2}$J & $1.44X10^{-2}$J]**

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CHAPTER- 3
CURRENT ELECTRICITY

One mark questions

1. Define instantaneous electric current through a conductor. (U)
2. Define steady current in a conductor. (U)
3. Give the SI unit of electric current. (K)
4. In the nature where do the free charged particles exist? (K)
5. Write the relation between coulomb and ampere. (U)
6. How many electrons per second constitute a current of one micro ampere? (U)
7. Is electric current a scalar or vector quantity? (K)
8. How many electrons flow per second through a conductor carrying a current of 0.5 mA? (A)
9. Define free electron density of a conductor. (U)
10. What is the net charge conducted across any section at zero potential difference? (U)
11. What is the conventional direction of electric current? (K)
12. What is the net flow of electric charges in any direction inside the solid conductor? (U)
13. Name the current carriers in metals or solid conductors. (K)
14. Name the current carriers in electrolytic solutions or liquid conductors. (K)
15. Name the current carriers in discharge tubes or gaseous conductors. (K)
16. State Ohm's law. (K)
17. Define resistance of a metallic conductor. (U)
18. Write the SI unit of resistance. (K)
19. Define SI unit of resistance. (U)
20. How does the resistance of a conductor depend on its length? (U)
21. How does the resistance of a conductor depend on its area of cross section? (U)
22. Define electrical conductance. (U)
23. Mention the SI unit of conductance. (K)
24. Define resistivity of a material of a conductor. (K)
25. A wire of given resistivity is stretched to three times its length .What will be its new resistivity? (A)
26. Mention the relation between the resistance and resistivity? (U)
27. Mention the SI unit of resistivity? (K)
28. Define the term current density (j) (U)
29. Write the SI unit of current density. (K)
30. Is current density a scalar or a vector quantity? (K)
31. Define electrical conductivity. (U)
32. Mention the relation between current density and conductivity. (U)
33. Define drift velocity. (U)
34. What is the average velocity of free electrons in a metal at room temperature? (K)
35. What is the effect of temperature on the drift speed of electrons in a metallic conductor? (U)
36. Define relaxation time or mean free time. (U)

37. What is the effect of relaxation time of electrons on the conductivity of a metal? (K)
38. Define electron mobility. (U)
39. Mention the SI unit of mobility. (K)
40. Write the expression for mobility in terms of relaxation time. (U)
41. Name a material whose resistivity decreases with the rise of temperature. (K)
42. How does the resistance of an insulator change with temperature? (K)
43. What will be the value of resistance of a resistor having four colour bands in the order red, red, orange and gold? (U)
44. Write the value of resistance of a resistor having four colour bands in the order brown, red, black and silver? (U)
45. The value of resistance of a resistor is $2.5\times 10^3 \pm 10\%$. Write the colour sequence of the resistor. (A)
46. Write the colour code for the resistors of resistance 500Ω, 5KΩ, 37Ω, $4.5X10^3\Omega$. (U)
(each one mark)
47. The colour sequence is Brown, black, red and gold on a resistor. Write its resistance value. (U)
48. The value of resistance of a resistor is $0.1\pm 10\%$. Write the colour sequence of the resistor.(A)
49. What is the colour of the third band of a coded resistor of resistance $5.5\times 10^5\Omega$? (A)
50. Draw a graph indicating the variation of resistivity of copper with temperature. (S)
51. Represent graphically the variation of resistivity of nichrome with temperature. (S)
52. Draw a graph indicating the variation of resistivity of a semiconductor with temperature.(S)
53. How does the resistance of a conductor vary with temperature?(U)
54. What happens to the resistivity of a conductor when the temperature is increased? (U)
55. How does the resistivity of a semiconductor vary with temperature? (U)
56. Name a material which exhibits very weak dependence of resistivity with temperature? (K)
57. Why manganin or constantan are used to make resistance coils. (U)
58. When are the two resistors said to be in series? (K)
59. When resistors are said to be in parallel? (K)
60. 3Ω and 5Ω resistors are connected in series, if the rate of flow of charge in 3Ω resistor is 5A, what is the rate of flow of charge in 5Ω resistor? (A)
61. If V_1 and V_2 be the potential difference across resistors R_1 and R_2 in series, then what is the potential difference across the combination? (A)
62. What is the equivalent resistance of 'n' resistors each of resistance R connected in series? (U)
63. What happens to the effective resistance of the combination when two or more resistors are connected in series? (K)
64. What happens to the effective resistance when two or more resistors are connected in parallel? (K)
65. Two equal resistors are connected in parallel to the main current 3A source. What is the value of current through each resistor? (A)
66. Define emf of a cell? (U)
67. Define internal resistance of a cell. (U)
68. Give the expression for the potential difference between the electrodes of a cell of emf 'E' and internal resistance 'r'? (U)
69. Write the expression for equivalent emf when two cells of emf E_1 and E_2 connected in series. (U)

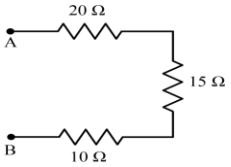
70. Write the expression for equivalent emf when two cells of emf E_1 and E_2 connected in series such that negative electrode of E_1 to negative electrode of E_2. (U)
71. Write the expression for equivalent emf of 'n' cells each of emf ξ connected in series. (U)
72. Give the expression for equivalent internal resistance of 'n' cells each of internal resistance 'r' connected in series. (U)
73. What is an electric network? (K)
74. What is a node or junction in an electrical network? (K)
75. What is a mesh or loop in an electrical network? (K)
76. State Kirchhoff's junction rule. (K)
77. What is the significance of junction rule or KCL? (U)
78. State Kirchhoff's loop rule? (K)
79. What is the significance of KVL or loop rule? (U)
80. Write the balancing condition for Wheatstone's network. (K)
81. What happens to the balancing condition of a balanced Wheatstone's network, if the galvanometer is replaced by a voltmeter of resistance 5000Ω? (U)
82. What happens to the balancing condition of Wheatstone's network, if the position of galvanometer and battery are interchanged? (U)
83. Name the device which works on the principle of Wheatstone network. (K)
84. Is the balance point of Wheatstone network affected by the internal resistance of the cell? (K)
85. What is the principle of Meter Bridge? (K)
86. Mention one use of Meter Bridge. (K)
87. Write the expression for unknown resistance R in terms of standard resistance S and balancing length l of a meter bridge. (U)
88. How the error in finding R the unknown resistance of a wire using Meter Bridge can be minimized? (U)
89. Mention one application of potentiometer. (K)
90. Write the equation used to compare emf of two cells in terms of balancing length in potentiometer experiment. (U)
91. Give the formula to determine the internal resistance of the cell using potentiometer. (U)
92. What is the advantage of potentiometer in the measurement of the internal resistance of a cell? (U)
93. In a potentiometer, potential difference per unit length of the wire in 2 Vm^{-1}. What is the balancing length for a cell of emf 1.4 V? (A)

TWO mark questions

1. Write any two differences between resistance and resistivity. (U)
2. Define the terms (1) drift velocity (2) relaxation time. (U)
3. Obtain an expression for acceleration of an electron in a current carrying conductor. (U)
4. State and explain Ohm's law. (K)
5. Write the limitations of ohm's law. (K)
6. Mention the factors on which resistivity of a metal depend. (U)
7. Write the expression for resistivity in terms of number density and relaxation time. (U)
8. Mention any two factors on which resistance of a conductor depends. (K)

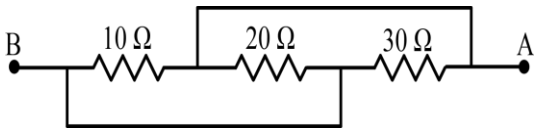
9. State another equivalent form of ohm's law in terms of current density and conductivity and explain the terms. (K)
10. A cell of emf 2V and internal resistance 1 Ω is connected across a resistor of 9 Ω. find the terminal potential difference of the cell. (A)
11. Draw V-I graph for ohmic and non- ohmic materials. (S)
12. How does the resistance of (1) good conductor, (2) semiconductor vary with increase in temperature? (U)
13. Define emf and internal resistance of a cell. (U)
14. Which are the two major types of resistors commercially made? (K)
15. Explain how wire bound resistors are made. (U)
16. To make resistors of high range which material is used and why? (U)
17. Distinguish between terminal potential difference and emf of a cell. (U)
18. Is terminal potential difference equal to the emf of a cell? Justify your answer. (U)
19. Terminal potential difference is less than the emf of a cell. Why? (U)
20. Mention the factors on which internal resistance of a cell depend. (K)
21. For what basic purpose, the cells are connected (1) in series (2) in parallel? (U)
22. Define electrical power and write its S.I unit. (U)
23. State and explain Kirchhoff's junction rule/ current law. (K)
24. State and explain Kirchhoff's loop rule / voltage law (K)
25. State Kirchhoff's laws/rules of electrical network. (K)
26. What is the cause of resistance of a conductor? Explain (U)
27. A large number of free electrons are present in metals. But there is no current in the absence of electric field across. Why? (U)
28. Why high voltage power from power generating station is preferred than high current for transmission of electrical power. (U)
29. Mention two uses of potentiometer. (K)
30. Why the connecting resistors in a meter bridge are made of thick copper strips? (K)
31. A Carbon resistor has three strips of red colour and a gold strip. What is the value of resistance and its tolerance? (U)
32. The potential difference between the terminals of an electric iron is 240 V and the current is 5.0A. What is the resistance of the electric iron? (A) **(48 Ω)**
33. A potential difference of 20 volts is applied across the ends of a resistance of 5 Ω. What current will flow in the resistor? (A) **(4 A)**
34. A current of 5 A flows through a wire whose ends are at a potential difference of 3 volts. Calculate the resistance of the wire.(A) **(0.6Ω)**
35. An electric bulb draws a current of 0.35 A for 20 minutes. Calculate the amount of electric charge that flows through the circuit. (A) **(420 C)**

36. Find the equivalent resistance between points A and B. (A)



(45 Ω)

37. Find the equivalent resistance between the points A and B?



(5.45 Ω)

Three mark questions

1. Arrive at the expression for electric current in terms of drift velocity. Or Derive $I = nAev_d$ where the symbols have their usual meaning (U)
2. Derive **E=J**ρ or $\vec{j} = \sigma\vec{E}$ or derive the expression for current density in terms of electric field and conductivity of the material using ohm's law. (U)
3. Explain how electric current is developed in conductors. (U)
4. Plot the graph of variation of resistivity with temperature for copper and explain why it is so? (S)
5. Explain how and why the transmission of high voltage power from power generating stations to houses and factories is achieved. (U)
6. Arrive at the relation between terminal potential difference and emf of a cell using ohm's law. (U)
7. How does resistivity of a conductor vary with temperature? Define temperature coefficient of resistivity. Draw the graph of variation of resistivity of a conductor with temperature. (S)
8. Obtain the expression for effective resistance of two resistors in series. (U)
9. Obtain the expression for effective resistance of two resistors in parallel. (U)
10. What is the principle of Meter Bridge? Arrive at the expression for the (unknown) resistance using Meter Bridge. (U)

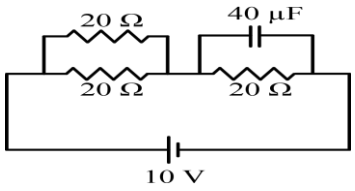
Five mark questions

1. Explain how resistance depends on the dimensions of the conductor and hence arrive at the expression for resistivity. (U)
2. Derive the expression for electrical conductivity. Or derive $\sigma = \frac{ne^2\tau}{m}$ where symbols have usual meaning. (U)
3. Assuming the expression for current in terms of drift velocity, deduce Ohm's law. (U)
4. What is meant by equivalent resistance? Derive the expression for equivalent resistance of two resistors connected in series. Write the expression for the effective resistance of 'n' resistors connected in series. (U)
5. What is meant by equivalent resistance? Derive expression for equivalent resistance of two resistors connected in parallel.(U)

6. Define emf and terminal potential difference of a cell. Derive an expression for main current using Ohm's law. (U)
7. Discuss the grouping of two cells in series and find their equivalent emf and internal resistance.(U)
8. Obtain the expression for the equivalent emf and internal resistance of two cells connected in parallel. (U)
9. Define electrical power. Arrive at an expression for electrical power in terms of current, potential difference and resistance of the conductor. (U)
10. What is a 'node' in electrical network? State and explain Kirchhoff's rules of electrical network. (K)
11. Deduce the condition for balance of Wheat stone's network using Kirchhoff's laws. (U)

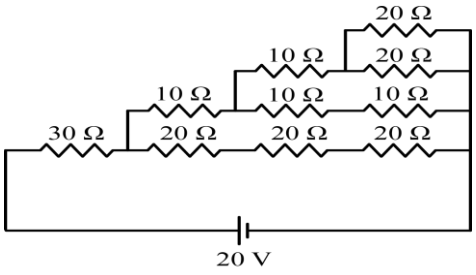
Numerical problems

1. A wire of resistance R is cut into five equal pieces. These five pieces of wire are then connected in parallel. What is the equivalent resistance of this combination in terms of the original resistance R? (A) **[R/25]**
2. A copper wire has a diameter of 0.5 mm and resistivity of 1.68×10^{-8} Ωm. What will be the length of this wire to make its resistance of 2 ohm? (A) **[23.8 m]**
3. What is the main current in the circuit?



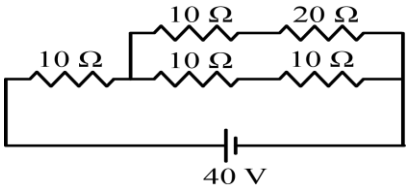
[0.33 A]

4. What is the current through 30 Ω resistors in the given circuit?



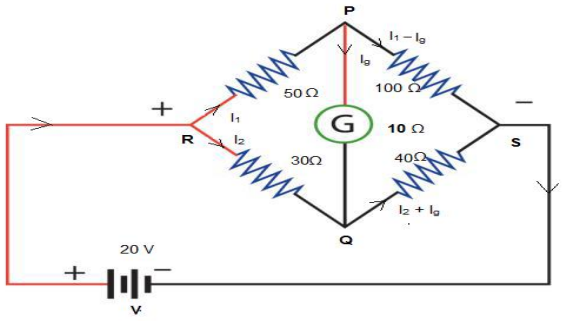
[0.44 A]

5. What is the current through 20 Ω resistor?



[0.72 A]

6. Calculate the current through the galvanometer connected across P and R of 10 Ω resistance with a potential difference of 20 V [**0.0315A]**



7. A grinder motor is designed to operate at a current of 5 A and at a p.d. of 200 V. What resistance must be connected in series with the motor so as to maintain the rated current when it is operated on a 220 V line? (A) **[4 Ω]**
8. A coil of wire has a resistance of 18 Ω at 10 ℃ and 18.48 Ω at 23 ℃. Find the temperature coefficient of resistance. What is the resistance at 0 ℃. (A) **[0.0021/^{0}C , 17.63 Ω]**
9. How do you arrange 45 cells, each of emf 1.4 V and internal resistance 0.1 Ω so as to send maximum current through an external resistance of 0.5 Ω. What is the maximum current? (A) **[3 branches of 15 cells each, 21 A]**
10. A battery of 6V gives a current of 2 A when connected to a resistance of 2 Ω. What is the internal resistance, terminal p.d. and lost voltage of the battery? Explain the term lost voltage. (A) **[1 Ω, 4 V]**
11. Two resistors 3 Ω and 6 Ω are connected in parallel. A cell of emf 2 V and internal resistance 1 Ω and a resistor of 7 Ω are connected to the resistor combination. What is the power dissipated across 7 Ω resistor? (A) **[0.28 W]**
12. Two resistances 100 Ω and 200 Ω are connected in series to a 150 V supply. A voltmeter of resistance 200 Ω is connected across 100 Ω resistor. What is the reading of voltmeter? (A) **[37.5 V]**
13. 17. Three bulbs are rated 40 W- 220 V, 60 W- 220 V and 100 W- 220 V respectively. (i) Find the resistance of each bulb. (ii) What is the maximum permissible current in each bulb? (A) **[1210 Ω, 806.7 Ω, 484 Ω, 0.45A]**
14. Two resistors of 2 Ω and 3 Ω are connected to the left gap of a metre bridge in turn. A standard resistance of 4 Ω is connected to the right gap. Find the balancing lengths in each case. (A) **[0.333m, 0.429 m]**
15. Two cells rated as 10 V, 2 Ω and 8 V, 1Ω are connected in parallel to send current in the same direction across a 6 Ω resistor. Find the p.d. across 6 Ω resistor. (A) **[7.8V]**
16. In a typical Wheatstone network, resistances P, Q, R and S are 10 Ω, 20 Ω, 30 Ω and 50 Ω respectively. Is the network balanced? If not, how do you vary (i) the arm R and (ii) the arm S to balance the network? (A) **(No, 150 Ω, 10 Ω)**

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CHAPTER-4
MOVING CHARGES AND MAGNETISM

One mark questions:

1. What was the conclusion made by Oersted when a magnetic compass needle is brought near a current carrying straight wire? (U)
2. Who investigated the phenomena that "moving charges or currents produce a magnetic field around its space". (U)
3. Name the scientist who unified both the electricity and magnetism. (K)
4. Write the expression for the magnetic force acting on a charged particle moving in a uniform magnetic field. (U)
5. Write the expression for the magnetic force acting on a charged particle moving in a uniform magnetic field in vector form. (U)
6. What is the value of magnetic force when a charged particle moves parallel to the direction of magnetic field? (U)
7. How many tesla makes one gauss? (U)
8. What should be the angle between the velocity vector of the charged particle and the magnetic field to experience a maximum force, when a charged particle is moving in a uniform magnetic field? (U)
9. What is the magnitude of the force experienced by a charged particle if it moves along the direction of the magnetic field? (U)
10. An alpha particle and a proton are projected with same velocity v perpendicular to the direction of the magnetic field B. which particle experiences maximum force? (U)
11. An alpha particle is moving along positive X- axis with a velocity v. What is the direction of the magnetic force on it, when magnetic field is directed along positive Y-axis? (U)
12. A proton is projected along +X-axis, experiences a force due to magnetic field along +Y-axis. What is the direction of the magnetic field? (U)
13. Does a neutron moving in a magnetic field experience a force? (K)
14. What is the magnitude of force experienced by a stationary proton in a magnetic field? (K)
15. Mention the rule used to find the direction force on a charged particle moving in a magnetic field. (K)
16. State Fleming's left hand rule. (K)
17. Define S.I unit of magnetic field in terms of force acting on a charged particle in a magnetic field. (U)
18. What is Lorentz force? (U)
19. Write the expression for Lorentz force. (U)
20. Write the expression for Lorentz force acting on a charged particle in the vector form. (U)
21. A proton enters a magnetic field at 30^0. At what angle should it enter to experience double the force? (A)
22. What happens to a current carrying conductor if it is placed in a magnetic field? (U)

23. Write an expression for the force acting on a current carrying conductor in a magnetic field. (U)
24. A current carrying conductor placed perpendicular to the direction of the magnetic field. What is the direction of force acting on it? (U)
25. When is the mechanical force acting on a current carrying conductor placed in magnetic field is zero? (K)
26. Which rule gives the direction of the magnetic force acting on current carrying conductor kept in a magnetic field? (K)
27. What will be the path of a charged particle in a uniform magnetic field, when it is moving parallel to the field direction? (K)
28. What will be the path of a charged particle in a uniform magnetic field, when it is moving perpendicular to the field direction? (K)
29. What is the nature of trajectory of a charged particle in uniform magnetic field when it enters the field making an angle θ with the field? (K)
30. A proton and an alpha particle enter the region of uniform magnetic field at right angles to the direction of the field with same velocity. Which particle describes greater circular path? (K)
31. A proton and an electron having the same momentum enters a uniform magnetic field at right angles to the direction of the field. Which particle describe smaller circular path? (K)
32. A charged particle moves through a magnetic field. Is the momentum of the particle affected? (K)
33. How does the frequency of revolution of a charged particle in a magnetic field depends on its charge? (U)
34. How does the frequency of revolution of a charged particle in a magnetic field depends on its mass? (U)
35. How does the frequency of revolution of a charged particle in a magnetic field depends on its velocity? (U)
36. Write the expression for the velocity of a charged particle in terms of crossed electric and magnetic fields to move without deviation. (U)
37. What is the magnitude of the force experienced by a charged particle in a crossed electric and magnetic fields when it proceeds without deviation? (K)
38. What is a cyclotron? (K)
39. On what principle a cyclotron works? (U)
40. Write the expression for the frequency of cyclotron. (K)
41. Mention any one use of cyclotron. (K)
42. What is a mass spectrometer? (K)
43. What is the principle of mass spectrometer? (U)
44. Give the vector form of Biot-Savart's law. (U)
45. What is the direction of the magnetic field due to a current element? (K)
46. Write the S.I unit of current element? (K)
47. Write the S.I unit for permeability of free space. (K)

48. What is the value of $\left(\frac{\mu_0}{4\pi}\right)$ in S.I system? (K)
49. Name the rule to find the direction of a magnet field due to a circular current loop. (K)
50. State right hand thumb rule. (K)
51. Write the expression for magnet field at the center of circular current loop. (U)
52. What is the direction of magnetic field at the center of a current carrying circular coil, when current is flowing in clockwise direction? (K)
53. How does the magnetic field at the center of circular current loop depend on its radius? (U)
54. How does the magnetic field at center of circular current loop depend on number of turns of the coil? (U)
55. What happens to the magnetic field at the center of the current loop when the current through it is doubled? (U)
56. Graphically show the variation of magnetic field with distance from the center of a wire carrying current. (S)
57. If the magnitude of the current through the circular coil is halved, then what is the magnitude of magnetic field at its center? (U)
58. State Ampere's circuital law. (K)
59. Write the expression for magnetic field at a point due to long straight current carrying conductor. (K)
60. What is a solenoid? (K)
61. What is meant by an ideal solenoid? (K)
62. Write the expression for the magnetic field at a point inside current carrying solenoid. (K)
63. What is a toroid? (K)
64. Write the expression for the magnetic field at a point inside the air cored toroid. (U)
65. What is the magnitude of magnetic field at a point in the open space inside the toroid? (K)
66. What is the magnitude of magnetic field at a point outside the toroid?(K)
67. Write the expression for the force between two long straight parallel conductors carrying currents. (U)
68. What is the nature of force between two parallel conductors carrying currents in the same direction?(K)
69. What is the nature of force between two parallel conductors carrying currents in the opposite direction?(K)
70. When do the two parallel conductors carrying currents attract each other? (K)
71. Two parallel long conductors carry currents in the same direction experience a force F. If the direction of the current in one is reversed, then what is the force experienced by them? (U)
72. Two parallel beams of electrons travelling in the same direction, separated by a certain finite distance. What is the nature of force between them? (U)
73. Define magnetic moment of a current loop. (U)
74. Write the expression for the torque exerted by a current loop kept in a uniform magnetic field. (U)
75. Give the S.I unit of magnetic dipole moment. (K)
76. Write the expression for the magnetic dipole moment of a current loop in vector form. (U)

77. Is magnetic dipole moment a vector or a scalar quantity? (K)
78. How magnetic dipole moment does depend on strength of the magnetic field? (K)
79. Current in a loop is flowing in clockwise direction. This face of the loop behaves as which magnetic pole? (K)
80. Current in a loop is flowing in anticlockwise direction. This face of the loop behaves as which magnetic pole? (K)
81. What happens to the current loop when it is placed in a uniform magnetic field? (K)
82. Write the expression for the magnitude of the torque on a current loop in a uniform magnetic field. (K)
83. Write the expression for torque on a current loop in a uniform magnetic field in vector form. (U)
84. What is the direction of torque on a current loop placed in a uniform magnetic field? (U)
85. A current carrying loop does not tend to rotate in a uniform magnetic field. What do you conclude from this statement? (U)
86. Write the expression for magnetic dipole moment of revolving electron in hydrogen atom. (K)
87. Define gyromagnetic ratio of the electron. (U)
88. Write the S.I unit of gyromagnetic ratio. (K)
89. Give the numerical value of gyromagnetic ratio of the electron. (K)
90. Define Bohr magneton. (U)
91. Write an expression for Bohr magneton. (U)
92. Give the S.I unit of Bohr magneton. (K)
93. Write the value of Bohr magneton. (K)
94. Mention the principle on which a moving coil galvanometer works. (K)
95. How current is measured in a moving coil galvanometer? (K)
96. When the galvanometer is said to be sensitive? (K)
97. Define current sensitivity of a moving coil galvanometer. (U)
98. Define voltage sensitivity of a moving coil galvanometer. (U)
99. Give the S.I unit of current sensitivity. (K)
100. Give the S.I unit of voltage sensitivity. (K)
101. What is an ammeter? (K)
102. How do you convert a galvanometer into an ammeter? (K)
103. What should be the resistance of an ideal ammeter? (U)
104. How do you increase the range of an ammeter? (U)
105. Which of the following has lower resistance (a) an ammeter or (b) a miliammeter? (K)
106. What is a voltmeter? (K)
107. How do you convert a galvanometer into a voltmeter? (K)
108. What should be the resistance of an ideal voltmeter? (U)
109. Which of the following has high resistance (a) a voltmeter or (b) a milivoltmeter? (K)

Two mark questions:

1. Write the expression for magnetic force acting on a charged particle moving in a uniform magnetic field and explain the terms. (K)

2. Represent the direction of the magnetic field (i) into the plane of the paper (ii) emerging out of the plane of the paper. (S)
3. Write the S.I unit of magnetic field and also its dimensions. (U)
4. Find the magnitude and direction of the force on 3nC of charge moving in a magnetic field of strength 0.002T with a speed $4X10^5$ ms^{-1} at perpendicular to the field. (A)
5. When is the force on a charged particle moving in a magnetic field (a) maximum and (b) minimum? (K)
6. Does a moving charge always experience a force in a magnetic field? Explain. (U)
7. A proton and an electron enter a magnetic field at the same angle and with the same speed. Do they experience the same force? Justify your answer. (U)
8. What is Lorentz force? Write the expression representing this force. (K)
9. Find the magnitude of the force experienced by an electron moving with a velocity $0.5X10^7 ms^{-1}$ in a magnetic field of strength $0.5X10^{-2}T$ making an angle 30^0 with the magnetic field. (A)
10. A proton and an electron moving with the same momentum enter a magnetic field at right angles to it. Compare the radii of their trajectory. (A)
11. Write the expression for the force acting on a current carrying conductor in a magnetic field and explain the terms.(K)
12. When is the force on a conductor carrying current in a magnetic field (a) maximum and (b) minimum? (K)
13. Write the expression for radius of circular path described by a charged particle in a uniform magnetic field and explain the terms. (K)
14. Arrive at the relation between speed of light, permeability of free space and permittivity of free space. (U)
15. A 10 μC charge moving with a velocity of 2×10^5 ms^{-1} enters a uniform magnetic field of 2 T, along the direction parallel to the field. Find the radius of its path. (A)
16. Write the expression for angular frequency of a charged particle moving in a uniform transverse magnetic field and explain the terms. (U)
17. Write the expression for the pitch of the helical path traced by an electron in a uniform magnetic field and explain the terms. (K)
18. What is meant by velocity selector? Give its importance. (U)
19. On what principle a cyclotron works? Explain. (U)
20. What are the functions of electric and magnetic fields in a cyclotron? (U)
21. Draw neat labeled diagram of cyclotron. (S)
22. Mention two places where cyclotron is used. (K)
23. Write the expression for cyclotron frequency and explain the terms. (K)
24. Write the expression for maximum kinetic energy acquired by the charged particles accelerated by a cyclotron and explain the terms. (K)
25. Give the vector form of Biot-Savart's law and explain the terms. (U)
26. Write the expression for magnetic field at a point due to current element and explain the terms. (K)
27. When is the magnetic field at a point due to a current element (1) maximum and (2) minimum? (K)

28. Write the expression for the magnet field produced at a point on the axis of circular current loop and explain the terms. (U)
29. How will magnetic field strength at the center of the circular current loop change, if the current through the coil is halved and radius of the loop is doubled? (A)
30. State and explain Ampere's circuital law. (K)
31. Write the expression for magnetic field at a point due to long straight current carrying conductor and explain the terms. (K)
32. How does the magnetic field at a point due to straight long current carrying conductor vary with the
    (a) strength of the current and
    (b) Perpendicular distance of the point from the conductor. (U)
33. Write an expression for magnetic field at a point inside current carrying solenoid and explain the terms. (U)
34. Mention the factors on which the magnetic fields at a point inside a solenoid depend. (U)
35. How does the magnetic field at a point inside an air cored solenoid vary with the (i) number turns per unit length and (ii) strength of a current though the solenoid. (U)
36. Write the expression for the magnetic field at a point inside the air cored toroid and explain the terms. (K)
37. Write the expression for the force between two long straight parallel conductors carrying currents and explain the terms. (K)
38. What is the nature of the force between two parallel conductors carrying currents in the (a) same direction and (b) opposite direction? (K)
39. Define 'ampere' the S.I unit of current by writing the expression for force between two parallel currents. (U)
40. How does the force between the conductors carrying currents vary with (a) strength of current in the conductor and (b) the distance between the conductors? (U)
41. When is the torque on a current loop in magnetic field (i) maximum and (ii) minimum (K)
42. Define gyromagnetic ratio of an electron. Mention its value. (U)
43. Write an expression for angular deflection produced by a coil in moving coil galvanometer and explain the terms. (K)
44. Draw a neat labeled diagram of moving coil galvanometer. (S)
45. What is the significance of radial magnetic field in a moving coil galvanometer? (U)
46. What is the role of soft iron cylinder inside the coil in a moving coil galvanometer? (U)
47. Why an ammeter is always connected in series with a circuit? (U)
48. Why should an ammeter have low resistance? (U)
49. Why a voltmeter is always connected in parallel with a circuit? (U)
50. Why should a voltmeter have high resistance? (U)

Three mark questions:

1. Describe Oersted's experiment. (K)
2. On what factors the force experienced by a charged particle moving in a magnetic field depends? (K)

3. On what factors Lorentz force depends? (K)
4. Write the three features observed at the interaction of a charged particle in the presence of both the electric field and the magnetic field. (U)
5. Arrive at the expression for the velocity selector by stating the condition, when a charged particle is moving in combined electric and magnetic field. (U)
6. Mention the places where cyclotron is used. (K)
7. Derive the expression for the force acting on a conductor carrying current in a uniform magnetic field. (U)
8. Obtain the expression for radius of circular path described by a charged particle in a uniform magnetic field. (U)
9. Obtain the expression for time period of revolution of a charged particle in a uniform transverse magnetic field. (U)
10. Obtain the expression for the maximum kinetic energy acquired by a charged particle accelerated by a cyclotron. (U)
11. Give the theory of cyclotron. (or) Obtain an expression for cyclotron frequency. (U)
12. State and explain of Biot-Savart's law. (U)
13. Assuming the expression for the magnetic field at a point on the axis of a circular current loop, obtain the expression for the magnetic field at the center of the loop. (U)
14. Derive the expression for the magnetic field due to a straight infinite current carrying wire using Ampere's circuit law. (U)
15. Derive the expression for the magnetic field at a point inside a solenoid carrying current. (U)
16. Explain how a circular current loop behaves as a magnetic dipole. (U)
17. Assuming the expression for magnetic dipole moment of a revolving electron in a hydrogen atom, obtain the expression for Bohr magneton. (U)
18. Derive the expression for magnetic dipole moment of a revolving electron. (U)
19. Explain how to convert a galvanometer into an ammeter. (U)
20. Explain how to convert a galvanometer into a voltmeter. (U)
21. Write any three factors on which the current sensitivity of a moving coil galvanometer depends. (U)
22. Write any three factors on which the voltage sensitivity of a moving coil galvanometer depends. (U)
23. How do you increase the current sensitivity of moving coil galvanometer? (U)
24. How do you increase the voltage sensitivity of moving coil galvanometer? (U)
25. Does the increase in current sensitivity increase voltage sensitivity? Explain (U)
26. Give any three comparative differences between Biot-Savart's law for magnetic field and Coulomb's law for electrostatic field. (U)

Five mark questions:

1. With a neat labeled diagram, explain the construction and working of a cyclotron. (S)
2. What is the principle of cyclotron? Arrive at the expression for the cyclotron frequency and the kinetic energy of the ions. (U)
3. Derive the expression for magnetic field at a point on the axis of a circular current loop. (U)
4. What is a toroid? Derive the expression for the magnetic field due to a toroid. (U)
5. Derive the expression for the force between two long straight parallel conductors carrying currents and hence define ampere, the S.I. unit of current. (U)
6. Obtain the expression for the torque acting on a rectangular current loop placed in a uniform magnetic field?(U)
7. Derive the expression for magnetic dipole moment of a revolving electron in a hydrogen atom.(U)
8. With neat labeled diagram, explain the working of a moving coil galvanometer.{OR} Give the theory of moving coil galvanometer. (U)

Numerical problems

1. A current of 1A is flowing through a circular loop of 100mm radius. Find the magnetic field at a point which is at a distance of 100mm from the center of this loop on its axis due to this current loop. Also calculate the magnetic field at the center of this loop.(A) **[$2.22X10^{-6}$T, $6.3X10^{-6}$T]**
2. A magnetic field of $35.34X10^{-6}$T is applied on an electron in a direction perpendicular to its motion. Find the time required for the electron to complete one revolution, also find the speed with which the electron moves if the radius of the path is 2mm. Given mass of the electron = $9.1X10^{-31}$Kg, and charge= $1.6X10^{-19}$C. (A) **{period=$1X10^{-6}$s and speed = $12.42X10^{3}ms^{-1}$}**
3. Two straight parallel conductors of 2m length are 0.2m apart. Find the magnitude of the force acting on the conductors if a current of 3A flows through each of them. Also find the force per unit length of the conductor. (A) **[$18X10^{-6}$N, $9X10^{-6}$N]**
4. A miliammeter of resistance 0.5Ω gives full scale deflection for a current of 5mA. How to convert it into an ammeter of range (0-0.5A) and a voltmeter of range (0-50V). (A)
5. A rectangular coil of length 0.06m and breadth 0.03m, having 100 turns is placed in a uniform magnetic field of strength 0.5T such that its plane is parallel to the field. If 5mA of current is flowing through the coil, find the force on each side of the coil and also the torque exerted by it. (A) **[$1.5X10^{-2}$N, $4.5X10^{-4}$Nm]**

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CHAPTER-5

Magnetism and Matter

One mark questions:

1. How the name 'magnet' is derived? (K)
2. Does magnetic mono pole exist? (K)
3. Is source of magnetic field analogue to the source of electric field? (U)
4. What is a magnetic dipole? (K)
5. Define magnetic dipole moment of a bar magnet. (U)
6. Is magnetic dipole moment a vector or a scalar quantity? (K)
7. What is the direction of dipole moment of a bar magnet? (U)
8. What happens to the magnetic dipole moment of a bar magnet if it is cut into two pieces along its length? (K)
9. What happens when a bar magnet is suspended freely? (K)
10. Is magnetic field a vector or a scalar quantity? (K)
11. What are the magnetic field lines? (U)
12. Is magnetic field lines form continuous closed loops. (K)
13. What happens when a magnetic needle is kept in a uniform magnetic field? (K)
14. Write the expression for torque acting on a compass needle kept in a uniform magnetic field. (K)
15. Write the expression for torque acting on a compass needle in a uniform magnetic field in vector form. (U)
16. Mention the expression for the potential energy of a magnetic dipole in a uniform magnetic field. (K)
17. Write the expression for time period of oscillation of small magnetic needle in a uniform magnetic field. (K)
18. How does the time period of oscillation of small magnetic needle in a uniform magnetic field depends on its magnetic dipole moment? (U)
19. How does the time period of oscillations of small magnetic needle in a uniform magnetic field depends on the strength of the external magnetic field? (U)
20. How does the time period of oscillations of small magnetic needle in a uniform magnetic field depends on its moment of inertia? (U)
21. What happens to the time period of oscillation of a small magnetic needle if the strength of uniform magnetic field in which it is kept increases by four times? (A)
22. Does the time period of oscillations of small magnetic needle in a uniform magnetic field depend on temperature? (K)
23. Which parameter in magnetism is analogous to the permittivity in electrostatics of a dipole? (U)
24. State Gauss's law in magnetism. (K)
25. Define magnetic meridian. (U)
26. Define geographic meridian. (U)
27. Define magnetic declination. (U)
28. Define inclination or magnetic dip. (U)

29. What is the value of dip at the equator? (K)
30. What is the value of magnetic dip at the poles? (K)
31. If the value of horizontal component of the earth BH is equal to vertical component BV, then what is the value of dip at that place? (U)
32. How does the value of magnetic inclination/dip vary from equator to the poles? (K)
33. How does the value of magnetic declination vary with the latitudes? (K)
34. How does the value of horizontal component of earth's magnetic field vary from equator to poles? (K)
35. Write the relation connecting the angle of dip, horizontal and vertical components of magnetic field of the earth at a place. (K)
36. Define magnetization of a magnetic material. (U)
37. Mention the S.I unit of magnetization of a magnetic material. (K)
38. Is magnetization of a magnetic material a scalar or a vector? (K)
39. Is magnetic flux through a scalar or vector quantity? (K)
40. How does the magnetization of a magnetic material vary with the magnetic intensity? (U)
41. Define magnetic susceptibility of a magnetic material. (U)
42. Mention the significance of magnetic susceptibility of a magnetic material. (K)
43. Define relative permeability of a material. (U)
44. How the relative permeability is related to its magnetic susceptibility? (U)
45. Give the relation between magnetic flux density B, magnetization of the material M and magnetic intensity H. (K)
46. Susceptibility of ferromagnetic substance is 3000. What is its relative permeability? (A)
47. What happens when diamagnetic material is placed in varying magnetic field? (U)
48. How does magnetic susceptibility of diamagnetic material depend on temperature? (U)
49. What does negative susceptibility signify in diamagnetic material? (U)
50. What is the net orbital magnetic moment of an atom of a diamagnetic material? (U)
51. Which type of magnetic material has relative permeability greater than one? (K)
52. For which material susceptibility low and negative? (K)
53. What is Meissner effect? (K)
54. What are paramagnetic materials? (K)
55. Give an example for paramagnetic material. (K)
56. Mention any one property of paramagnetic material. (K)
57. Sketch neat diagram to represent the distribution of magnetic field lines through paramagnetic material when placed in a uniform magnetic field. (S)
58. How does magnetic susceptibility of paramagnetic material depend on temperature? (U)
59. For which material susceptibility is low and positive? (K)
60. State Curie's law in magnetism. (K)
61. What is Curie temperature? (K)
62. What happens to the property of a ferromagnetic substance when it is heated? (U)
63. How does the ferromagnetism change with temperature? (U)
64. Susceptibility of iron is more than that of aluminum. What is the inference of this statement? (U)
65. Can susceptibility be positive and negative for the same material? (K)

66. What is magnetic hysteresis? (K)
67. What is hysteresis loss? (K)
68. What is retentivity? (K)
69. What is coercivity? (K)
70. What is coercive field? (K)
71. What does the area under hysteresis curve represent? **OR** what is the significance of hysteresis loop? (U)
72. What are permanent magnets? (K)
73. Why steel is preferred over soft iron for making permanent magnets? (U)
74. Mention a material which is used for making permanent magnets. (K)
75. Why should the material used for making permanent magnets have high coercivity? (U)
76. Why electromagnets are made of soft iron? (U)

Two mark questions:

1. Write any two properties of a bar magnet. (K)
2. Mention any two properties of magnetic field lines. (K)
3. Can two magnetic field lines intersect each other? Justify your answer. (U)
4. Explain a method to plot the magnetic field lines of a bar magnet. (U)
5. When is the potential energy of a dipole in magnetic field (i) minimum (ii) maximum? (K)
6. When is the torque acting on a magnetic needle/bar magnet/magnetic dipole in a uniform magnetic field (a) maximum and (b) minimum? (K)
7. Write the expression for potential energy of a magnetic dipole in a uniform magnetic field and explain the terms. (K)
8. Write the expression for the time period of oscillation of small magnetic needle in a uniform magnetic field and explain the terms. (K)
9. State and explain Gauss's law in magnetism. (U)
10. Mention the two differences between Gauss law in magnetism and Gauss law in electrostatics. (U)
11. Write the latitude and longitude locations of earth's magnetic poles. (K)
12. Define magnetic declination and dip at a place. (U)
13. At what place on the earth the dip is (i) maximum and (ii) minimum? (K)
14. Define magnetization of a magnetic material. Mention its S.I unit (U)
15. Define magnetic intensity. Give its S.I unit. (U)
16. What is diamagnetism? Give an example of a diamagnetic material. (K)
17. Mention any two properties of diamagnetic materials. (K)
18. Explain why diamagnetic materials are repelled by magnets? (U)
19. Which are the two important properties required for a material to behave as superconductor? (U)
20. What is paramagnetism? Give an example of a paramagnetic material. (K)
21. Mention any two properties of paramagnetic materials. (K)
22. Explain why paramagnetic substances are weakly magnetized in the direction of the magnetic field? (U)
23. State and explain Curie's law in magnetism. (K)
24. Draw the behavior of magnetic field lines near a (i) diamagnetic (ii) paramagnetic substance. (S)

25. What is ferromagnetism? Give an example of a ferro magnetic material. (K)
26. Mention any two properties of ferromagnetic materials. (K)
27. Why ferromagnetic substances magnetized easily and strongly? (U)
28. How does susceptibility of ferromagnetic vary with temperature? Explain. (U)
29. What is soft ferromagnetic material? Give an example. (K)
30. What is hard ferromagnetic material? Give an example. (K)
31. Draw the variation of magnetic field (B) with magnetic intensity (H) when ferromagnetic substance is subjected to a cycle of magnetization. (S)
32. What are the salient features of a hysteresis curve? (U)
33. What is hysteresis curve? Mention the significance of hysteresis curve. (K)
34. Mention any two applications of hysteresis curve. (K)
35. What is a permanent magnet? Name the material used for making permanent magnet. (K)
36. Paramagnetic and diamagnetic substances cannot be used for permanent magnets. Why? (U)
37. Which type materials are required for the manufacture of electromagnets? Give an example. (K)
38. Which material is used to make electromagnets and why? (U)
39. Steel is preferred for making permanent magnets whereas soft iron is preferred for making electromagnets. Why? (U)
40. What type of material is required for making permanent magnets? Give an example. (K)
41. The area of hysteresis curve of materials used in transformer cores and telephone diaphragms should be narrow. Why? (U)
42. Give any two uses of permanent magnets. (K)
43. Mention any two methods to destroy magnetism of a magnet. (K)

Three mark questions:

1. Give any three properties of a bar magnet. (K)
2. Mention any three properties of magnetic field lines. (K)
3. Sketch the magnetic field lines of (a) a bar magnet (b) a current carrying finite solenoid (c) an electric dipole. (S)
4. Arrive at the expression for magnetic potential energy of a dipole in a magnetic field. (U)
5. State and prove Gauss law in magnetism. (U)
6. What is 'dynamo effect' of earth? Explain. (U)
7. Name the elements of earth's magnetic field. (K)
8. Define the terms: (1) Declination, (2) Inclination or Dip and (3) Horizontal component of earth's magnetic field at a given place. (U)
9. Define the terms: (1) magnetization of a magnetic material, (2) magnetic intensity and (3) magnetic susceptibility. (U)
10. Define magnetic permeability and magnetic susceptibility. Write a relation between them. (U)
11. Obtain the relation between relative magnetic permeability magnetic susceptibility. (U)
12. Mention any three properties of diamagnetic material. (K)
13. Explain the cause for the diamagnetic behavior of materials. (U)
14. Mention any three properties of paramagnetic material. (K)
15. Mention any three properties of ferromagnetic material. (K)

16. Mention any three differences between diamagnetic and paramagnetic materials. (U)
17. Mention any three differences between diamagnetic and ferromagnetic materials. (U)
18. Mention any three differences between ferromagnetic and paramagnetic materials. (U)
19. Explain magnetic hysteresis by drawing hysteresis loop. (S)
20. Write the applications of electromagnets. (K)
21. Mention the different methods to magnetize a given material. (K)
22. Give the characteristics of magnetic materials used for making permanent magnets. (K)
23. The core of electromagnets is made of ferromagnetic material having high permeability and low retentivity. Explain why? (U)

Five mark questions:

1. Which are the commonly known ideas regarding magnetism in nature till now? (K)
2. Show that a current carrying solenoid is equivalent to a bar magnet. (U)

   (Or)
3. Derive the expression for magnetic field at a point along the axis of a current carrying solenoid and hence show that a solenoid is equivalent to a bar magnet. (U)
4. Derive the expression for time period of oscillation of a dipole in a uniform magnetic field. [OR] Obtain an expression for time period of oscillation of small magnetic needle in a uniform magnetic field. (U)
5. Compare the electrostatic analogy of an electric dipole with a magnetic dipole in magnetism. (U)
6. Obtain the relation between magnetic susceptibility, magnetic permeability of a substance with permeability of free space. (U)

Numerical problems

1. Find the vertical component and the total magnetic field at a place where the horizontal component is 0.38X10-4T and the angle of dip is 170. (A) [0.12X10-4T, 0.4X10-4T]
2. A circular coil of radius 5X10-2m and 20 turns carrying a current of 2A is placed perpendicular to a magnetic field of strength 2X10-3T. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is slightly turned and released, it oscillates about its stable equilibrium with a frequency of 1.5s-1. Calculate the moment of inertia of the coil about its axis of rotation. (A) [2.22X10-5Kgm2]
3. A short bar magnet placed with its axis at 450 with a uniform external magnetic field of 3T experiences a torque of magnitude equal to 4.5X10-2J. Find the magnitude of the magnetic moment of the magnet. (A)

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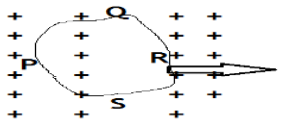
CHAPTER - 6

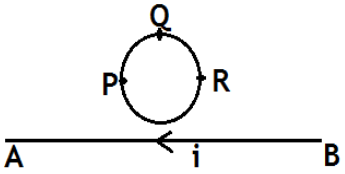
ELECTROMAGNETIC INDUCTION

One mark questions

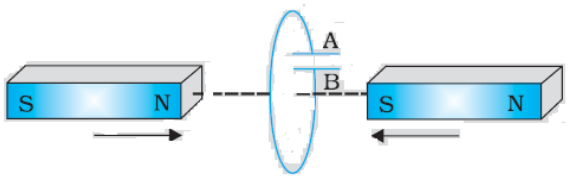
1. What is electromagnetic induction? (K)
2. Define magnetic flux through a surface. (U)
3. State Faraday's law of electromagnetic induction. (K)
4. Determine the direction of induced current in the loop given below if the loop moves out of the region of magnetic field. (A)



5. State Lenz's law of electromagnetic induction. (K)
6. What are eddy currents? (K)
7. Why eddy currents are undesirable in the metallic cores of the transformer? (U)
8. In the domestic electric power meters a rotating shiny metallic disc is seen. Why it rotates? (U)
9. How to minimize eddy currents? (U)
10. Define self-inductance of a coil. (U)
11. Write the S.I unit of self-inductance. (K)
12. Define the S.I unit of self-inductance. (U)
13. What is mutual inductance? (K)
14. Define co-efficient of mutual inductance. (U)
15. The strength of the electric current flowing in the wire from B to A is decreasing. In which direction the current is induced in the metallic loop. (A)



16. What is motional emf? (K)
17. A wire pointing north –south is dropped freely towards earth. Will any potential difference be induced across its ends? (U)
18. What happens to self-inductance of a coil if a ferromagnetic material is inserted inside the coil? (U)
19. Mention the expression for magnetic potential energy stored in an inductor when current flows through it. (K)
20. On what principle AC generator works? (K)
21. Predict the polarity of the capacitor in the situation described by the figure. (U)



Two mark questions

1. Define magnetic flux through a surface? Give its mathematical formula in vector form. (U)
2. A circular plate is placed in a uniform magnetic field such that the plane is making an angle θ with the field. For what angle of inclination the magnetic flux through the surface is (a) maximum (b) minimum? (K)
3. State and explain Faraday's law of electromagnetic induction. (U)
4. A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 revolutions per minute in a plane normal to the horizontal component of earth's magnetic field 0.4×10^{-4}T. What is the induced emf between the axle and the rim of the wheel? (A)
5. State and explain Lenz's law in electromagnetic induction. (U)
6. Mention two methods of reducing eddy currents. (K)
7. Mention any two applications of eddy currents. (K)
8. The magnetic flux linked with a coil changes from 12×10^{-3} Wb (Tm^2) to 6×10^{-3}Wb in 0.01 second. Calculate the induced emf in the coil. (A)
9. Give the expression for mutual inductance induced between two co-axial solenoids and explain the terms. (K)
10. Give an expression for self-inductance of a coil and explain the terms. (K)
11. Draw a neat labeled diagram of AC generator. (S)

Three mark questions

1. Describe coil and magnet experiment of Faraday and Henry to demonstrate electromagnetic induction phenomena. (U)
2. Describe coil and coil experiment of Faraday and Henry to demonstrate electromagnetic induction. (U)
3. Describe the experiment of two stationary coils carried out by Faraday and Henry to demonstrate electromagnetic induction. (U)
4. Derive the expression for motional emf in a conducting rod moving in uniform magnetic field. (U)
5. Arrive at the expression for motional emf induced by considering Lorentz force acting on free charge carriers of a conductor. (U)
6. Mention any three applications of eddy currents. (K)
7. Derive an expression for the charge flowing through a circuit when there is a change in the magnetic flux linked with it. (U)
8. Obtain the expression for co-efficient of mutual inductance between two co-axial solenoids. (U)

9. Deduce the expression for self-inductance of a coil. (U)
10. Arrive at the expression for the emf induced in a coil due to varying current in the same coil. (U)
11. Obtain the expression for energy stored in an inductor. (U)
12. Explain the working of an AC generator with a neat labeled diagram. (S)

Five mark questions

1. Show that Lenz's law is in accordance (consistent) with the law of conservation of energy.(U)
2. What are eddy currents? Mention its applications. (K)
3. A straight conductor is moving in a uniform time independent magnetic field. Show that the mechanical energy needed to move the rod is converted into electrical energy and then to thermal energy. [or] show that the power dissipated in a rod moving in a uniform magnetic field is $P = \frac{B^2 l^2 v^2}{r}$ where r=resistance of the conductor. (U)
4. Describe the construction and working of AC generator with a labeled diagram and hence arrive at the expression for the instantaneous value of emf induced in it. (S)

NUMERICAL PROBLEMS

1. A circular coil of 100 turns, 0.2m radius has a resistance of 100Ω is held at right angles to a uniform magnetic field of 2T. it is then turned through 45^0 about an axis at right angles to the field. Calculate the charge induced in the coil. (A) **[$73.5X10^{-3}$]**
2. The electric current in a circuit varies from +2A to -2A in a time interval of 10^{-2}s.another coil of resistance 20Ω and inductance 2H is placed near it. Find the induced current in the second coil. (A) **[40A]**
3. A solenoid of radius 2.5cm, length 0.5m has 500 turns per centimeter. If a current of 1A is set up in the solenoid calculate the magnetic flux through the solenoid. (A) **[3Wb]**
4. An iron core is inserted into a solenoid of length 0.5m, area of cross-section 0.001m^2 and 400 turns per unit length. Find the permeability of the core if 5A of current produces a magnetic flux of 1.6X10^{-3}Wb through it. (A) **[636.94]**
5. A vertical copper disc of diameter 20cm makes 10 revolutions per second about a horizontal axis passing through its center. A uniform magnetic field 10^{-2}T acts perpendicular to the plane of the disc. Calculate the potential difference between its center and rim. (A) **[$3.14X10^{-3}$V]**

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Chapter- 7.

ALTERNATING CURRENT

One mark questions

1. What is the phase angle between current and voltage across a resistor when AC is applied to a pure resistor? (K)
2. Draw a graph representing current and voltage across a resistor when AC is applied to a pure resistor. (S)
3. Define root mean square value of current or voltage. (U)
4. Write the expression for the power dissipated in the resistor when AC is passed through it. (K)
5. How the RMS value and peak value of current /voltage are related? (U)
6. If the peak value of current is 1.41A, then what is the value of root mean square current? (A)
7. What is a phasor diagram in AC circuits? (U)
8. How does the bandwidth of LCR series circuit vary with quality factor? (U)
9. Define power factor in an AC circuit. (U)
10. What is wattles current? (U)
11. The peak voltage of an AC supply is 300 V. What is the RMS voltage? (A)
12. Write the expression for inductive reactance in terms of frequency of AC applied. (K)
13. Write the expression for capacitive reactance in terms of frequency of AC applied. (K)
14. What is the value of average power supplied to an inductor in one complete cycle of AC? (K)
15. What is the power factor of an AC circuit containing a pure inductor? (K)
16. What is the power factor of an AC circuit containing only capacitor? (K)
17. What is the power factor of an AC circuit containing only pure resistor? (K)
18. Draw impedance diagram of a series LCR circuit. (S)
19. Give the expression for power factor in an AC circuit containing an inductor, a capacitor and a resistor in series. (K)
20. What is electrical resonance in RLC series circuit? (U)
21. Define resonant frequency of an RLC series circuit. (U)
22. Define band width of LCR series circuit. (U)
23. Write the expression for Q factor or quality factor of an AC circuit. (K)
24. An AC source is connected to a 3pF capacitor and 3Ω resistor in series. Can we have resonance phenomena in it? (K)
25. The power factor of an AC circuit is 0.5. What is the phase angle between voltage and current in the circuit? (A)
26. What is an ideal transformer? (K)
27. On what principle a transformer works? (K)
28. The number of turns in the primary of a transformer is greater than the number of turns in the secondary. Does the voltage steps-up or steps down in it? (U)
29. What is a step-up transformer? (K)

30. What is a step-down transformer? (K)
31. What is the reactance of an inductor in a dc circuit carrying a steady current? (K)
32. Why voltage is stepped up in large scale transmission? (U)
33. Which physical quantity in electrical system is analogue to 'mass' of the mechanical system? (U)

Two mark questions

1. Mention any two advantages of AC over DC. (K)
2. What is quality factor in an LCR series circuit? Give the expression for it. (K)
3. Write the expression for resonant frequency of RLC series circuit and explain the terms. (K)
4. Give the expression for quality factor in a RLC series circuit. Explain the symbols used. (K)
5. Alternating current is represented by the equation $I = I_0 \text{Sin}(314)t$. Find the value of frequency of AC. (A)
6. Write any two differences between inductive reactance and capacitive reactance. (U)
7. Give any two differences between step- up transformer and step- down transformer. (U)
8. An AC source of voltage $V = V_0 \sin \omega t$ is connected to an ideal inductor. Draw phasor diagram for the circuit. (S)
9. What is the phase difference between voltage and current when an AC is connected to a capacitor? Represent it using phasor diagram. (S)
10. What is the phase difference between voltage and current when an AC is connected to an inductor? Represent it using phasor diagram. (S)
11. What is the phase difference between voltage and current when an AC is connected to a resistor? Represent it using phasor diagram. (S)
12. Draw a graph of variation of voltage and current versus ωt in case of an inductor connected to an AC source. (S)
13. Draw a graph of variation of voltage and current versus ωt in case of a resistor connected to an AC source. (S)
14. Draw a graph of variation of voltage and current versus ωt in case of an inductor connected to an AC source. (S)
15. What is capacitive reactance? Give the expression for it in terms of frequency of applied AC.(K)
16. What is inductive reactance? Give the expression for it in terms of frequency of applied AC. (K)
17. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. What should be the number of turns in the secondary in order to get output power at 230 V? (A)
18. A charged 30 μF capacitor is connected to a 27 mH inductor. What is the angular frequency of free oscillations of the circuit? (A)

Three mark questions

1. Derive the expression for current in case of AC applied to a pure resistor. (U)
2. Obtain the expression for current in case of AC applied to an inductor. (U)
3. Derive the expression for current through a capacitor when AC is applied. (U)

4. Show that the average power over one complete cycle is zero in case of a capacitor connected in series with AC. (A)
5. Derive the expression for the average power dissipated in a series RLC circuit. (U)
6. What is resonance in LCR series circuit? Obtain the expression for resonant frequency of it. (U)
7. Give the theory of LC oscillator. (U)
8. Explain how an LC circuit behaves as an oscillator. (U)
9. Define band width of LCR series circuit. Give an expression for band width explaining terms used. (U)
10. Mention any three energy losses in a transformer. (K)
11. Explain how power is dissipated by writing the expression for power factor in case of (i) pure inductive or capacitive (ii) series LCR (iii) series LCR at resonance circuits. (U)

Five mark questions

1. Show that the relation between AC current and AC voltage in case of AC applied to a resistor is similar to that in the DC applied to it. (U)
2. Derive the expression for instantaneous current when AC voltage is applied to a pure inductor. Draw phasor diagram for the circuit and represent graphically. (S)
3. Show that the instantaneous value of current is 90^0 ahead of voltage in case of AC applied to a capacitor. Represent it graphically. (S)
4. Derive the expression for impedance and hence the current of an RLC series circuit connected to an AC using phasor diagram. (U)
5. Show that average power over a complete cycle in a pure inductor connected to an AC source is zero. (A)
6. Derive the expression for quality factor of a series RLC circuit connected to AC source. (U)
7. Give the construction and working of a transformer. (U)
8. What is a transformer? Mention the energy losses of a transformer. (K)

Numerical problems

1. A 50Ω resistor, 0.5H inductor and 200μF capacitor are connected in series with 220V and 50Hz source. Find the impedance of the circuit and hence the current. (A) **[149.7Ω, 1.47A]**
2. A current of 4A flows in a coil when connected to a 12V d.c.source. if the same coil is connected to 12V, 50Hz a.c. source, a current of 2.4A flows in the circuit. Calculate the self-inductance of the coil. (A) [**80mH]**
3. A resistance of 10Ω is connected in series with an inductor of inductance 0.5H. These two are connected to 200V, 50Hz a.c. source. Calculate the capacitance that should be put in series with the combination to obtain the maximum current? Also find the current through the circuit. (A) **[20.24μF, 20A]**
4. A source of 220V, 40Hz is connected to a series combination of 6Ω resistor, 0.01H inductor. Calculate the phase angle and the power factor of the circuit. (A) **[$22^0$42', 0.92]**

5. In a step-down transformer having primary to secondary turns ratio 20:1, the input voltage applied is 250V and output current is 8A. Assuming 100% efficiency calculate (i) voltage across the secondary coil, (ii) current in primary coil (iii) output power. (A) **[12.5V, 0.4A, 100W]**

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CHAPTER-8

ELECTROMAGNETIC WAVES

One mark questions

1. Who has experimentally demonstrated the existence of electromagnetic waves? (K)
2. Name the scientist who argued that electric field changing with time gives rise to magnetic field.(K)
3. Which set of equations mathematically express all the basic laws of electromagnetism? (K)
4. Which is the most important prediction to emerge from Maxwell's equations?(K)
5. Whose work unified the domain of electricity, magnetism and light.(K)
6. What is displacement current?(K)
7. What modification was made by Maxwell in Ampere's circuital law?(U)
8. What is conduction current?(K)
9. Name the law associated with the following equation $\oint \boldsymbol{B} \cdot \boldsymbol{dl} = \mu_0 i_c + \mu_0 \varepsilon_0 \frac{d\varphi}{dt}$ **(U)**
10. What is the unit of displacement current?(K)
11. How electromagnetic waves are produced?(U)
12. Give an example for an accelerating charge.(K)
13. Name the Indian physicist who has worked in the field of production of electromagnetic wave.(K)
14. Mention the invention made by Indian physicist J.C.Bose in the field of electromagnetic waves. (K)
15. What is the angle between electric field vector and magnetic field vector of electromagnetic waves?(K)
16. What is the angle between electric field vector / magnetic field vector with the direction of propagation in an electromagnetic wave?(K)
17. What is the direction of magnetic field in a capacitor?(U)
18. What is the direction of electric field in a capacitor?(U)
19. Mention the expression for the speed of propagation of electromagnetic waves in free space in terms of permittivity and permeability of free space. (K)
20. Mention the expression for the speed of propagation of electromagnetic waves in a material medium.(K)
21. What is the source of an electromagnetic wave? (K)
22. Who proposed electromagnetic wave theory? (K)
23. Write the expression for the displacement current.(U)
24. What are electromagnetic waves?(K)
25. Name the hypothetical medium assumed for the propagation of transverse waves.(K)
26. Whose experiment demolished the hypothesis of ether?(K)
27. Is a material medium essential for the propagation of electromagnetic waves?(K)
28. Do electromagnetic waves carry energy and momentum?(U)
29. What is radiation pressure?(U)
30. Write the expression for momentum transferred by an electromagnetic wave if it is absorbed completely?(U)
31. Why do we feel warmth when exposed to sunlight?(U)
32. In which field the great technological importance of the property of electromagnetic waves carrying energy is used? (K)
33. What is an electromagnetic spectrum?(K)
34. What are electromagnetic waves?(K)

35. Arrange IR rays, Gamma rays, visible rays, X- rays in increasing order of wave length.(U)
36. Arrange Micro waves, Gamma rays, visible rays, X- rays in increasing order of frequency.(U)
37. Name the electromagnetic radiation having highest frequency in the electromagnetic spectrum. (U)
38. Name the electromagnetic radiation with highest Wave length.(U)
39. Name the electromagnetic radiation with lowest frequency. (U)
40. Name the electromagnetic radiation with lowest wave length.(U)
41. What is the wave length range of visible light?(K)
42. How are radio waves produced?(U)
43. Mention one application of radio waves.(K)
44. How are micro waves produced?(U)
45. Name the domestic application of micro waves.(K)
46. How are IR waves produced?(U)
47. Name a source of UV rays?(K)
48. What is the harmful effect of UV rays? (K)
49. Why one should not continuously get exposed to U-V radiation? (U)
50. Why, one cannot get tanned or sun burn through glass window?(U)
51. Why do welders wear special glass goggles or face masks while in their work?(A)
52. Expand LASIK.(U)
53. What is the role of ozone layer in the atmosphere?(A)
54. How are X- rays produced?(U)
55. Give one use of Gamma rays.(K)
56. Mention the application of X-rays. (K)
57. How are gamma rays produced?(U)

Two mark questions

1. Distinguish between conduction current and displacement current. (U)
2. What is displacement current? Write the expression for displacement current.(K)
3. After the discovery of displacement currents what was the generalisation made by Maxwell? (U)
4. State Ampere-Maxwell law. Write its mathematical form.(K)
5. What was Marconi's invention in electromagnetic waves? What for it is used now?(U)
6. Why it was not easy to demonstrate experimentally electromagnetic waves existence?(U)
7. Write the equations representing electric and magnetic fields of electromagnetic waves. (U)
8. Briefly explain, how does an accelerating charge act as a source of an electromagnetic wave? (U)
9. Write the expression for the speed of electromagnetic wave in (a) vacuum and (b)a material medium in terms of electric permittivity and magnetic permeability . (K)
10. Obtain the relation between wavelength, frequency ad speed of electromagnetic wave. (K)
11. Give any two uses of radio waves.(K)
12. Write any two uses of micro waves.(K)
13. Give any two uses of IR-waves(K)
14. Mention any two uses of UV waves.(K)
15. Explain briefly the inconsistency in Ampere's circuital law.(U)
16. State any two properties of displacement current.(K)

Three mark questions

1. Why Maxwell suggested about displacement current? (U)
2. What are the predictions of Maxwell from Maxwell's equations? (K)
3. Explain clearly how Maxwell was led to predict the existence of electromagnetic waves. (U)
4. What are the contributions of Hertz in the field of electromagnetic waves? (K)
5. Write any three properties of electromagnetic waves. (K)
6. Name the main parts of the electromagnetic spectrum giving their wavelength range or frequency range (U)
7. Mention Maxwell's equations. (U)
8. Write any three applications of IR rays.(K)
9. A plane electromagnetic wave of frequency 97.2 K Hz travels in free space along x-direction. Calculate the magnetic field at a point in space and time where the electric field is 9.6 Vm^{-1} in y-axis. (A) **[$3.2X10^{-8}$ T]**
10. Light from a source incident on a non-reflecting surface of area 25 cm^2 for about 20 minutes. If the energy flux of light is 20Wcm^{-2} calculate the total momentum absorbed for complete absorption. (A) **[$2X10^{-3}$ $Kgms^{-1}$]**

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CHAPTER -9

RAY OPTICS AND OPTICAL INSTRUMENTS

One mark questions

1. Mention the wavelength range of electromagnetic waves which can be detected by human eye.(K)
2. Give the wavelength range of visible light. (K)
3. In which medium the speed of light has maximum value? (K)
4. Give the value of speed of light in air/vacuum up to three decimal places accuracy. (U)
5. Define pole of a mirror. (U)
6. Define principal axis of a mirror. (U)
7. Define principal focus of a mirror. (U)
8. Define focal length of spherical mirror. (U)
9. Draw the ray diagram for the formation of image by a concave mirror with object between P and F. (S)
10. Draw the ray diagram for the formation of image by a convex mirror with object between P and F.(S)
11. What is refraction of light? (K)
12. A ray of light travels from denser medium to rarer medium. If the angle of incidence is zero then what is the angle of refraction? (U)
13. What happens to speed of light when a ray of light travels from air to glass? (U)
14. Does the frequency of light change when it travels from one optical medium to another optical medium? (K)
15. The speed of light in a medium is $2X10^8$ ms^{-1}. What is the refractive index of that medium? (A)
16. State Snell's law of refraction. (K)
17. Write the formula for refractive index of the material for normal refraction. (U)
18. When is Snell's law of refraction not valid?
    OR For what angle of incidence Snell's law is not valid? (U)
19. Refractive index of carbon disulphide and glass are 1.63 and 1.5 respectively. Which is optically denser? (U)
20. Two optical media of refractive indices n_1 and n_2 contain x and y waves of the same colour in the same thickness. What is the relative refractive Index n_{21}? (U)
21. Is the optical density and material density the same? (U)
22. Is speed of light same in all optical media? (K)
23. What happens to a ray of light when it travels from optically rarer to denser medium? (K)
24. Define critical angle of a medium. (U)
25. What is the angle of refraction for a light ray if it incident at critical angle from denser medium? (U)
26. For which colour of light refractive index of a medium is minimum? (U)
27. For which colour of light refractive index of a medium is maximum? (U)
28. For which colour of light critical angle is minimum when light passes from glass to air? (U)
29. What is total internal reflection? (K)
30. Mention the relation between refractive index and critical angle of a medium. (K)

31. A water tank is viewed first normally and then obliquely. Are the apparent depths the same in both the cases? (U)
32. On what principle an optical fibre works? (K)
33. The focal length of an equiconvex lens is equal to its radius of curvature. What is the value of refractive index of the material of lens? (A)
34. Two converging lenses of equal focal lengths are placed in contact. What is the focal length of the combination? (A)
35. Define power of a lens. (U)
36. Write the relation between power and focal length of a lens. (K)
37. Two lenses one converging and other diverging lens each of focal length f are placed in contact. What is the power of the combination? (U)
38. Three lenses of powers +1D, -1D & +2D are kept in contact. What is the effective power of the combination? (A)
39. Write the expression for the power of number of thin lenses in contact. (K)
40. Define linear magnification of a lens. (U)
41. Write the expression for linear magnification of a lens in terms of object distance and image distance. (U)
42. An object is kept at a distance of 10cm from a lens whose magnification is 1.5. At what distance from the lens image if formed? (A)
43. What is dispersion of light? (K)
44. State Rayleigh's law of scattering. (K)
45. Name the phenomenon involved in the formation of rainbow in the sky. (K)
46. How does the sky appear when viewed (What would be the colour of sky) in the absence of atmosphere? (U)
47. What is accommodation of eye? (U)
48. Define least distance of distinct vision? (U)
49. For normal vision what is the value of least distance of distinct vision? (K)
50. How to rectify myopia or near sightedness? (K)
51. How to correct hyper metropia or far sightedness? (K)
52. How to correct astigmatism defect in eye? (K)
53. Mention any one quality of a good refracting telescope. (K)
54. Define resolving power of an optical instrument. (U)
55. Where do we find the world's largest objective lens refracting type telescope? (K)
56. The largest telescope of India is situated in which place? (K)

Two mark questions

1. Write mirror equation and explain the terms. (K)
2. State the laws of reflection (K)
3. State the laws of refraction. (K)
4. Draw the ray diagram for Lateral shift of a ray refracted through a parallel-sided glass slab. (S)
5. If a glass rod is put in a beaker containing a colorless liquid, the rod immediately seems to disappear. What is the reason for this? Explain. (U)

6. A parallel sided slab is introduced in the path of converging beam of light. What will happen to the point of convergence and why? (U)
7. A properly cut diamond sparkles but a similarly cut glass does not sparkle. Give Reason. (U)
8. Explain the phenomenon of total internal reflection. (U)
9. Mention the conditions for total internal reflection to occur. (K)
10. With the help of a diagram show how to bend rays of light by 90^0 using total internal reflecting prisms. (S)
11. Represent with a diagram how to invert the image without changing its size using total internal reflecting prism. (S)
12. Draw a diagram to represent the bending of light rays by 180^0 using total internal reflecting prism. (S)
13. Why does the surface of an air bubble inside water or glass shine when light falls on it? (U)
14. A man is standing very near a swimming pool looks at a stone lying at the bottom. The depth of pool is 'd'. At what distance from the surface of water (R.I. = n) is the image of the stone formed? (U)
15. Mention any two uses of optical fibres.(K)
16. Why sunglasses have zero power even though their surfaces are curved? (U)
17. Name any two factors affecting focal length of a lens. (K)
18. Can convergent lens in one medium behave as a divergent lens in another medium? Explain. (U)
19. Write lens maker's formula and explain the terms. (K)
20. Define power of a lens. Mention the expression for it. (U)
21. What is the SI unit of power? Define the SI unit of power of a lens. (U)
22. Define linear magnification and give the expression for linear magnification produced by a thin lens in terms of object distance and image distance. (U)
23. Draw a neat labeled ray diagram representing the dispersion of white light by a prism. (S)
24. Draw a neat labeled ray diagram for the refraction of monochromatic light by a prism. (S)
25. Represent graphically the variation of angle of deviation with angle of incidence in case of a triangular prism. (S)
26. Draw a Schematic diagram of Newton's classic experiment on dispersion of white light through two prisms. (S)
27. A ray of composite light passes through a prism. Which colour is (a) most deviated and (b) least deviated? (U)
28. Write the expression for the refractive index of the material of the prism in terms of the angle of the prism and the angle of minimum deviation, and explain the terms. (U)
29. Which colour of light has maximum speed in (i) free space (ii) glass? (U)
30. According to Rayleigh scattering for which colour, intensity, is (a) highest and (b) least? (U)
31. Why does sun appear red at dawn and dusk? (U)
32. Why does sky appear blue? Explain. (U)
33. Why sea appears blue? Explain. (U)
34. What is hyper metropia? How can it be corrected? (K)
35. What is myopia? How can it be corrected? (K)
36. What is Astigmatism? How can it be corrected? (K)

37. Explain how rainbow is formed in nature. (U)
38. What are the conditions for the formation of a rainbow? (K)
39. Draw the ray diagram for the formation of primary rainbow. (S)
40. Draw the ray diagram for the formation of secondary rainbow. (S)
41. Give two differences between primary rainbow and secondary rainbow. (U)
42. Draw a neat labeled ray diagram for the image formation by a simple microscope. (S)
43. Mention the expression for the magnifying power of a simple microscope when the image is formed at near point, and explain the terms. (K)
44. Mention two optical instruments in which a system of combination of lenses is used? (K)
45. Give the expression for (a) tube length and (b) magnifying power of the refracting telescope.(K)
46. Draw a neat labeled ray diagram of an astronomical (reflecting) telescope. (S)
47. Give any two advantages of reflecting telescope over refracting telescope. (U)
48. Find the refractive index of a medium which has a critical angle of 45^{o}. (A) [Ans.: n=$\sqrt{2}$]
49. If the focal length of a glass lens = 20 cm, find the power of the lens? (A) [Ans.: 5 D]
50. A concave mirror of focal length 1 cm produces a real image 10 times the size of the object. What is the distance of the object from the mirror? (A) [Ans.: 1.1cm]

Three mark questions

1. Explain the Cartesian sign conventions used for measuring the distances in case of spherical surfaces. (K)

2. Obtain the relation between focal length (f) and radius of curvature(R) of a mirror
OR show that f = R/2 for a mirror. (U)

3. Define critical angle and write the two conditions for total internal reflection to occur. (U)

4. Obtain the relation between refractive index and critical angle for a medium. (U)

5. Mention three illustrations of total internal reflection. (K)

6. Describe the demonstration of the phenomena of total internal reflection of light using a glass beaker. (U)

7. With the help of ray diagram write the significance of Newton's classic experiment on dispersion of white light. (S)

8. Explain why sky is blue in colour. (U)

9. Why sun appears red at rise and set? Explain. (U)

10. Briefly explain the formation of mirage with a schematic diagram. (S)

11. Explain the function of human eye when light incident on it. (U)

12. Which are the common defects of human eye, how to rectify them? (K)

13. Obtain the expression for linear magnification of a simple microscope. (U)

14. Derive the expression for the angular magnification of a simple microscope. (U)

15. Deduce the expression for magnification of a compound microscope. (U)

16. Write any three distinguishing properties between refracting and reflecting type telescopes. (U)

17. What is a thin prism? Write the expression for the deviation produced by a thin prism. Explain the symbols.(K)

Five mark questions

1. Derive the mirror equation in the case of real and inverted image formed by a concave mirror. (U)
2. Derive the relation between object distance (u) and image distance (v) in terms of refractive index of the medium (n) and the radius of curvature(R) of the spherical surface.
   OR Obtain the relation between u, v, R and n for spherical surface. (U)
3. Briefly explain the principle, construction and working of optical fibres. (U)
4. Derive Lens maker's formula for a double convex lens. (U)
5. Obtain the expression for the refractive index of the material of the prism in terms of the angle of the prism and the angle of minimum deviation. (U)
6. Define focal length of a lens. Derive the expression for equivalent focal length of combination of two thin convex lenses in contact. (U)
7. Which phenomenon is responsible for the formation of rainbow? Explain in detail the formation of rainbow. (U)
8. With neat labeled ray diagram of a simple microscope for the image formation, briefly explain its working and write the expression for its magnification when the image is at near point. (S)(U)
9. With neat labeled ray diagram of a compound microscope explain briefly its working and mention the expression for its magnification when the final image is formed at (i) near point and (ii) at infinity. (S)(U)

NUMERICAL PROBLEMS

1. A candle is held 6 cm away from a concave mirror of radius of curvature 24cm. Where does the image formed? What is the nature of the image?(A) **[v=12cm virtual and magnified erect image]**
2. An object is placed at a distance of 40cm. from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, by how much distance is the image displaced? (A) **[v'= – 60cm]**
3. A car has a convex mirror as its side mirror of focal length 30 cm. A second car is 5m behind the first car. Find the position of the second car as seen in the mirror of first car. (A) **[0.28m]**
4. A ball is approaching a convex mirror of focal length 30 cm with speed 20 m/s. Calculate the speed of its image when the ball was at 5 m from the mirror? (A) **[0.064 m s^{-1}]**
5. A convex lens has a focal length of 0.3 m in air. Calculate its focal length when it is immersed in water. Given that refractive index of water = 4/3 and refractive index of glass = 3/2. (A) **[1.2m]**
6. A small bulb is placed at the bottom of a tank containing water to a depth of 60 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.) (A) **[1.47m^2]**
7. A transparent cube of side 15 cm contains an air bubble in it. When viewed normally through one face, the bubble appears to be at 6 cm from the surface. When viewed normally through the opposite face the distance appears to be 4 cm. Find the actual distance of the bubble from the second face and the refractive index of the material of the cube. (A) **[6 cm, n = 1.5]**
8. Find the refractive index of the material of a prism of angle 59^o 42', if the angle of minimum deviation produced for a particular colour of light is 39^o 28'. Also find angle of incidence. (A) **[n=1.53 and i =49^o 35']**

9. Find the angle of minimum deviation produced by an equilateral prism of refractive index 1.55. Also find the angle of minimum deviation when the prism is completely immersed in water (n=1.33). (A)

[$D_m = 41^0 36'$ and $D_m' = 11^0 16'$]

10. A ray light is incident on one face of an equilateral prism of glass of refractive index 1.55 at an angle of 40^o. Calculate the angle of deviation produced by the prism. For what other angle of incidence, the deviation will be the same? (A) **[$44^o 16'$]**

11. A convex lens of focal length 0.24 m and of refractive index 1.5 is completely immersed in water of refractive index 1.33. Find the change in focal length of the lens (A) [**0.70 m]**

12. A convex lens of focal length 0.25 m is kept in contact with a concave lens of focal length 0.15m. Calculate the focal length and power of the combination.(A) **[–0.375m and – 2.667 diopter]**

13. An image of height 2cm is formed by a convex lens when an object of height 8cm is placed at a distance of 80cm from it. Find the focal length and power of the lens. (A)

[f = 16 cm=0.16m and P = 6.25D]

14. A compound microscope has objective lens and eye–piece of focal lengths 5cm and 8 cm respectively. If an object is placed at a distance of 8 cm from the objective, then find the magnification produced by the microscope when the final image at near point**. (A) [-6.88]**

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CHAPTER- 10
WAVE OPTICS

One mark questions

1. Who gave the corpuscular model for light before Newton? (K)
2. What was the drawback of corpuscular theory of light? (K)
3. Who proposed wave theory of light? (K)
4. Who proved experimentally that the speed of light in denser medium is less than in rarer medium? (K)
5. Which model of light predicted that the speed of light in denser medium is less than in rarer medium? (K)
6. Why wave theory of light was not readily accepted in the beginning? (U)
7. Who experimentally proved the wave nature of light? (K)
8. Which experiment proved the wave theory of light? (K)
9. Who proposed electromagnetic theory of light? (K)
10. What is the nature of light waves according to Maxwell's electromagnetic theory of light? (K)
11. Define a wave front. (U)
12. What is the shape of a wave front obtained from a point source? (K)
13. Which type of wave front is obtained by a point source at a very large distance? (K)
14. To get a cylindrical wave front what should be the shape of the light source? (K)
15. What is the shape of the wave front obtained from a distant star? (K)
16. Which type of wave front is obtained when a plane wave is reflected by a concave mirror? (K)
17. State Huygens' Principle. (K)
18. Name the physicist who experimentally studied the interference of light for the first time. (K)
19. State the principle of superposition of waves. (U)
20. *What is* interference of light? (K)
21. What is constructive interference of light? (U)
22. What is destructive interference of light? (U)
23. Define fringe width of interference pattern in Young's double slit experiment. (U)
24. Write the expression for fringe width of interference pattern in Young's double slit experiment.(K)
25. What is the effect on the interference fringes in Young's double-slit experiment when the monochromatic source is replaced by a source of white light? (U)
26. How does the fringe width of interference pattern vary with the wavelength of incident light? (K)
27. How does the fringe width of interference pattern vary with the intensity of incident light? (K)
28. Draw the graph of the intensity distribution of light in Young's double-slit experiment. (S)
29. Instead of using two slits as in Young's experiment, if two separate but identical sodium lamps are used, what is the result on interference pattern? (U)
30. Does longitudinal wave exhibit the phenomenon of interference? (K)
31. If Young's double slit experiment is performed in water, what will be the effect on the fringe width? (U)
32. In which direction the energy of the light wave travels with respect to the wave front? (K)

33. Do the backward moving wave fronts exist in Huygens wave model for light? (K)

34. Young's double slit experiment is performed using red light. If red light is replaced by blue light, what is the effect on the fringe width of interference pattern? (K)

35. What happens to the fringe width of interference pattern when the distance of separation between two slits is doubled in Young's experiment? (U)

36. The distance between the slits and the screen in Young's double slit experiment is doubled. What happens to the fringe width? (U)

37. Let the fringe width in Young's double slit experiment be β. What is the fringe width if the distance between the slits and the screen is doubled and slit separation is halved?(U)

38. *What is the intensity of light due to constructive interference in Young's double slit experiment if the intensity of light emerging from each slit is I_o? (U)*

39. In a single slit diffraction experiment if the width of the slit is doubled what happens to the width of the central diffraction band? (U)

40. Name a phenomenon which confirms the wave nature of light. (K)

41. What is diffraction of light? (K)

42. Which colour of light undergoes diffraction to the maximum extent? (U)

43. How will the diffraction pattern due to a single slit change if violet light replaces green light? (U)

44. Do all types of waves exhibit diffraction or only light waves? (K)

45. What happens to the resolving power of an optical instrument when the wavelength of light used is increased? (U)

46. Define the resolving power of an optical instrument. (U)

47. Write the expression for limit of resolution of telescope. (K)

48. How can resolving power of telescope be increased? (U)

49. Name a factor which affects the resolving power of a microscope. (K)

50. Mention the expression for limit of resolution of microscope. (K)

51. Express Doppler shift in terms of wavelength of light used. (K)

52. Write the formula for the Doppler shift in terms of frequency of light used. (K)

53. Give one application of the study of Doppler effect in light. (U)

54. Which phenomenon confirms the transverse wave nature of light? (K)

55. What is polarization of light? (K)

56. What is pass axis of the Polaroid? (K)

57. By what percentage the intensity of light decreases when an ordinary unpolarised (like from sodium lamp) light is passed through a Polaroid sheet? (K)

58. The intensity of incident light on a Polaroid P_1 is I. What is the intensity of light crossing another Polaroid P_2 *when* the pass-axis of P_2 makes an angle 90^o with the pass-axis of P_1? (U)

59. What should be the angle between the pass axes of two Polaroids to get the maximum intensity of transmitted light form the second Polaroid? (U)

60. State Brewster's Law. (K)

61. Define Brewster's angle (OR polarising angle). (U)

62. Write the relation between refractive index of a medium (reflector) and polarising angle. (K)

63. The intensity of light incident on a polariser is I and that of the light emerging from it is also I. Is the incident light polarised or unpolarised? (U)

64. A ray of light is incident at polarising angle on a glass plate. What is the angle between the reflected ray and refracted ray? (U)

65. What is partially polarised light? (K)

66. When can we have total transmission of light through a prism? (K)

67. Does the polarising angle depend on the refractive index of that medium? (K)

Two mark questions

1. Name the two theories of light in support of its wave nature. (K)
2. What are coherent sources? Give an example. (K)
3. Can two sodium vapour lamps be considered as coherent sources? Justify your answer. (U)
4. Which of the two, red and yellow produces wider interference fringes? Why? (U)
5. Name any two factors affecting fringe width of interference pattern in Young's double slit experiment. (K)
6. Is it possible to conclude that light is either transverse or longitudinal wave from interference phenomenon? Justify your answer. (U)
7. Write the conditions for constructive and destructive interference in terms of path difference of interfering waves. (U)
8. Mention the conditions for constructive interference in terms of path difference and phase difference. (U)
9. Write the conditions for constructive and destructive interference in terms of phase difference of interfering waves. (U)
10. Mention the conditions for destructive interference in terms of path difference and phase difference of interfering waves. (U)
11. We do not encounter diffraction effects of light in everyday observations. Explain why? (U)
12. Why diffraction effects due to sound waves are more noticeable than due to light waves? (U)
13. Explain how the principle of conservation of energy is consistent with interference and diffraction phenomena of light. (U)
14. Mention the conditions for diffraction minima and maxima in diffraction due to single slit. (K)
15. Represent graphically the variation of intensity of light due to diffraction at single slit. (S)
16. Give any two methods of increasing the resolving power of a microscope. (K)
17. What is Fresnel distance? Write its expression. (K)
18. What is red shift? What is its significance? (U)
19. What is blue shift? When does it occur? (U)
20. Write the mathematical expression for Malus law and explain the terms. (K)
21. Diagrammatically represent polarised light and unpolarised light. (S)
22. Mention any two methods of producing plane polarised light. (K)
23. Write any two uses of Polaroids. (K)
24. An unpolarised light is incident on a plane glass surface. Find the angle of incidence so that the reflected and refracted rays are perpendicular to each other? (For glass n = 1.5). (A)

    OR Give the value of Brewster angle for air to glass transmission of light if the refractive index of glass is 1.5. (A) [Ans.: $56^{o}18'$]
25. The polarising angle for a medium is 52^{0}. Find its critical angle? (A) [Ans.: 51.4^{o}]

26. Brewster's angle for a certain medium is 52^{o}. Find the refractive index of the medium? (A) [Ans.: n = 1.48]
27. The refractive index of certain glass is 1.5 for light whose wavelength in vacuum is 600nm. Find the wavelength of this light in glass? (A) [Ans.: 400nm]

Three mark questions

1. Who solved the major drawback of Huygens's wave theory? Explain how it was solved. (U)
2. Using Huygens wave theory of light, show that the angle of incidence is equal to angle of reflection in case of reflection of a plane wave by a plane surface. (U)
3. Using Huygens principle show that the frequency of light wave remains the same when light travels from one optical medium to another. (U)
4. Draw diagram representing refraction of a plane wave incident on a rarer medium from a denser medium, and explain critical angle and total internal reflection. (S) (U)
5. Illustrate with the help of suitable diagram, the refraction of a plane wave by (i) a thin prism (ii) a convex lens and reflection by a concave mirror. (S)
6. What is Doppler's effect in light? Write the formula for the Doppler shift. Where it is used? (U)
7. Briefly describe Young's double slit experiment with the help of a schematic diagram. (U) (S)
8. Give the theory of interference of light. (U)
9. Arrive at the condition for constructive and destructive interference in terms of phase difference between the two waves. (U)
10. What is the effect on (i) the angular fringe width (ii) the linear fringe width in Young's double-slit experiment due to each of the following operations:
(a) The screen is moved away from the plane of the slits
(b) One monochromatic source is replaced by another monochromatic source of shorter wavelength and
(c) The separation between the two slits is increased? (U)
11. Why interference pattern cannot be seen when pin hole of young's double slit experiment is illuminated by two identical but separate sodium sources? Explain (U)
12. How to get two coherent sources of light? Why they are said to be coherent? (U)
13. Compare the interference pattern of light obtained by young's double slit experiment with diffraction pattern due to single slit. (U)
14. Obtain the expression for limit of resolution of microscope. (U)
15. Briefly explain Polarization by reflection with the help of a diagram. (U) (S)
16. With the help of a diagram explain how polarised sun light is produced by scattering. (U) (S)
17. Show that the refractive index of a reflector is equal to tangent of the polarising angle.
OR show that $n = \tan i_B$ *OR* Arrive at Brewster's law. (U)
18. What are Polaroids? Mention any two uses of Polaroids. (K)

Five mark questions

1. Using Huygens's wave theory of light, derive Snell's law of refraction. (U)
2. Obtain the expressions for resultant displacement and amplitude when two light waves having same amplitude and a phase difference ϕ superpose. Hence give the conditions for constructive and destructive interference in terms of path difference/phase difference.

   OR

   Give the theory of interference. Hence arrive at the conditions for constructive and destructive interferences in terms of path difference/phase difference. (U)
3. Derive the expression for the width of interference fringes in Young's double slit experiment. (U)
4. Explain the phenomenon of diffraction of light due to a single slit and mention the conditions for diffraction minima and maxima. (U)
5. State Brewster's law and arrive at it. (U)

NUMERICAL PROBLEMS

1. Light is incident on a glass plate at an angle of 60^o. The reflected and refracted rays are mutually perpendicular to each other. Calculate the refractive index of the material of the plate? (A)

   [**n = 1.732]**
2. In a Young's double-slit experiment, the slits are separated by 2.8 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 mm. Determine the wavelength of light used in the experiment. Also find the distance of fifth dark fringe from the central bright fringe. (A) [**600nm and 1.35mm]**
3. A beam of unpolarised is incident on an arrangement of two Polaroids successively. If the angle between the pass axes of the two Polaroids is 60^0, then what percentage of light intensity emerges out of the second Polaroid sheet? (A) **[12.5%]**
4. An optical instrument resolves two points at a distance from it using light of wavelengths 450nm and 600nm, find the ratio of their respective resolving powers.(A) **[4:3]**
5. A monochromatic light of wavelength 700 nm is incident on a 3.5 mm wide aperture. Find the distance up to which the ray of light can travel so that its spread is less than the size of the aperture. (A) **[17.5 m]**
6. Assume that light of wavelength 5000Å is coming from a star. What is the limit of resolution and resolving power of a telescope whose objective has a diameter of 200 inch? (A)

   [**1.2×10^{-7} rad and 0.83×10^{7}]**
7. In Young's double slit experiment the two slits are 0.3 mm apart and are illuminated by a light of wavelength 650 nm. Calculate the distance of (i) the 3rd dark and (ii) 5th bright fringes from the mid-point in the interference pattern obtained on a screen 1.2 m away from the slits. (A)

   ` **[(i) 6.5mm (ii) 13 mm]**
8. 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 0.1m, fringe width increases by 6×10^{-5} m. The separation between the slits is 1 mm. Calculate the wavelength of the light used. (A) **[600nm]**

9. In Young's double slit experiment, distances between 2nd and 10th bright fringes for a light of wavelength 486nm is same as that of the distance between 3rd and 9th bright fringes for the light of different wavelength is used. Find the wavelength of light. (A) [**648nm]**

10. In Young's double slit experiment with monochromatic light and slit separation of 1.2mm, the fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5cm towards the slits, the change in fringe width is 20 μm. Calculate the wavelength of the light used. (A) **[480 nm]**

11. A parallel beam of light of wavelength 625 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 80 cm away. It is observed that the first minimum is at a distance of 2.5 mm from the center of the screen. Find the (i) width of the slit (ii) angular width of central maximum.(iii) linear width of central maximum.(A) **[(i) 0.2 mm (ii)0.00625 rad (iii) 5mm]**

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CHAPTER-11

DUAL NATURE OF RADIATION AND MATTER

One mark questions

1. Who discovered cathode rays? (K)
2. Name the scientist who has confirmed cathode ray hypothesis of William Crookes. (K)
3. Which observation with respect to cathode ray particles suggested universality of cathode rays? (K)
4. Who named cathode ray particles as electrons? (K)
5. Who suggested that the electrons are fundamental constituents of matter? (K)
6. Who experimentally proved that the electric charge is quantized? (K)
7. The determination and measurement of the value of elementary charge credit goes to which experimental work? (K)
8. Define work function of a photo sensitive material. (U)
9. Define electron volt. (U)
10. What is thermionic emission? (K)
11. What is field emission? (K)
12. Why metals are preferred for electron emission? (U)
13. Who discovered the phenomenon of photo electric emission? (K)
14. What is photo-electric emission? (K)
15. What are photo electrons? (K)
16. What is photo electric effect? (K)
17. Name the phenomenon which illustrates the particle nature of light. (K)
18. Can radiation of any frequency be used for electron emission from a metal surface? (K)
19. How photo current depends on intensity of incident radiation? (K)
20. Represent graphically the variation of photoelectric current with intensity of incident light. (S)
21. Do stopping potential depends on the intensity of incident radiation? (K)
22. Define threshold frequency for a photo sensitive metal. (U)
23. What is the effect of intensity of incident radiation on kinetic energy of photoelectrons? (K)
24. Why threshold frequency is different for different metals? (U)
25. In an experiment of photo electric effect a graph of kinetic energy of photoelectrons with frequency of incident light is plotted. What does the slope of the curve indicate? (U)
26. What is meant by saturation current in photo electric emission? (U)
27. In an experiment of photo electric effect the kinetic energy of photo electrons is found to be 2 eV. for certain intensity of incident light. If the intensity of incident light is doubled what will be the kinetic energy of photo electrons? (A)
28. How does the velocity of photo electrons emitted vary with frequency of incident light on a photo cathode? (U)
29. What is the significance of stopping potential of a photo sensitive material? (U)
30. How does the stopping potential vary with frequency of incident radiation? (U)

31. Name the theory which explains the phenomenon of photo electric emission. (K)
32. Which physical constant can be determined from the slope of the graph of maximum kinetic energy of photo electrons with the frequency of incident radiation? (U)
33. What is the charge on photons? (K)
34. Are photons deflected by electric and magnetic fields? (K)
35. Material particle collides with photons, do the momentum is conserved? (K)
36. In a collision between photon and particle, is energy conserved? (K)
37. Do the photon number is conserved in the process of collision between the particle and photon? (K)
38. Who postulated the dual nature of matter? (K)
39. What are matter waves? OR what are de Broglie waves? (K)
40. State de-Broglie hypothesis of matter waves. (K)
41. Define de-Broglie wavelength. (U)
42. How does the de-Broglie wavelength of an electron depend on its velocity? (U)
43. A particle accelerates under the influence of an electric field. What happens to its de-Broglie wavelength? (U)
44. Write the expression for the de-Broglie wavelength of an electron accelerated through a potential difference of V volts? (K)
45. Who discovered the wave nature of electron? (K)
46. Name the experiment which confirms the wave nature of material particle. (K)
47. State Heisenberg's uncertainty principle. (K)
48. Write the mathematical equation representing Heisenberg's uncertainty principle. (K)
49. What was the outcome of Davisson and Germer experiment? (K)
50. Mention one application of wave property of electrons. (K)
51. Mention one advantage of using the electron microscope over the optical microscope. (U)

Two mark questions

1. Mention the two discoveries which are the milestones in understanding atomic structure. (K)
2. Explain how cathode rays were discovered by William Crooke. (U)
3. What was the inference of Millikan's oil drop experiment? (U)
4. Name any two types of electron emission. (K)
5. Mention two factors on which the photo electric work function of a metal depends? (K)
6. Mention the Hertz's observations on photo electric effect. (U)
7. Why Alkali metals are photo sensitive even to visible light? (U)
8. Define "Stopping potential". How does it depend on the frequency of incident radiation? (U)
9. Graphically show the variation of photo electric current with intensity of incident light. (S)
10. Show graphically, the variation of photo current with stopping potential for different frequencies but same intensity of incident radiation. (S)
11. Represent graphically the variation of photo current with collector plate potential for different intensity of incident radiation. (S)
12. Draw the graph representing the variation of stopping potential with frequency of incident radiation for a given photo sensitive material. (S)

13. What was the picture given by Einstein about electromagnetic radiation to explain photo electric effect? (U)
14. Write Einstein's photo electric equation and explain the terms. (K)
15. Mention the expression for de-Broglie wavelength of matter waves and explain the terms.(K)
16. Mention the expression for de-Broglie wavelength of photon and explain the terms. (K)
17. Mention the expression for de- Broglie wavelength of a material particle in terms of kinetic energy and explain the terms. (K)
18. A proton and an α-particle are accelerated by the same potential difference. Compare their de-Broglie wavelength. (U)
19. Find the de-Broglie wavelength of an electron having a kinetic energy of 500eV. (A)
20. Are matter waves electromagnetic in nature? Justify your answer. (U)
21. Why de-Broglie wavelength associated with macroscopic particles cannot be detected? Explain. (U)
22. Calculate the de-Broglie wavelength of a particle of mass 0.05 kg moving with a speed of $100ms^{-1}$. (A)
23. What is Born's probability interpretation of matter waves? (U)

Three mark questions

1. Who discovered the phenomena of photo electric emission? Explain how he discovered this phenomenon? (K)
2. Explain briefly Hallwach's experimental observations on photo-electric effect. (K)
3. Explain briefly the Lenard's experimental observations on photo electric effect. (K)
4. Describe the experiment to study the photo electric effect. (K)
5. Define the terms
   (i) Threshold frequency **(ii)** Threshold wavelength **(iii)** Stopping potential, with reference to photo electric effect. (U)
6. Explain why wave theory of light failed to explain photoelectric effect observations. (U)
7. Write three observed features of photoelectric effect which cannot be explained by wave theory of light. (U)
8. State de-Broglie's hypothesis of matter waves. What was the reason for stating this hypothesis? (U)
9. Show that the wavelength of photon $\lambda = \frac{h}{p}$ where h=Planck's constant and p=momentum of photon. (U)
10. Obtain the expression for de-Broglie wavelength in terms of accelerating potential. (U)
11. Derive the expression for de-Broglie wavelength in terms of kinetic energy of electrons. (U)
12. Describe Davisson and Germer experiment to establish the existence of wave nature of electron. (U)
13. Write the applications of de-Broglie's hypothesis of matter waves. (K)

Five mark questions

1. What were the observations of Hallwach's and Lenard's about photo electric emission? (K)
2. Describe the experiment to study photo electric effect with a neat labeled diagram. (U) (S)
3. Write the experimental observations of photo electric effect. (U)

4. Give Einstein's explanation for photo electric effect experimental observations. (U)
5. Give the photon picture of electromagnetic radiation. (U)
6. Mention five characteristic properties of photon. (K)
7. Describe Davisson and Germer electron diffraction arrangement with a neat labeled diagram. (U) (S)

Numerical problems

1. Calculate the number of photons emitted per second by a 25W source of monochromatic light of wavelength 600nm. (A) **[$7.546X10^{19}$]**

2. The threshold wavelength of a photo sensitive metal is 275 nm. Calculate the maximum velocity of the photo electrons ejected when light of 180nm incident on it. (A) **[$9.1X10^{5} ms^{-1}$]**
3. Lithium has work function of 2.3eV. It is exposed to light of wavelength $4.8X10^{-7}$m. Find the maximum kinetic energy with which electron leaves the surface. Also calculate the longest wavelength which can produce the photoelectrons. (A)
4. The threshold frequency is of a photosensitive metal is $0.5X10^{15}$Hz, Calculate the photoelectric work function of the metal. If a photon of frequency 0.75×10^{15}Hz incident on this metal surface, find the maximum kinetic energy (in eV) of photoelectrons emitted. (A)
   [W = 2.072eV, $K.E_{max}$ = 1.036eV]
5. The photo electric threshold for a metal surface is 600nm. Calculate the maximum kinetic energy (in eV) of the photoelectrons emitted for radiation of wavelength 400nm. (A) **[$(K.E)_{max}$ = 1.04eV)**
6. The work function of cesium is 2.14eV. Find (a) the threshold frequency for cesium and (b) the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential of 0.60V. (A) **[$\gamma_0 = 5.16 \times 10^{14}$ Hz, λ = 454nm]**

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CHAPTER:12

ATOMS

One mark questions

1) Who proposed the first atom model? (K)
2) What is the name of the atom model given by J.J.Thomson? (K)
3) Is an atom electrically neutral? (K)
4) What are the constituents of an atom according to J.J.Thomson? (K)
5) Name the model of atom given by Rutherford. (K)
6) In Geiger-Marsden experiment which element is used as a source of α-particles? (K)
7) Who was first credited to discover the nucleus? (K)
8) What is the magnitude of charge on α-particle? (K)
9) In α-particle scattering experiment, which implication has led Rutherford to conclude that the mass of the atom is concentrated in a small volume? (K)
10) Which experiment determines the upper limit to the size of the nucleus? (K)
11) Name the experiment responsible for the discovery of atomic nucleus. (K)
12) How do we define angle of scattering in α-particle scattering experiment? (U)
13) Who discovered the nucleus of an atom? (K)
14) What was Balmer's contribution for the study of hydrogen spectrum? (K)
15) Define the term 'impact parameter in α-particle scattering experiment. (U)
16) Name the series of hydrogen spectrum which has least wavelength. (K)
17) Name the series of hydrogen spectrum that lies in UV region.
18) To which part of the electromagnetic spectrum does Lyman series belong? (K)
19) Name the series of hydrogen spectrum which lies in the visible region. (K)
20) To which part of the electromagnetic spectrum does Balmer series belong? (K)
21) To which part of the electromagnetic spectrum does Paschen series belong? (K)
22) An electron transits from 5th orbit to 3rd orbit in hydrogen atom, Name the region of the spectral line to which it belongs. (U)
23) What is meant by the series limit of a spectral series? (K)
24) Which force provides the centripetal force required for the electron to go round the nucleus in uniform circular motion in Bohr atom? (K)
25) What does a stationary orbit mean according to Bohr in his atom model? (K)
26) Does an electron revolving round a nucleus in a Bohr atom radiate energy? (K)
27) Write Bohr's quantisation rule. (K)
28) When does an atom radiate energy according to Bohr's theory? (K)
29) How does the radius of the Bohr orbit vary with its principal quantum number? (K)
30) Are the electron orbits in hydrogen atom equally spaced? (K)
31) How does the energy of an electron vary with its principal quantum number? (U)
32) What is the significance of the negative sign in the expression of energy of an electron? (U)

33) What type of emission spectra is given by atoms? (K)
34) What is line emission spectrum? (K)
35) What is absorption spectrum? (K)
36) How absorption spectrum is obtained? (K)
37) What causes a line spectrum? (K)
38) Name a source of line emission spectrum. (K)
39) What kind of spectrum is obtained when substances are excited in their atomic state? (K)
40) What information do we get by the study of line spectrum? (K)
41) How is the wave number of a spectral line related to its wavelength? (U)
42) What is the value of Rydberg's constant? (K)
43) What is meant by the energy level diagram for an atom? (U)
44) In Bohr's atomic model which energy level corresponds to the minimum energy? (K)
45) What is ionization energy? (K)
46) What is excitation energy? (K)

Two mark questions

1. Who proposed plum pudding model for atom? Describe the arrangement of constituents of atom in it. (K)
2. Who discovered electron? And which experiment has led to its discovery? (K)
3. Who proposed planetary model of atom? Explain how the constituents of atom are arranged according to this model. (K)
4. Mention the two draw backs of Rutherford's atom model. (K)
5. Show graphically the variation of number of α-particle scattered with the scattering angle for a given energy of α-particle. (S)
6. Draw a schematic diagram of Geiger-Marsden α-particle scattering experiment. (S)
7. When the impact parameter is said to be (a) maximum? & (b) minimum? (K)
8. Give the names of first two members of the Balmer series. (K)
9. Calculate the wavelength of H_α-line using Balmer formula. Given Rydberg constant= $1.097X10^7 m^{-1}$. **(A)**
10. Write Balmer formula for the wavelengths of spectral series of hydrogen atom and explain the terms. (K)
11. How do we get series limit using Balmer formula? Write the value of the shortest wavelength in the Balmer series. (K)
12. Write the empirical formula for wave number of first two spectral series. (K)
13. Write Bohr's frequency condition and explain the terms. (K)
14. What is 'Bohr radius'? Write its formula.(K)
15. Write the expression for Rydberg's constant and explain the terms. (K)
16. Write the formula for the energy of electron in n^{th} Bohr orbit of hydrogen atom in electron volt and write the value for the third orbit. (U)

Three mark questions

1. What are the experimental observations of Geiger-Marsden's scattering experiment? (K)
2. Explain briefly the conclusions of Rutherford α-particle scattering experiment. (U)

3. Draw the trajectories traced by different alpha particles in Geiger-Marsden experiment. (S)
4. Define impact parameter in α-scattering experiment. How does the scattering angle depends on impact parameter and what is the conclusion drawn by Rutherford by analyzing this? (U)
5. State the basic assumptions of the Rutherford nuclear model of an atom. (K)
6. Name the first three spectral series of hydrogen atom. (K)
7. State the postulates of Bohr's theory of hydrogen atom. (K)
8. Sketch the energy level diagram of hydrogen atom. (S)
9. Obtain the Bohr's quantisation condition on the basis of de-Broglie's theory (wave picture of an electron). (U)
10. Mention any three limitations of Bohr's atom model. (K)

Five mark questions

1. Explain with a schematic diagram, Geiger-Marsden experiment of α-particle scattering. (U)
2. Derive the expression for the total energy of an electron in a hydrogen atom on the basis of Rutherford's atom model.(U)
3. Explain spectral series of hydrogen atom. (U)
4. Derive the expression for the radius of n^{th} stationary orbit of hydrogen atom using Bohr's postulates. (U)
5. Derive the expression for the total energy of an electron in n^{th} stationary orbit of hydrogen atom by assuming the expression for orbit radius. (U)
6. Derive the expression for the frequency of radiation in hydrogen spectrum assuming the expression for energy of electron in a stationary orbit. (U)

Numerical problems.

1. The wavelength of the first member of the Balmer series in the hydrogen spectrum is 656.3nm. Calculate the wavelength of the first member of the Lyman series in the same spectrum. (A) **[121.54 nm]**
2. The energy of an excited hydrogen atom is -3.4eV. Calculate the angular momentum of the electron according to Bohr's theory.(A) **[$2.11X10^{-34}$Js]**
3. A doubly ionized lithium atom has atomic number 3. Find the wavelength of the radiation required to excite the electron in Li^{+2} from the first to the third Bohr orbit. Assume that the ionization energy is 13.6eV. (A) **[113.74 A^0]**
4. A stationary He^+ emitted a photon corresponding to the first line of Lyman series. This photon liberated a photo electron from a stationary hydrogen atom in the ground state. Find the velocity of the photo electron. (A) **[$3.1X10^6 ms^{-1}$]**
5. A hydrogen atom rises from its n=1 state to the n=4 state by absorbing energy. If the potential energy of the atom in n=1 state is -13.6 eV, calculate the potential energy in n=4 state and energy absorbed by the atom in the transition from n=1 to n=4 state. (A)
6. Calculate the de Broglie wavelength of a neutron moving with a kinetic energy 150 eV, and an electron accelerated by a voltage of 50KV. given mass of the neutron = $1.675X10^{-27}$Kg, and that of electron = $9.1X10^{-31}$ Kg. (A) **[$2.3X10^{-12}$ m, $5.5X10^{-12}$ m]**

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Chapter-13

NUCLEI

One mark questions

1) Define atomic mass unit (amu). (U)
2) Write the value of 1 atomic mass unit in kilogram. (K)
3) Name the instrument used to measure the atomic masses. (K)
4) How is the radius of the nucleus of an atom related to its mass number? (U)
5) What is the radius of a nucleus of mass number 216? (A)
6) What is the order of the magnitude of nuclear density? (K)
7) How does the nuclear density depend on the size of the nucleus? (U)
8) Is the nuclear density same for all the elements? (K)
9) Give an example for mass-energy conversion. (U)
10) Give an example showing the conversion of energy into mass. (U)
11) What happens when an electron and a positron collide? (U)
12) What is the energy equivalent to 1amu? (K)
13) Who discovered neutron? (K)
14) Do free neutrons are stable? (K)
15) Define mass number of nucleus? (K)
16) How many isotopes gold has? (K)
17) What are isobars? (K)
18) What are isotones? (K)
19) What is nuclear mass defect? (U)
20) Write the expression for mass defect in terms of masses of their nucleons. (K)
21) What is nuclear binding energy? (U)
22) Give the relation between binding energy and mass defect. (K)
23) What happens to the loss of mass involved in the formation of a nucleus? (U)
24) Mention the significance of binding energy per nucleon of a nucleus. (U)
25) What is binding energy curve? (K)
26) What are nuclear forces? (K)
27) Why nuclear forces are strongest of all the forces in nature? (U)
28) Why nuclear forces are called short range forces? (U)
29) Why nuclear forces are called exchange forces? (U)
30) Nuclear forces are non-central forces Explain? (U)
31) Nuclear forces are saturated forces why? (U)
32) Which property of nuclear forces is responsible for constancy of binding energy per nucleon? (K)
33) Name the phenomenon by which energy is produced in star. (K)

34) Why nuclear fusion reactions are called thermo nuclear reactions? (K)
35) Write any one equation representing nuclear fusion reaction. (K)
36) Why nuclear fusion reaction is not possible in the laboratory? (K)
37) What is radioactivity? (K)
38) Who discovered the phenomenon of radio activity? (K)
39) How many types of radioactive decay occur in nature? (K)
40) What is the cause for the radioactivity in lighter nuclei? (U)
41) How does the number of radioactive atoms vary with time? (K)
42) Show graphically the variation or number of radioactive atoms in the sample with time. (S)
43) Define activity of radioactive substance. (U)
44) Mention the SI unit of activity. (K)
45) Define becquerel. (U)
46) Mention the practical unit of activity. (K)
47) Define curie. (U)
48) Write the equivalence between curie and becquerel. (K)
49) How does the half-life of a radioactive sample depend on its decay constant? (U)
50) Define mean life of a radioactive substance. (U)
51) Write the relation between mean life and half-life of a radioactive nuclide. (K)
52) What is disintegration energy or Q-value of a nuclear reaction? (U)
53) In which type of β-decay antineutrino is emitted? (K)
54) Which is the particle emitted along with electron, when a neutron is converted into a proton in a nucleus? (K)
55) In which type of β-decay, the particle neutrino is emitted? (K)
56) In the following nuclear reaction identify the particle X. (U)

$$p \longrightarrow n + e^{+} + X$$

57) Two nuclei have mass numbers in the ratio 8:125. What is the ratio of their nuclear radii? (A)
58) What is nuclear fission? (K)
59) What is the principle of nuclear reactor? (K)
60) Define' multiplication factor' in a nuclear reactor? (U)
61) For what value of 'k' the multiplication factor the operation of the reactor is said to be critical? (K)
62) Which moderators are commonly used in nuclear reactors? (K)
63) Mention the disaster which occurred due to increase of multiplication factor in a nuclear reactor. (K)
64) How nuclear reaction rate is controlled in a nuclear reactor? (K)
65) What is the function of control rods in a nuclear reactor? (K)
66) What is nuclear fusion? (K)
67) What is the estimated age of the sun based on nuclear reactions? (K)

Two mark questions

1. What are isotopes? Give an example of it. (K)
2. Name the isotopes of hydrogen and write their masses. (K)
3. What are isobars? Give an example. (K)
4. What are isotones? Mention an example of it. (K)
5. Do free neutrons are stable in nature? Justify your answer. (U)
6. What is meant by binding energy per nucleon? Explain. (U)
7. Nuclear forces are strongest forces in nature why? (U)
8. What are neutrinos? In which process they are obtained? (K)
9. Write any two characteristics of neutrinos. (K)
10. Where does the decay of proton to neutron take place? And why? (U)
11. State and explain radioactive decay law. (K)
12. Mention any two types of radioactive decay in nature. (K)
13. What is γ-decay? When does this occur? (U)
14. What is the change in atomic numbers and mass number of a nucleus when it emits an α-particle? (A)
15. What is the change in atomic number and mass number of a nucleus during negative β-decay? (A)
16. What is the change in atomic number and mass number of a nucleus during positive β-decay? (A)
17. What happens to the atomic number and mass number of the nucleus during a γ-decay?(A)
18. ${}_{92}U^{238}$ emits an α-particle and two β-particles. Write the atomic number and mass number of the daughter nucleus. (A)
19. The radioactive isotope D decays according to the sequence $D \xrightarrow{\beta-decay} D_1 \xrightarrow{\alpha-decay} D_2$

    If the mass number and atomic number of D_2 are 176 and 71 respectively find mass number and atomic number of D. (A)
20. Give examples for controlled and uncontrolled nuclear fission reactions. (K)
21. What happens to the future of the sun when the hydrogen burning stops? (U)
22. Define the terms (i) mass defect and (ii) binding energy of a nucleus. (U)

Three mark questions

1. Name the three isotopes of hydrogen and write their masses. (K)
2. Explain how neutrons were discovered. (U)
3. Mention any three characteristics of a nucleus. (K)
4. How the size of the nucleus is experimentally determined? Explain. (U)
5. Show that the density of the nucleus is independent of its mass number. (U)
6. Write any three characteristics or nuclear forces. (K)
7. Show graphically the variation of potential energy of a pair of nucleons as a function of their separation and explain. (S) ((U)
8. What is a binding energy curve? Explain the main features of it. (U)

9. What is radioactive decay? How many types of decay are there in nature? Which are they? (K)
10. What is nuclear fission? Explain with example. (U)
11. What is nuclear fusion? Explain with example. (U)
12. Arrive at the relation between activity and decay constant of a radioactive sample. (U)
13. Derive the expression for the half-life of a radioactive nuclide. (U)
14. Explain alpha decay by giving an example and when is it possible? (U)
15. Write three characteristics of neutrinos. (K)
16. What is negative β-decay? Explain with example. (U)
17. What is positive β-decay? Explain with example. (U)
18. What is γ-decay? Explain with example. (U)
19. Estimate the energy released during the fission of uranium. (A)
20. Explain how controlled chain reaction is sustained in the nuclear reactors. (U)
21. Draw a schematic labeled diagram of a nuclear reactor based on the thermal neutron fission. (S)
22. Explain why very high temperature is essential for fusion reaction. (U)

Five mark questions

1. Explain the characteristics of nucleus. (K)
2. What are the conclusions drawn by observing the binding energy curve? (U)
3. State radioactive decay law and arrive at $N = N_0 e^{-\lambda t}$ where the symbols have their usual meaning. (U)
4. Show graphically, the variation of binding energy per nucleon with the mass number and also explain how energy is released in the process of nuclear fission and nuclear fusion. (S) (U)
5. Distinguish between nuclear fission and nuclear fusion. (U)
6. Obtain the expression for the number of atoms present in a radioactive sample in a given instant of time. (U)
7. Define half-life of a radioactive element. Derive the expression for half of a radioactive element in terms of decay constant. (U)
8. Deduce the relation between half-life and mean life of a radioactive substance. (U)
9. Explain how electricity is generated in a nuclear reactor. (U)

Numerical Problems

1. One gram of a radioactive substance disintegrates at the rate of $3.7X10^{10}$ disintegrations per second. The atomic mass of the substance is 226. Calculate its mean life. **[2282 years]**
2. Find the binding energy of an α-particle from the following data.
   Mass of the helium nucleus=4.001265 a.m.u
   Mass of the proton = 1.007277 a.m.u
   Mass of the neutron = 1.00866 a.m.u (A) **[7.10525 MeV]**
3. Calculate the mass defect and specific binding energy of $_7N^{14.}$ Given: The rest mass of nitrogen nucleus is 14.00307 amu. Mp = 1.00783amu, M_n = 1.00867amu (A)
   [Ans: Δm = 0.11243 amu, S.BE = 7.*48 MeV*]
4. Calculate the energy of released in the following fusion reaction of 1Kg of $_1H^2$.
   $$_1H^2 +_1 H^2 \longrightarrow _2 He^3 +_0 n^1 + Q$$
   Given: Mass of $_2He^3$ = 3.0161amu, mass of $_1H^2$ = 2.0141amu and mass of neutron $_0n^1$ = 1.0087amu. (A) **[Ans: Q=4.769 X 10^{26}MeV]**
5. The half-life of a radioactive substance is 30s calculate i) the decay constant and ii) time taken to the sample to decay by 3/4th of the initial value? (A)
   [Ans: λ=0.0231 per sec, t=60 sec]
6. Calculate the half-life and mean life of Radium 226 of activity 1Ci; Given mass of Radium -226 gram and 226 gram of radium consists of 6.023×10^{23} atoms. (A)
   [Ans: T = 5 X 10^{10} Sec, τ = 7.2 X 10^{10} Sec]
7. The half-life of a radioactive element is 4×10^8 years.Calculate its decay constant and mean life. (A) **[Ans: λ = 1.733 X 10^{-9} Per Year, τ = 5.772 X 10^8 Years]**
8. Find the activity in curie of 1g of radon: 222, whose half-life is 3.825 days.
   Avogadro number = 6.023×10^{23}, given; 1 curie = 3.7×10^{10} disintegrations per second. (A)
   [Ans: R = 1.5375 X 10^5 Ci]
9. Determine the mass of Na^{22} which has an activity of 5mci. Half-life of Na^{22} is 2.6 years.
   Avogadro number = 6.023×10^{23} atoms**. (A)** **[Ans: m = 7.996 X 10^{-10} Kg]**
10. Calculate the mass in gram of radium 226. Whose activity is 1 curie and half-life is 1620 years.
    (Avogadro's number = 6.023×10^{23}) (A) **[Ans: m = 1.024 g]**

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CHAPTER-14

SEMICONDUCTOR ELECTRONICS

One mark questions

1. Which devices were used instead of transistors before its invention? (K)
2. On what principle cathode ray tube (CRT) works? (K)
3. What is a semi-conductor? (K)
4. Give an example of elemental semi-conductor. (U)
5. Give an example of organic semi-conductor. (U)
6. How 'energy bands' are formed in a solid? (U)
7. What is a 'valence band' in solids? (U)
8. Where do the 'conduction band' is situated in solids? (K)
9. Do the 'conduction band' is filled with electrons or empty in solids normally? (K)
10. What is the value of energy gap in conductors? (K)
11. What is the value of energy gap in semiconductors? (K)
12. What is the value of energy gap in insulators? (K)
13. What is forbidden energy gap? (K)
14. What is fermi energy? (K)
15. For which type of material conduction band overlaps with valence band? (K)
16. How does conductivity of semiconductor change with temperature? (U)
17. What is the unique property of the semiconductor which is used is electronics? (U)
18. What is a 'hole' in semi-conductor? (U)
19. What are intrinsic semi-conductors? (K)
20. What are extrinsic semi-conductors? (K)
21. With the help of a diagram show that an intrinsic semi-conductor behaves as insulator at 0K (S)
22. What is meant by 'doping' a semi-conductor? (K)
23. What is the advantage of doping a semiconductor? / OR (U)
24. What is the necessity of doping of a semi-conductor? (U)
25. Which type of extrinsic semi-conductor is obtained by doping with pentavalent impurity? (K)
26. Mention the name of the extrinsic semi-conductor which is doped with trivalent dopant. (K)
27. Doping silicon with indium (boron/aluminum) leads to which type of semiconductor? (K)
28. Doping in silicon with phosphorous (arsenic, antimony) leads to which type of semiconductor? (K)
29. What is diffusion current in a p-n junction diode? (U)
30. What is 'drift current' in a p-n junction diode? (U)
31. What is barrier potential in a semiconductor diode? (U)
32. What is depletion region in a semiconductor diode? (U)
33. Write the circuit symbol of p-n junction diode. (S)
34. When the diode is said to be forward biased? (K)
35. When the diode is said to be reverse biased? (K)
36. What happens to the width of the depletion region when the diode is forward biased? (K)

37. What happens to width of the depletion region when the diode is reverse biased? (K)
38. What is breakdown voltage of a semiconductor diode? (U)
39. What is cut-in voltage of a semiconductor diode? (U)
40. What is reverse saturation current? (U)
41. What is dynamic resistance in a semiconductor diode? (U)
42. What is a rectifier? (K)
43. What is a half-wave rectifier? (K)
44. What is a full-wave rectifier? (K)
45. How to get a steady d.c output from the pulsating d.c output of a full wave rectifier? (U)
46. What are filter circuits in rectifiers? (K)
47. What is internal field emission or field ionization in a Zener diode? (U)
48. Symbolically represent a Zener diode. (S)
49. In which region Zener diode is operated in voltage regulator? (K)
50. What is photo diode? (K)
51. What is LED? (K)
52. Mention any one use of LED? (K)
53. Give one application of photo diode. (K)
54. Why commonly used silicon diode will not emit light when it is forward biased? (U)
55. Which region of a transistor has maximum doping concentration? (K)
56. What is a BJT? (K)
57. Write the relation between emitter current, collector current and base current in a transistor. (K)
58. Define input resistance of a transistor in CE mode? (U)
59. Define output resistance of a CE transistor? (U)
60. Write the formula for a.c. current amplification factor of a common emitter transistor. (U)
61. Write the formula for d.c. current amplification factor of a common emitter transistor. (U)
62. Define current amplification factor of a common emitter transistor. (U)
63. What is voltage gain in an amplifier? (K)
64. Write the formula for voltage gain of the transistor amplifier in CE configuration. (U)
65. What is an amplifier in electronic circuits? (K)
66. What is a feedback amplifier? (K)
67. Why a transistor oscillator is also called tuned collector oscillator? (U).
68. Write the expression for the resonant frequency of oscillation of transistor oscillator. (U)
69. What are logic gates in electronics? (K)
70. What are digital signals in electronics? (K)
71. What are analogue signals in electronics? (K)
72. Write the circuit symbol of OR gate. (S)
73. Draw the circuit symbol of AND gate. (S)
74. Represent the circuit symbol of NOT gate. (S)
75. Write the circuit symbol of NAND gate. (S)
76. Draw the logic symbol of NOR gate. (S)
77. What is a 'truth table' in logic gates? (U)
78. What is the use of writing truth table for the logic gate? (U)

79. Which logic gate is called as an 'inverter'? (K)
80. Write the truth table of OR gate. (U)
81. Give the truth table of AND gate. (U)
82. Write the truth table of NOT gate. (U)
83. Represent the behavior of NAND gate using truth table. (U)
84. Give the truth table of NOR gate. (U)
85. The input of a NOT gate is '1'. What is its output? (A)
86. Which electronic components are used to construct logic gates? (K)
87. Why NAND & NOR gates are called universal gates? (U)
88. The inputs of a NOR gate is '1' & '0'. Write the output of this gate. (A)
89. What is an integrated circuit? (K)
90. Which technology is most widely used in the fabrication of IC? (K)
91. Represent a typical analogue signal with a diagram. (S)
92. Represent digital signal graphically. (S)
93. What is the function of digital IC? (U)
94. OPAMP belongs to which category of IC? (K)
95. Expand OPAMP. (K)
96. Give an example for 'passive component' of an integrated circuit. (K)
97. Mention a component which is called as 'active component' in integrated circuits. (K)

Two mark questions

1. Write two advantages of semi-conductor devices over vacuum tubes. (K)
2. Distinguish between intrinsic and extrinsic semiconductors. (U)
3. Distinguish between p-type and n-type semiconductors. (U)
4. How hole current is developed in intrinsic semi-conductors? Explain. (U)
5. What are extrinsic semiconductors? Mention the types of extrinsic semiconductor. (K)
6. Why majority charge carriers increase on doping a pure semiconductor? (U)
7. Draw the graphs showing the V-I characteristics of a p-n junction diode a) in forward bias b) in reverse bias. (S)
8. Carbon, silicon and germanium have same lattice structure. Why carbon is an insulator while germanium and silicon are semiconductors? (U)
9. Draw schematic block diagram of p-n junction of a semiconductor diode. (S)
10. Give any two applications of LED's/ light emitting diode. (K)
11. Draw a graph representing the output characteristics of a transistor in CE mode. (S)
12. Draw input and output waveforms of a full wave rectifier. (S)
13. Represent I-V characteristics of a Zener diode graphically. (S)
14. Define the terms 'threshold voltage' & reverse saturation current in a p-n junction diode. (U)
15. What is space-charge region in a semiconductor? (U)
16. Which property of diode is used in rectification of a.c? And how it is used? (U)
17. Draw I-V characteristics of a solar cell. (S)

18. What is a transistor? Mention the two different types of transistors. (K)
19. Name the universal gates in logic circuits. (K)
20. Two inputs are given to a NOR gate through two NOT gates. Write the truth table for the resulting logic gate and identify the resulting logic gate. (A) (U)
21. The output a NOR gate is passed through a NOT gates. Write the truth table for the resulting logic gate and identify the resulting logic gate. (U) (A)
22. Which are the two categories of integrated circuits? (K)
23. What is the function of linear IC? Give an example of it. (K)
24. Write the block diagram representing transistor amplifier with a feedback oscillator. (S)
25. How the junctions of a transistor are usually biased? (K)
26. Write the formula for voltage gain of a transistor in CE configuration and explain the terms. (U)
27. Obtain the expression for the power gain in a transistor in CE mode when it is used as an amplifier. (U)
28. A transistor is having a β equal to 80 has a change in base current of 250μA. Calculate the change in the collector current. (A)

Three mark questions

1. Distinguish between conductors, semi-conductors and insulators on the basis of property of conductivity.(U)
2. Classify on the basis of electrical resistivity metals, semi-conductors and insulators. (U)
3. Which are the three different types of compound semi-conductors, give an example for each. (K)
4. Distinguish between conductor, semiconductor and insulator based on band theory of solids. (K)
5. What is an intrinsic semiconductor? Explain the variation of conductivity with temperature in it. (U)
6. Explain how a p-n junction is formed in a semiconductor. (U)
7. With suitable circuit diagram, explain the V-I characteristics of a semiconductor diode under forward bias. (U) (S)
8. Explain the V-I characteristics of a semiconductor diode under reverse bias by drawing a suitable graph. (U) (S)
9. Explain why reverse current suddenly increases at the breakdown region in a Zener diode? (U)
10. With the help of a circuit explain how a capacitor filters ripples of pulsating d.c. in rectifier. (U)(S)
11. What is a Zener diode? How it is fabricated? (U)
12. Mention the three optoelectronic junction devices. (K)
13. Describe the construction and working of a photo diode. (U)
14. What are the advantages of LED's incandescent low power lamps? (K)
15. Describe the construction and working of a solar cell. (U)
16. What are the criteria for the selection of material for solar cell fabrication? (U)
17. Give any three applications of solar cell. (K)
18. Which are the three segments (regions) of a transistor? Describe them in brief. (U)
19. Describe the action of a transistor. (U)
20. When is the transistor said to be switched ON and switched OFF? Represent it by drawing transfer characteristics of a base biased transistor in CE configuration. (U) (S)

21. Obtain the expression for voltage gain of n-p-n transistor, when it is used as an amplifier in CE configuration. (U)
22. Define (i) input resistance (ii) output resistance and (iii) current amplification factor of a transistor in CE mode. (U)
23. Describe the three important ac parameters of common emitter transistor in CE configuration. (U)
24. Write the block diagram of feedback amplifier. What is positive feedback? Write the expression for frequency of LC coupled oscillator. (U) (S)
25. Why a feedback is essential for an oscillator? How it is achieved? (U)
26. Name any three feedback circuits. (K)
27. Mention any three applications of logic gates. (K)
28. Using only NOR gates, show with a circuit diagram, how to construct
    (i) NOT gate, **(ii)** OR gate and **(iii)** AND gate.
29. A logical circuit with three inputs and one output is constructed using one NOR gate and one AND gate. Two inputs A and B are given to NOR gate. A third input C and the output of NOR gate are given as inputs to AND gate. Determine the input state which provide the final output Y=1 from the AND gate.

Five mark questions

1. Describe the action of a semiconductor diode under forward and reverse bias with I-V diagrams. (U) (S)
2. What is a rectifier? Explain with necessary circuit diagram, the construction and working of a half wave rectifier. (U) (S)
3. What is a rectifier? Describe the construction and working of a full wave rectifier by drawing input and output waveforms. (U) (S)
4. Explain with necessary diagram how a Zener diode acts as a voltage regulator. (U) (S)
5. Draw circuit arrangement for studying input and output characteristics of n-p-n transistor in CE configuration and explain its action with the help of graphs. (U) (S)
6. Explain with necessary circuit diagram the working of n-p-n-transistor as an amplifier in CE mode. (U) (S)
7. Explain with necessary circuit diagram the working of n-p-n-transistor as a switch. (U) (S)
8. With a necessary circuit describe the working of a tuned collector oscillator. (U) (S)

Numerical problems

1. The input frequency of a rectifier is 100 Hz. Calculate the output frequency if the rectifier is (a) half wave rectifier (b) full wave rectifier. (A) **[50HZ, 100Hz]**
2. An amplifier of voltage gain 12 is connected in series with another amplifier of voltage gain 20. If the input signal is 20 mV, calculate the output voltage of ac signal. (A) **[4.8 V]**
3. An LED is constructed from a p-n junction, based on a certain Ga-As-P semi-conducting material whose energy gap is 1.9 eV. Calculate the wavelength of the light emitted by this LED, also identify the colour of the emitted light. (A) **[650 nm, Red in colour]**

4. A silicon transistor is connected in CE mode to use it as a switch, in which base voltage is varied from 0-6.0 V. the transistors dc current gain is 300, base resistance 150 KΩ, collector resistance 1.5 KΩ & collector voltage 6 V. Assume that the transistor is saturated and if VCE =0V, VBE=1V, calculate the minimum base current for which the transistor will reach saturation and hence determine input voltage when the transistor is switched on. (A)

[13.3 μA, 1.995 V]

5. The current amplification factor of CE transistor amplifier is 110. An audio signal voltage across 2.5 KΩ collector resistor is 2.5V, calculate base current. (A) **[9μA]**
6. One cubic meter of silicon is simultaneously doped with $3.05X10^{16}$ atoms of arsenic and $5X10^{14}$ atoms of indium. If intrinsic carrier concentration $n_i = 4X10^{16}$, calculate the number of electrons and holes. (A)
7. A p-n junction diode is connected in series with 5kΩ across a battery of emf 5.7V and negligible internal resistance in such a way that the diode is forward biased. If the barrier potential in diode is 0.7V, calculate the current through the diode. What is the resistance that should be combined with 5kΩ so that the current through the diode becomes 3mA? (A)
8. The electrical conductivity of a semiconductor increases when an electromagnetic radiation of wavelength shorter than 2480nm is incident on it. Calculate the energy band gap in eV for the semiconductor. (A).

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CHAPTER-15
COMMUNICATION SYSTEM

One mark questions

1. What is communication in electronics? (K)
2. Name the Indian scientist who has contributed to electronic communication. (K)
3. Who invented radio communication? (K)
4. What is a transmitter in communication? (K)
5. Give an example for a transmitter used in communication. (U)
6. What is a microphone? (K)
7. Name the device which converts sound signal into electrical signal. (K)
8. What is the purpose of using a transmitter in communication system? (U)
9. Which are the three essential elements used in communication? (U)
10. What a channel/medium in communication consists of? (U)
11. What is a carrier wave in communication? (K)
12. What is a signal in communication? (K)
13. Expand 'BCD' in communication. (K)
14. What does 'ASCII' represent in communication? (K)
15. What is 'noise' in communication? (U)
16. What is attenuation in communication system? (U)
17. Mention any one example for point to point communication. (K)
18. What is a transducer in communication? (U)
19. What function does a 'receiver' do in communication? (K)
20. What is attenuation in communication? (U)
21. What is amplification of signal in communication? (K)
22. Is amplification necessary in communication system? (K)
23. At what stage the amplification of the signal is done in communication? (K)
24. What does the word 'range' mean in communication system? (K)
25. What is the meaning of the term 'frequency band width' in communication? (K)
26. What is 'modulation' in communication? (K)
27. What is the need of modulation in communication? (U)
28. Which are the different types of modulation? (K)
29. What does 'demodulation' mean in communication? (U)
30. What is modulation index? (K)
31. What is the function of a 'repeater' in communication? (U)
32. What for the repeaters are used in communication? (U)
33. Give the audible range of frequency. (K)
34. What is the value of band width usually allocated for transmission of a TV signal? (K)
35. Mention the value of bandwidth for co-axial cable transmission medium. (K)

36. From which layer of the earth's atmosphere, radio waves are reflected? (K)
37. On what factor does the size of the antenna depend? (K)
38. For a given antenna, how does the effective power radiated by the antenna vary with wavelength? (U)
39. Mention one advantage of frequency modulation (FM) over amplitude modulation (AM). (U)
40. What is phase modulation in communication? (U)

Two mark questions

1. Which are the two basic modes of communication system? (K)
2. Write the block diagram of a generalized communication system. (S)
3. Mention any two communication systems which make use of space wave mode of propagation. (U)
4. Explain how transmission of electromagnetic waves takes place using sky waves. (U)
5. Which are the two types of signal used in communication? (K)
6. In digital electronics what does '0' / '1' corresponds to? (U)
7. Give the value of frequency and bandwidth for a speech signal. (K)
8. Explain how troposphere interacts with the propagating electromagnetic wave. (U)
9. Explain how D-part of stratosphere interacts with the propagating electromagnetic wave. (U)
10. Explain how E-part of stratosphere interacts with the propagating electromagnetic wave. (U)
11. Explain how mesosphere interacts with the propagating electromagnetic wave. (U)
12. Explain how thermosphere interacts with the propagating electromagnetic wave. (U)
13. Write the formula for the distance to the radio horizon of the transmitting antenna and explain the terms. (U)
14. What is the meaning of the word 'translation' in communication system? Why is it required? (U)
15. Mention the different types of pulse modulation in communication. (K)
16. What are the significant characteristics of a pulse? (K)
17. Draw block diagram of a receiver in communication. (S)
18. Draw a block diagram of transmitter in communication. (S)
19. Draw a block diagram of a simple modulator for obtaining an AM signal in communication. (S)

Three mark questions

1. Explain how transmission of electromagnetic waves takes place using ground waves. (U)
2. Explain how transmission of electromagnetic waves takes place using sky waves. (U)
3. Explain how transmission of electromagnetic waves takes place using space waves. (U)
4. What is modulation index? What is its maximum value and why is it so? (U)
5. Explain why modulation is necessary in communication. (U)
6. Explain amplitude modulation process using a sinusoidal signal as modulating signal. (U)
7. Explain how amplitude modulated wave is detected. (U)

Numerical problems.

1. In a line of sight (LOS) communication mode a transmitting antenna at the top of a tower has a height of 36 m, and a receiving antenna at a height of 49m. Calculate the maximum distance between them for satisfactory communication. Given radius of the earth 6400 Km. (A) **[46.51 Km]**
2. A carrier wave of frequency 2.5 MHz and peak voltage of 25 V is used to modulate a message signal of frequency 20 KHz and peak voltage of 10 V. calculate the modulation index and the side bands produced. (A) **[0.4, (2.57—2.48)MHz]**
3. A carrier wave of peak voltage 12V is used to transmit a message signal. What should be the peak voltage of the modulating signal in order to have a modulation index of 75%. (A) **[9V]**
4. A T.V transmitting antenna is 77m tall. How much service area can it cover if the receiving antenna is at the ground level? (A) **[28.16×10^8 m^2]**

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Model Question Paper-1

BLUE PRINT

II PUC PHYSICS (33)

TIME : 3 hours 15 minute **Max Marks : 70**

Unit	Chapter	Topic	Number of Teaching hours	Marks Allotted	1 Mark(VSA)	2Marks(SA1)	3 Marks(SA2)	5 Marks(LA)	5 Marks(NP)
1	1	Electric charges & Fields	**9**	**8**			✓		✓
2	2	Electrostatic potential and Capacitance	**9**	**8**	✓	✓		✓	
3	3	Current electricity	**15**	**13**	✓	✓		✓	✓
4	4	Moving Charges and Magnetism	**10**	**10**		✓	✓		✓
5	5	Magnetism and Matter	**8**	**6**	✓			✓	
	6	Electromagnetic Induction	**7**	**6**	✓	✓	✓		
6	7	Alternating Current	**8**	**7**	✓		✓ ✓		
	8	Electromagnetic Waves	**2**	**2**		✓			
7	9	Ray Optics and Optical Instruments	**9**	**8**			✓		✓
8	10	Wave Optics	**9**	**8**	✓	✓		✓	
9	11	Dual nature of Radiation and Matter	**6**	**5**	✓ ✓		✓		
	12	Atoms	**5**	**5**					✓
10	13	Nuclei	**7**	**6**	✓			✓	
	14	Semiconductor Electronics	**12**	**10**		✓	✓	✓	
	15	Communication Systems	**4**	**3**	✓	✓			
		Total	**120**	**105**	**10**	**16**	**24**	**30**	**25**

PHYSICS (33)

II PUC

MODEL PAPER – 1

Time : 3:15 Hrs. **Max Marks:70**

Instructions:

1) **All parts are compulsory.**
2) **Answer without relevant diagram / figure/circuit, where ever necessary will not carry any marks.**
3) **Direct answers to the numerical problems without the relevant formulae and detailed solutions will not carry any marks.**

PART – A

I Answer All the questions: **10 x 1 = 10**

1) Define electric potential at a point due to a point charge.
2) Mention any one application of potentiometer.
3) An aluminum piece is subjected to varying temperature. What is the effect of temperature on its susceptibility?
4) How much emf is induced in a coil of self-inductance 2H if the current in it is changing at the rate of $2As^{-1}$?
5) What is meant by power factor of an ac circuit?
6) Define polarizing angle for a material.
7) What are matter waves?
8) State Heisenberg's uncertainty principle.
9) Give an example for β^+ decay process.
10) What is a transducer in communication?

PART – B

II Answer any FIVE of the following questions: **5 x 2 = 10**

11) Distinguish between polar and non-polar molecules.
12) Define mobility of electrons. How is mobility of electrons in a conductor related to relaxation time?

13) Give the expression for gyromagnetic ratio of an electron revolving round the nucleus and explain the terms.
14) State and explain Faraday's law of electromagnetic induction.
15) Write the relation between the magnitude of electric and magnetic fields in an electromagnetic wave with speed of light and hence find the magnitude of the electric field at a point in space and time if the magnetic field at that place is 2×10^{-8} T.
16) What is Doppler Effect in light? Write the expression for Doppler shift.
17) Define the terms input resistance and current amplification factor of a transistor in CE mode.
18) Draw the block diagram of AM receiver in communication.

PART – C

III Answer any FIVE of the following questions: 5 x 3 = 15

19) Mention any three properties of electric charges.
20) Derive the expression for magnetic force on a conductor carrying current kept in a magnetic field.
21) What are eddy currents? Mention any two applications of eddy currents.
22) Obtain the expression for the current in an AC circuit containing pure capacitor.
23) What is a transformer? On what principle it works? Mention one power loss in a transformer.
24) Draw the ray diagram for the formation of image by a compound microscope. What is meant by tube length of a compound microscope?
25) Mention the three types of electron emission.
26) What is a NAND gate? Write its circuit symbol and truth table for two inputs.

PART – D

IV Answer any TWO of the following questions: 2 x 5 = 10

27) Derive the expression for the capacitance of a parallel plate capacitor. And hence write the expression for the capacitance when a dielectric medium is inserted between its plates.
28) Obtain the expression for the conductivity of a conductor in terms of its relaxation time. **Or** Deduce $\sigma = \frac{ne^2\tau}{m}$ where the symbols have their usual meaning.
29) Show that a bar magnet behaves as an equivalent current carrying solenoid.

V Answer any TWO of the following questions: 2 x 5 =10

30) Obtain the expression for the fringe width of interference fringes in Young's double slit experiment.
31) State the law of radioactive decay. Show that $N = N_O\, e^{-\lambda t}$ for a radioactive element.
32) What is a rectifier? Explain the working of semi-conductor diode as a full wave rectifier with a necessary circuit diagram. Also give the input and output wave forms for the same

VI Answer any THREE of the following: 3x5=15

33) Two pith balls of mass 10mg each are suspended by two threads from the same support are charged identically. They move apart by 0.08m and threads make an angle 60^0 with each other. Find the charge on each pith ball

34) Two cells of 6 V and 4 V having internal resistance of 3 Ω and 2 Ω respectively are connected in parallel so as to send a current through an external resistance 8 Ω in the same direction. Find the current through the cells and the current through the external resistance.

35) A circular coil of radius 0.08m consisting of 100 turns is carrying a current of 0.4A. Calculate the magnitude of the magnetic field i) at the center of the coil and ii) at a point 0.2m from the center of the coil on its axis.

36) A parallel beam of light is incident on a face of a prism of refracting angle 60^o. Find the refractive index of the prism if the angle of minimum deviation is 40^0. What is the new angle of minimum deviation if the prism is immersed in water of refractive index 1.33?

37) Calculate the value of Rydberg constant if the wavelength of the first member of Balmer series in the hydrogen spectrum is 6563 Å. Also find the wavelength of the first member of Lyman series in the same spectrum.

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Model Question Paper-2

BLUE PRINT

II PUC PHYSICS (33)

TIME : 3 hours 15 minute **Max Marks : 70**

Unit	Chapter	Topic	Number of Teaching hours	No of marks	1mark	2 marks	3 marks	5 marks (T)	5 mark (P)
1	1	Electric charges & Fields	**9**	**8**			✓	✓	
2	2	Electrostatic potential and Capacitance	**9**	**8**			✓		✓
3	3	Current electricity	**15**	**13**	✓	✓ ✓	✓	✓	
4	4	Moving Charges and Magnetism	**10**	**8**	✓	✓			✓
5	5	Magnetism and Matter	**8**	**6**	✓	✓	✓		
	6	Electromagnetic Induction	**7**	**7**		✓		✓	
6	7	Alternating Current	**8**	**8**			✓		✓
	8	Electromagnetic Waves	**2**	**2**	✓ ✓				
7	9	Ray Optics and Optical Instruments	**9**	**8**	✓	✓		✓	
8	10	Wave Optics	**9**	**8**			✓		✓
9	11	Dual nature of Radiation and Matter	**6**	**5**	✓ ✓		✓		
	12	Atoms	**5**	**5**				✓	
10	13	Nuclei	**7**	**6**	✓			✓	

	14	Semiconductor Electronics	**12**	**10**		✓	✓	✓	
	15	Communication Systems	**4**	**3**	✓	✓			
		Total	**120**	**105**	**10**	**16**	**24**	**30**	**25**

PHYSICS (33)

MODEL PAPER – 2

Time : 3:15 Hrs. **Max Marks:70**

Instructions:

1) **All parts are compulsory.**
2) **Answer without relevant diagram / figure/circuit, where ever necessary will not carry any marks.**
3) **Direct answers to the numerical problems without the relevant formulae and detailed solutions will not carry any marks.**

PART – A

I Answer All the questions: **10 x 1 = 10**

1) Write the colour code for a carbon resistor of resistance is (2.5 K ± 20%)Ω
2) What is the magnetic moment associated with a current loop of area 2 x 10-3 m2 and carrying current of 0.5A?
3) Which important property differentiates magnetic field lines and electric field lines.
4) What is meant displacement current?
5) Mention any one application of γ- ray.
6) Define critical angle for a pair of media.
7) Give the expression for de-Broglie wavelength of a charged particle in terms of its accelerating potential.
8) Represent graphically the variation of photoelectric current with the intensity of incident radiation for a given photo sensitive material.
9) Give an example for isobars.
10) Mention one advantage of frequency modulation (FM) over amplitude modulation (AM) in communication.

PART – B

II Answer any FIVE of the following: **5 x 2 = 10**

11) Mention any two limitations of Ohm's law.
12) State Kirchhoff's rules of electrical network.
13) Define 'tesla' using the expression for the force on a charged particle moving in a magnetic field.
14) Which are the two properties required for a material to be used as a core of electromagnets.
15) What are thermal generators? Mention the value of frequency of ac used in India.

16) Mention any two differences between primary rainbow and secondary rainbow.
17) What is a light emitting diode? Write an advantage of using it over conventional low power lamps.
18) Explain the term 'amplification' in communication system. Why is it necessary?

PART – C

III Answer any FIVE of the following: 5 x 3 = 15

19) Derive the expression for torque on an electric dipole placed in a uniform electric field.
20) What is an equipotential surface? Draw the equipotential surfaces for i) a uniform electric field and ii) a point charge.
21) Draw the graphs representing the variation of resistivity with temperature for (1) copper (2) nichrome (3) a typical semiconductor.
22) Define the term 'angle of dip'. Find the value of dip at a place if the vertical component of Earth's magnetic field is $\sqrt{3}$ times the horizontal component.
23) Show that the charges oscillate with a frequency given by $\omega = \frac{1}{\sqrt{LC}}$ when a charged capacitor of capacitance C is connected to an inductor of inductance L.
24) What is meant by diffraction of light? Write the conditions for maxima and minima of diffraction pattern in terms of the wavelength of light used for the diffraction at single slit.
25) Explain the experimental setup used to study photoelectric effect with a neat labeled diagram.
26) What are logic gates? Give the logic symbol of NOT and AND gates.

PART – D

IV Answer any TWO of the following: 2 x 5 = 10

27) State Gauss theorem in electrostatics. Derive the expression for electric field at a point due to an infinitely long straight charged conductor.
28) Derive the expression for the effective emf and the effective internal resistance of two cells connected in parallel.
29) Describe the construction and working of an AC generator and arrive at the expression for the emf induced in it.

V Answer any TWO of the following questions: 2 x 5 =10

30) Derive $n = \frac{\sin\frac{A+D}{2}}{\sin\frac{A}{2}}$ for the prism. Where the symbols have their usual meaning.
31) State Bohr's postulates for atom model. Mention any two limitations of Bohr's atomic model.
32) With a suitable circuit explain the action of a transistor as an amplifier in CE configuration.

VI Answer any THREE of the following: 3x5=15

33) A 900 pF capacitor is charged by 100 V source. Calculate the electrostatic energy stored in the capacitor? The capacitor is then disconnected from the source and connected to another uncharged 900 pF capacitor. Find the common potential of the system?
34) A pointer galvanometer with a scale of 30 divisions has a resistance of 12 Ω. Full scale deflection is obtained for a current of 3 mA. Calculate the current sensitivity of the galvanometer. How will you convert this galvanometer into a voltmeter of range 0 to 18 V?
35) A resistor and a capacitor are connected in series to a 50 Hz ac source. The voltage (rms) across the resistor and capacitor are 151V and 160.3V respectively. Calculate the rms voltage of the source. Also find the capacitive reactance and impedance of the circuit, if the current in the circuit is 0.755A.
36) Double-convex lens is to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. Calculate the radius of curvature required if the focal length is to be 20cm? Also find the focal length of the lens if it is immersed in water of refractive index 1.33?
37) Calculate the energy released in the reaction $^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n + Q$

Given: mass of $^{235}_{92}U = 235.0439\ amu$

mass of $^{141}_{56}Ba = 140.9178\ amu$,

mass of $^{92}_{36}Kr = 91.8854\ amu$

and mass of neutron = 1.008655 amu. Express the result in joules.

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Model Question Paper-3

BLUE PRINT

II PUC PHYSICS (33)

TIME : 3 hours 15 minute **Max Marks : 70**

Unit	Chapter	Topic	Number of Teaching hours	Marks Allotted	1 Mark(VSA)	2Marks(SA1)	3 Marks(SA2)	5 Marks(LA)	5 Marks(NP)
1	1	Electric charges & Fields	**9**	**8**	✓	✓		✓	
2	2	Electrostatic potential and Capacitance	**9**	**8**			✓		✓
3	3	Current electricity	**15**	**13**	✓	✓		✓	✓
4	4	Moving Charges and Magnetism	**10**	**9**	✓		✓	✓	
5	5	Magnetism and Matter	**8**	**6**	✓	✓	✓		
	6	Electromagnetic Induction	**7**	**6**	✓	✓	✓		
6	7	Alternating Current	**8**	**8**			✓		✓
	8	Electromagnetic Waves	**2**	**2**		✓			
7	9	Ray Optics and Optical Instruments	**9**	**9**	✓		✓		✓
8	10	Wave Optics	**9**	**8**	✓	✓		✓	
9	11	Dual nature of Radiation and Matter	**6**	**6**	✓				✓
	12	Atoms	**5**	**5**				✓	
10	13	Nuclei	**7**	**5**		✓	✓		
	14	Semiconductor Electronics	**12**	**9**	✓ ✓	✓		✓	
	15	Communication Systems	**4**	**3**			✓		
		Total	**120**	**105**	**10**	**16**	**24**	**30**	**25**

PHYSICS (33)

MODEL PAPER – 3

Time : 3:15 Hrs. **Max Marks: 70**

Instructions:

1) **All parts are compulsory.**
2) **Answer without relevant diagram / figure/circuit, where ever necessary will not carry any marks.**
3) **Direct answers to the numerical problems without the relevant formulae and detailed solutions will not carry any marks.**

PART – A

I Answer All the questions: **10 x 1 = 10**

1. Who discovered the fact that amber rubbed with wool or silk attracts light objects?
2. Define current density.
3. What should be the angle between the velocity vector of the charged particle and the magnetic field to experience a maximum force, when a charged particle is moving in a uniform magnetic field?
4. Write the relation between relative permeability and magnetic susceptibility of a magnetic material.
5. State Lenz's law in electromagnetic induction.
6. An elderly person is facing difficulty while reading a book which is about 25cm distance from his eyes. Name the eye defect from which the person is suffering.
7. Give any one application of Polaroid.
8. A graph of stopping potential of a photo sensitive metal with the frequency of incident radiation is plotted. What does the slope of this curve represent?
9. How to get a steady d.c output from the pulsating d.c output of a full wave rectifier?
10. Represent a typical analogue signal with a diagram

PART – B

II Answer any FIVE of the following questions: **5 x 2 = 10**

11. Write Coulomb's law in vector form and explain the terms.
12. Define relaxation time of conduction electrons. How it depends on the temperature of the conductor?
13. State and explain Gauss law in magnetism.
14. A coil of self-inductance 2H is carrying a current of 2A. Calculate the energy stored in the coil.
15. What was Marconi's invention in the field of electromagnetic waves? What for it is used now?

16. Mention any two methods of increasing the resolving power of a microscope.
17. What are isotones? Give an example.
18. A transistor is having a β equal to 80 has a change in base current of 250μA. Calculate the change in the collector current.

PART – C

III Answer any FIVE of the following questions: 5 x 3 = 15

19. Obtain the expression for electric potential energy of a system of two point charges in the absence of external electric field.
20. What is a cyclotron? Give the expression for cyclotron frequency and explain the terms.
21. Mention any three properties of diamagnetic substance.
22. Derive the expression for emf induced in a straight conductor moving perpendicular to a uniform magnetic field.
23. What is meant by resonance in a series LCR circuit? Write the expression for the current through LCR series circuit at resonance. Mention any one application of resonant circuits.
24. Obtain the relation between radius of curvature and focal length of a concave mirror with necessary ray diagram.
25. Draw the schematic diagram of a nuclear reactor and label its parts. What is the function of a moderator in a nuclear reactor?
26. Mention the three important reasons which necessitate the process of modulation in communication.

PART – D

IV Answer any TWO of the following questions: 2 x 5 = 10

27. Derive the expression for electric field at a point outside a charged spherical shell using Gauss law. What is the electric field inside the charged spherical shell?
28. Obtain the condition for the balance of a Wheatstone's network using Kirchhoff's rules of electrical network.
29. Deduce the expression for the force between two long parallel conductors carrying steady currents and hence define 'ampere' the S.I. unit of electric current.

V Answer any TWO of the following questions: 2 x 5 =10

30. Give the theory of interference of light by considering waves of equal amplitude and hence arrive at the conditions for constructive and destructive interference in terms of path difference.
31. Derive the expression for the total energy of an electron revolving in the n^{th} orbit of hydrogen atom, assuming the expression for the radius of the orbit.
32. With a necessary diagram explain how a Zener diode works as voltage regulator.

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

33. A parallel plate capacitor has two plates of dimensions 10 cm x 7 cm separated by a distance of 0.7 mm. A glass plate of thickness 0.4 mm (dielectric constant = 6) and another dielectric medium of thickness 0.3 mm (dielectric constant = 2.5) are placed between the plates of the capacitor. Calculate the capacitance of the capacitor before and after introduction of the dielectric media.
34. A silver wire has a resistance of 2.1 Ω at 27.5 °C, and a resistance of 2.7 Ω at 100 °C. Determine the temperature coefficient of resistivity of silver. Also find the resistance of the silver wire at 0 °C.
35. A resistor of 200 Ω, an inductor of 25 mH and a capacitor of 15.0 μF are connected in series to a 220 V, 50 Hz ac source. Calculate the current through the circuit. Also find the phase difference between the voltage across the source and the current.
36. A ball is approaching a convex mirror of focal length 30 cm with speed 20 m/s. Calculate the speed of its image when the ball was at 5 m from the mirror?
37. The threshold wavelength of photo sensitive metal is 5000Å. Find the velocity of the photoelectrons emitted by it when radiation of wavelength 4000Å is incident on it. Given h = 6.625×10^{-34}Js, e = 1.6×10^{-19}C and mass of electron = 9.1×10^{-31}kg.

*******##*******

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