Chap 1: Electric Charges and Fields

1. When a glass rod is rubbed with silk and ebonite rod is rubbed with wool,equal and opposite charges appear on these two,explain why. Is there a transfer of some mass also,explain how it can be evaluated. Which property of charge is shown by the statement $Q_1+Q_2 = 0$.

2. An object is to be shielded from electrostatic field suggest a possible arrangement for this purpose.Explain why you are advised to sit inside metallic car during lightening.

3. A metallic conductor is given some charge then whole charge comes on the outer surface of conductor, explain why.Charge given to an insulator can be distributed inside volume also. Comment on it.

4 . What do you mean by the term quantization of charge. On the basis of quantization, justify which of these two magnitude of charges are possible $+1.4\times10^{-19}$ C, -1.6×10^{-18} C. Why law of quantization is not valid on macroscopic scale.

5. When a charged glass rod is brought near a metallic sphere and a paper piece respectively, it attracts these, explain why.Name the process involved in each case ? Is there some net field inside metal sphere and paper piece. Can we charge these two with absolute positive or negative charge with the help above mentioned process.

6. How will you charge an isolated metal sphere with uniformly distributed positive or negative charge,explain. Can the two metal spheres placed in contact be made oppositely charged with the same process.

7. How will you transfer the whole charge of a small conducting body to another large conducting hollow body. A hollow conducting spherical shell of inner radius r_1 and outer radius r_2 is given a charge Q_1, find inner and outer surface charge density .Another point charge Q_2 is now placed at the centre of shell, find the new surface charge density of these surfaces.

8. Two identical metal sphere A and B holding the charges +Q and -4Q are placed at certain distance apart, a third uncharged identical sphere C is initially touched with A and then with B and finally placed at the center of the line joining two spheres. What are the new charges on the spheres A and B, which property of charge explains new distribution of charge.

9. State Coulomb's law, give it's vector form in terms of position vector of two point charges .How does this force obeys Newton's third law. Mention the three factors with which this force varies.Plot the graphs between the force and these factors.

10. Calculate the minimum possible force between two point charges placed in a medium air at a distance 1cm apart. How does this force change if magnitude of charges and the distance between the charges are doubled.

11. Define the term dielectric constant or relative permittivity of a medium on behalf of coulomb's law and give it's S.I unit also. What is the absolute permittivity of a medium whose dielectric constant is 3.

12 Two point charges initially placed in air exert a force F on each other.If these charges are now placed in a medium of dielectric constant 4 and distance between the charges is halved what is the new force between them in terms of F.

13. Can electrostatic force be given by KQ_1Q_2/r^2 between two large sized spheres holding some charges Q_1 andQ_2 . Describe the nature of this force if two charges Q_1 and Q_2 are such as $Q_1Q_2>0$ and $Q_1Q_2 <0$, draw the graph for force vs distance r and with the term $1/r^2$ for each case and interpret these graphs.

14. How do we verify that electrostatic force is conservative in nature, what is the work done by electrostatic force on an electron moving in a circular or elliptical orbit round the nucleus.

15. Do the two similar charges always repel each other, if not give an example. How will you place two point charges so that only one of them could experience electrostatic force due to other and other may not.

16. State principle of superposition in coulomb's law .Two point charges Q and -2Q are placed at a distance 2a apart from each other, where and what charge must be placed on the line joining these charges so that system is in equilibrium.

17. (a) A charge q is placed at the centre of the line joining two equal charges Q ,show that system of three charges will be in equilibrium if q =-Q/4.

(b)Four point charges +Q, -2Q, -Q and -2Q are placed at the four corners of a square of side a.Calculate the net force on charge +q placed at the centre of square.

18. A point charge -q and mass m starts revolving with a constant speed in a circle of radius r around another charge +Q at the center. Calculate the speed and time period of revolution of the charged particle .What is the work done by electrostatic force and which nature of this force explains magnitude of work done.

19 .Define electric field intensity at a point, Is it a vector or scalar quantity. State two S.I units of electric field intensity. Why do we consider a infinitesimally small test charge to be placed at a point to measure electric field intensity at that point.

20. Obtain an expression for electric field intensity at a point in the field region of a point charge using Coulomb's law. Write the vector form of this expression. Is the field uniform or non uniform in this region.

21. Define the term an electric dipole and it's dipole moment. State the direction, magnitude and S.I unit of dipole moment .Draw the electric field lines pattern produced by the two charges of this dipole. Can there be any point in between and outside in the vicinity where net field can be zero. Repeat the same if two charges were +Q and -2Q.

22. Derive an expression for electric field intensity at a mid point and at an axial of an electric dipole of dipole moment P=2aQ. Show the variation of field graphically with distance r from the centre of short dipole and compare it with the field intensity produced due to a point charge. Compare the magnitude of field intensity at far axial and equatorial point of short dipole.
23. Give four important properties of electric field lines and justify these. Draw the pattern of these field lines for the following (a)An isolated point charges Q>0 (b) An isolated point charge Q<0 (c) A pair of two charges Q_1 and Q_2 of equal magnitude, placed at certain distance apart if $Q_1Q_2>0$ and if $Q_1Q_2<0$.
24. Draw the field lines pattern of (i) An isolated negatively charged metal sphere (ii)A point charge +Q and a thick conducting sheet placed in-front of this charge(iii) A metal sphere placed between two oppositely charged plates of capacitor.
25. Two point charges q_1 and q_2 are placed at certain distance apart, if electric field intensity is zero not in between but outside on the same line joining two charges and near the charge q_1. Write two essential condition for this to occur.
26. Consider an electric field region where field intensity is zero at a point only. An electric charge is placed at that point, then show that equilibrium of charge is necessarily unstable.
27. State Gauss theorem.Obtain an expression for electric field inside and on the surface of a charged solid conductor of irregular shape in terms of surface charge density. Explain Why electric field is high at sharp points of this conductor. Also state why electric field must always be perpendicular to the surface of conductor.
28. Discus the direction of motion and the path followed by a charged particle +q in a region of uniform electric field of intensity E in the following cases (a)charge is released in this region (b) It is given some initial velocity u opposite to the direction of electric field. (c) It is given some initial velocity u perpendicularly to the field E. Find the position and speed of the particle after a time interval t second in each case.
29. An oil drop of charge –q and mass m is freely hanging in a region of uniform electric field. Give the direction and magnitude of this field to create such condition. If the direction of field is reversed with its magnitude unchanged. Will the drop be in equilibrium or not.What will be the new acceleration of oil drop in terms of g.
30. Define a dielectric substance. Give two point of differences between polar and non polar dielectric and two examples of each type. What do mean by the term dielectric strength of dry air. Give it's approximate value with appropriate unit.
31. What do you mean by the term dielectric polarization. Explain Why net electric field inside a mica slab is reduced when it is placed in an external electric field region. Explain what happens if this mica slab is replaced with copper slab in the same field .Guess about the value of relative permittivity of copper slab.
32. If the electric field induced inside a dielectric is 1/10 times of external field when it is placed in an external field, find the relative permittivity of dielectric medium.Draw the pattern of modified electric field lines.
33. Derive an expression for torque acting on an electric dipole when placed in a region of uniform electric field. State the direction and the role of this torque. Mention the position of dipole in the field where both net force and torque are zero and the position where force is zero but torque is non zero.
34. Derive an expression for potential energy of an electric dipole of dipole moment P placed in a region of uniform electric field E at some angular position. Mention the position of dipole in the field at which it is (i) At most stable. (ii) most unstable equilibrium (ii) torque is maximum. Calculate the potential energy of dipole in each of these positions.
35. An electric dipole of dipole moment P is placed at equilibrium position in uniform field E. If the dipole is slightly rotated from it's initial position and released .Show that it will execute S.H.M and calculate it's time period .Assuming moment of inertia of dipole about it's axis of rotation is I.
36. An electric dipole of dipole moment P initially placed at stable equilibrium position in an uniform electric field E is rotated to unstable equilibrium position in the same field, calculate the work done in this process and final potential energy of dipole.
37. Define the term electric flux, is it a vector or scalar quantity .Give it's two S.I unit. What do you mean by positive and negative flux .A square of side 10 cm placed in X-Z plane a region of uniform electric field of intensity500 N/C. Calculate the electric flux passing through this surface, if the field is along Y axis, along Z axis.
38. A point charge +Q is placed at the centre of a cube of edge 'a' , calculate (i) total electric flux passing through all six surfaces and through any one surface (ii)how would this flux change if (a) edge of the cube is doubled (b) Shape of the cube is transformed into spherical (c)nature of charge is reversed (d) Another point charge +Q is also placed outside the closed surface of this shell.
39. A cube of edge b is placed in a region of electric field of intensity E_0 normal to one of the face of the cube. Estimate the net flux passing through the cube and the possible charge inside the cube (a)If the field is uniform. (b) Field is increasing it's magnitude as E=c x where c is a constant and x is the distance from origin and the face of the cube through which field lines enter is at x=a.
40. Using Gauss theorem obtain an expression for electric field intensity inside, outside and on the surface of a thin uniformly charged conducting shell of radius R and holding a charge Q. Calculate the total electric leaving the

surface. Draw the graph for the variation of field intensity with distance r from the center of shell. How much flux will come out of this surface if surface charge density is doubled with its radius unchanged.

41. Is the magnitude for electric field for a outside point of a charged conducting shell is same as the electric field due to a point charge which is supposed to be concentrated at the centre of the shell in previous question. Why do you expect that field inside the charged conducting shell should be zero.

42. Obtain an expression for electric field intensity at a point situated normally at a distance r from a thin large sized charged sheet of surface charge density . Draw the graph for the variation of field with distance r. Is this field uniform or non uniform on both sides. Draw the pattern of these field lines for an isolated positive and negative charged sheets .

43. Using the result obtained for electric field due to thin charged sheet, obtain net field intensity in between and outside the two identical and oppositely charged plane sheet of large size and surface charge density and – respectively. Is this field uniform or non uniform in between the two sheets and draw the filed lines pattern. Also calculate the magnitude of force with which two sheets attract each other in terms of given values assuming that surface area at one side of each sheet is A.

44. An electron and proton are placed at two different points in a region between these two identical and oppositely charged sheets in previous question, what are the direction and magnitude of forces on these particles.

45.Calculate the net flux passing through a closed Gaussian surface, inside that (i)an electric dipole is placed (ii)Charged capacitor is placed.

46. Using gauss theorem deduce an expression for electric field intensity at a point situated normally at a distance r from a thin straight long charged wire of linear charge density and length l. Show the field lines pattern of the charged wire and draw the graph for variation of field intensity with distance r .Evaluate the total electric flux coming out from the Gaussian surface which you have drawn for the purpose to find electric field.

47. Write an expression for the electrostatic force acting on a point charge -q placed at a normal distance b from a thin positively charged wire of linear charge density . If this charge starts revolving round this wire in a circular orbit of radius b, calculate the speed and kinetic energy of this particle, draw the graph between the K.E of the charged particle with increasing linear charge density.

48 Two charges -2Q and +Q are placed at points (a, 0)and (4a,0) respectively. Using Gauss theorem,calculate the electric flux through two spherical surfaces of radii 3a and 5a respectively with their centre at origin.

49. Obtain an expression for electrostatic potential energy of an electric dipole of dipole moment P placed in a region of uniform electric field intensity E.Indicate the most stable and most stable equilibrium position in this field .How much is the work done in rotating the dipole with uniform angular speed between above two positions.

Chap 2: Electrostatic Potential and Capacitance

1. Define electric potential at a point . Do we always require a reference point where potential is assumed to be zero to define the potential at a point. Is the potential a vector or scalar quantity, justify it. State its unit and dimension. Obtain an expression for electric potential at a point situated at a distance r near a point charge +Q. What is the significance of positive value of this potential.
2. Show the variation of electric potential with distance r froma point charge. Compare this variation graphically with the variation of electric field at the same point due to same charge.Does the potential rises or falls along the direction of field lines.
3. Using an expression for electric potential at a point due to a point source charge, obtain an expression for electric potential at some general point of an electric dipole. Show the result in terms of position vector of that point from the center of dipole. Use this expression to obtain potential at an axial and equatorial point of same dipole.
4. A small electric dipole is placed along x axis at the origin. Draw the graphs for variation of field and potential at axial point with distance r from the center of short dipole. Electric field intensity and electric potential at an axial point at a distance x=r from the centre of short dipole are E and V respectively, then find the values at a distance x=2r.
5. Define the term potential gradient. Is it a vector or scalar quantity. Obtain a relation between electric field and potential gradient. What is the significance of negative sign in this relation. Using this relation state why electric potential is uniform or constant inside a thin charged conducting shell. Plot the variation of electric potential with distance r from the centre of charged shell.
6. If a charged solid conductor is placed inside the cavity of another hollow uncharged conductor and the two are connected through a connecting wire.Then, show that charge will necessarily flow from inner conductor to outer conductor. Can we use this idea to discharge a charged body.
7. Explain why electric field inside the charged solid conductor is zero and it is normal to the surface outside the conductor. Is the potential continuous or discontinuous across the surface of a charged conductor. What will you guess about electric field regarding this.
8. Define equipotential surfaces.State four important properties of equipotential surfaces. Why the equipotential surfaces are always perpendicular to electric field lines and why two such surfaces can not intersect each other.
9. Draw the equi potential surfaces and field lines pattern of the following: (i)an isolated point charge Q if Q>0 and Q<0, (ii) A pair of two like and unlike charges of same magnitude Q. Explain why the distance between equipotential surfaces is changed in between and outside region the two charges in the pair of two like and unlike charges.
10. State the position of three possible points where electric potential is zero on the line and outside the line joining two charges system +Q and -4Q placed at a distance 2a apart.
11. Four point charges +2Q , - Q , -2Q and +3Q are placed at the four corners of a square of side a .Calculate net electric field intensity and electric potential at the centre of this square. How much work is to be done in moving another point charge –q from infinity to the centre of this square.
12. Establish a relation for work done by an external agent in carrying a charge q from point A to B with constant speed in an electric filed region is equal to the product of charge and potential difference between these two points. Explain how the work done by the field and external agent are related with each other. Relate the units of different physical quantities used in this relation and hence define 1eV.
13. An electron and a proton are released from rest in a region of uniform electric field, explain which charge moves from high to low potential and which one from low to high potential. Do their potential energy increase or decrease in the two cases.If these are accelerated from rest through same potential difference,find which has greater final speed and and which has greater final K.E.
14. Obtain an expression for electrostatic potential energy of a system of two isolated like point charges Q_1 and Q_2 when placed in an electric field region of each other at a distance R apart.If the pair of these two charges were an electron and a proton, now justify if the distance between these two is increased whether the potential energy of the system of two charges increases or decreases, explain.
15. Obtain an expression for electrostatic potential energy of a system of two like point charges Q_1 and Q_2 in a region of external uniform electric field. Use this expression to find potential energy of an electric dipole in same field, assuming that both the charges of dipole are brought together in the field region.
16. Consider two conducting spheres of radii r_1 and r_2 where $r_1 > r_2$, are charged to same potential find the ratio of their (i) charges (ii) surface charge densities (iii) electric field intensities on the surface .If these spheres are connected through a wire, will there be flow of charges through the wire and in which direction.
17. (a) Does the electric potential energy of a system containing two point charges depend upon the choice of reference point where it is assumed zero. Explain the effect on the value of final potential energy if choice of reference point where potential is assumed to be zero is not infinity but at some nearby point with in the field.

    (b) Does the potential energy of two protons increases or decreases if the distance between them is increased. What about a pair of an electron and a proton.
18. Can a single conductor be a capacitor,what do you mean by it's capacitance. How you can increase it's capacitance

without increasing it's charge. Define S.I unit of capacitance.

19. State the working principle of a parallel plate capacitor. Show graphically how does the charge stored by capacitor varies with (i)applied potential difference, if capacitance is constant (ii) it's capacitance if applied potential difference is constant.

20. Derive an expression for capacitance of a parallel plate capacitor when the medium between the plates is (i) air (ii)a mica slab of dielectric constant K and thickness t (iii) a copper slab of thickness t=d/2. Also draw the electric field lines pattern between the two plates with medium inside the plates are as above.

21. Define dielectric constant of a medium in terms of capacitance of a parallel plate capacitor. Explain why the capacitance is increased on filling a dielectric medium. If the lower half of a parallel plate capacitor of capacitance C_0 in medium air is filled completely with a dielectric medium of dielectric constant 4. Find it's new capacitance in terms of C_0.

22. Obtain an expression for equivalent capacitance of three capacitors connected in series or in parallel, state which physical quantity remains same across each capacitor and which is distributed in case of series and parallel combination .If capacitances of these capacitors are C_1 ,C_2 and C_3 where $C_1 > C_2 > C_3$ and net capacitance is assumed C in each case ,then compare the value of C with C_1 , C_2 and C_3 in each combination.

23. Derive an expression for energy stored by a capacitor using Q-V graph or otherwise and define the significance of factor ½ in this expression .Name the field where this energy is stored . Obtain an expression for energy stored in unit volume between the two plates. Draw the graph for variation of energy stored with it's increasing capacitance for (i)an isolated charged capacitor(ii)Capacitor is connected across a battery.

24. Show that only 50% of total energy supplied by the battery to a capacitor is stored in the capacitor and justify where the remaining part of this energy is used. Show that total energy remains conserved in both series and parallel combination of capacitors.

25. What is the effect on energy stored and electric field between the plates of a parallel plate capacitor if it's plates are moved further apart by an external agent in the given two condition (i) after disconnecting the capacitor from battery (ii) battery remains connected.

26. Calculate the ratio of potential difference that must be applied across series and parallel combination of two identical capacitors so that total energy stored by two combination is same.

27. Two plates of a capacitor each of area A and possessing a charge Q are placed at distance d apart in a medium air, find the value of (i) electric field in between the plates and in the outer region (ii) show that force between the two plates is 1/2QE,what is the significance of the factor ½ in this expression.

28. Two plates of a parallel plate capacitor are at distance 4mm apart. A dielectric slab of thickness 3mm and dielectric constant 4 is placed between the plates, then distance between the plates is so adjusted that new capacitance is increased to 2/3 times of original capacitance, find the new distance between the plates.

29. Two capacitors with same plate area and distance between the plates. One having the medium air and other filled with dielectric of relative permittivity 4 are connected in series with a D.C supply, find the ratio of charge, voltage, electric field between the plates and energy stored by these capacitors. What shall be the answers for the these parts if these are connected in parallel across the same supply.

30. A capacitor of unknown capacitance C when connected across a supply of V volt, charge stored by it is 360μC. If the new potential difference is reduced by 120 volt then charge stored by it becomes 120μC. Find the voltage V and unknown capacitance.

31. A capacitor of capacitance C_0 connected across a supply of V_0 volt .It is now disconnected from the battery and distance between the plates is doubled. Discus the effect on charge stored, voltage, electric field between the plates and energy stored by the capacitor.What are the effects on the same physical quantities if given changes are made keeping the battery connected.

32. A capacitor of capacitance 2μf is connected across a battery of E.M.F 15 volt .It is now disconnected from the battery and connected across an uncharged capacitor of capacitance 3μf. Find the common potential, new charge on each and energy loss in this process.

33. What values of different net capacitances one can obtain using all the three capacitors of capacitances 2 μf, 6 μf and 12 μf connected together in different combinations.

Chap 3: Current Electricity

1. (a)Name the charge carriers in each of these:copper,silicon, ionized gas and Hg at very low temperature.

   (b)Electrons are continuously in motion through a conductor even then there is no current through a conductor until a cell is connected across the conductor, explain why
2. If electrons drift in a metallic conductor is from lower to higher potential, does it mean all the electrons in conductor are moving in same direction. Electrons drift speed is very small even then current is established in a long circuit immediately the circuit is closed, explain why
3. What are the nature of path of free electrons in a metal conductor in the presence and in the absence of electric field across the conductor. Force due to electric field should accelerate electrons in a conductor then why do all the electrons have an average drift speed only. Electrons are always in motion in a conductor. Why there is no current through it,explain.
4. Is the relation V=I R always ohm's law, if not explain in what cases it does not follow Ohm's law. Is this law applicable for all conductors of electricity.State three limitations of ohm's law and explain why the V-I curve deviates from straight line at higher value of current
5. Draw two I –V graphs for(i) a conductor at two different temp.Which graph shows higher temp. (ii)If drawn for two identical conductors,one made of copper and other of nichrome. Which graph is for copper wire.(iii) for series and parallel combination of two resistances, which one shows parallel combination.
6. Draw I-V graph for some specific semiconductor Ga-As, identify the region in which graph follows ohm's law, shows positive resistance, negative resistance. Why and which type of materials should be used for making standard resistance wire used in meter bridge and potentiometer.
7. A copper and a nichrome wire of same thickness also have same resistance, verify which wire is longer. state the two factors due to which we prefer nichrome as a standard resistance wire.
8. Define emf of a cell,state it's S.I unit. Can we find emf of a cell accurately using voltmeter, if not state the reason. Name the factors on which emf of a cell depends. Name the instrument which you will prefer to measure it and why. State the reason why the voltmeters have high resistance and ammeters have low resistance.
9. State the condition when terminal voltage across a cell is less than it's emf. Plot the variation of this potential difference across the cell with the increasing current drawn from the cell,increasing load resistance.Mark the intersecting points of these graphs on X and Y axes
10. A wire connected to a cell of constant emf. If the wire is stretched to increase it's length by 200%. Calculate change in it's resistivity and resistance,drift speed and current density.
11. State the principle of working of meter bridge. Why do we use thick metal copper strips for connection between two resistance in meter bridge experiment. How you will use this instrument to find specific resistance of a wire.
12. Is the measurement of unknown resistance using meter bridge more accurate than ohm's law, explain why What is zero error in meter bridge experiment, how do we minimize this error.Why we can not find very high or very low value of resistance using meter bridge.
13. Describe Kirchhoff's current and voltage law, and state the principle of their working. Use the voltage law to find terminal voltage across a cell of emf E and internal resistance r connected to a variable load resistance R. Also plot the graph between these two.
14. Mention the two important precaution and one limitation while performing meter bridge experiment. State the condition when meter bridge is most sensitive. Why we prefer balance point at the middle of meter bridge wire What is the effect on the balancing length if the diameter of meter bridge wire is doubled.
15. State the principle of working of potentiometer.Why emf of driver cell should always be greater than experimental cell. Why the potentiometer wire should have uniform thickness and resistivity. Why the current through this wire should not be passed for long time
16. Drawing the circuit diagram compare the emfs of two cells using potentiometer. Plot a graph between l_1 and l_2. What does the slope of this graph indicate.
17. Define the term drift velocity, mobility and relaxation time of electrons, how these are changed with rise in temp and potential difference applied across the conductor.
17. Why does a heater wire becomes hot when current is passed through it and no heat in the wires used in electrical fittings. When does a cell of emf E and internal resistance r supplies maximum output power across a load resistance R. Find the value of this maximum power.
18. Establish a relation between current and drift speed hence show that current density is directly proportional to drift speed. Explain why the average speed of free electrons remain constant, even if these are accelerated by applied electric field.
19. Derive an expression for drift speed in terms of relaxation time. State how does drift speed of free electrons is changed if potential difference applied across a given conductor is doubled
20. Deduce ohm's law in vector form.Obtain an expression for resistivity and resistance of a conductor .State the factors on which resistance and resistivity of a conductor depend.
21. A conductor of length L is connected across a supply of V volt, if supply voltage remains unchanged, then discuss the effect on Free electron density, resistance, resistivity,

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current, current density, drift speed of electrons and electric field across the conductor length of conductor is doubled by stretching it (ii) another conductor of double the original length is connected

22 . Explain the term resistivity of a conductor.Give its S.I unit. How and why the resistivity of conductors and semiconductors vary with temperature. Show graphically the variation of resistivity of these with rise in temperature.Write an expression for variation of their resistivity with temperature.

23. State how does the product of resistivity and conductivity does not change with temperature. Define the term temperature coefficient of resistance on the basis of resistance –temperature graph and give the sign for temp coefficient of resistance of copper carbon and constantan

24. Three conductors of conductanceG_1, G_2 and G_3 are connected in series and parallel respectively, find their equivalent conductance in each combination.

25. Two cylindrical conductors of same length, one solid of radius r and other hollow of inner radius r and outer radius 2r are made of same material, compare their resistances.

26. Two wires made of same material with their length in the ratio of 1:2 and diameters in the ratio of 2:3 are connected in series and in parallel respectively across a D.C source, find the ratio of drift speed of electrons, current in these wires and the ratio of heat produced in them.

27. A wire is of resistance 6 ohm is given to you, how much length of another wire of resistance 36ohm/m must be connected across 6 ohm wire so that net resistance of combination is 4 ohm

28. Three wires made of same material and thickness have their length in the ratio of 1:2:3.If these wires are connected in parallel across a D.C supply, find the ratio of current passing through these.

29. Write the colour code of these carbon resistances :2.5±10% ohm, 230±5% K Two electric lamps rated at 100W, 220V and other200W 220V. Find the ratio of their resistance, also calculate the ratio of heat produced when these are connected in series and in parallel across 220V supply.

30. Is the internal resistance of a cell a defect of this cell Verify that to draw large current from a low voltage supply it's internal resistance should be small. Mention the factors with which internal resistance of a cell varies.

31. A cell of emf E and internal resistance r is connected to a load resistance R, obtain an expression for terminal voltage of this cell in terms of these and show graphically the variation of terminal voltage and emf of cell with increasing load resistance R. At what value of R in terms of r terminal voltage is equal to half of it's emf and equal to it's emf.

32. A cell of emf E ,internal resistance r is connected across a load resistance R. Obtain an expression for current drawn from the cell with varying load resistance R.Plot the graph between these two.

33. A combination of n identical resistors each of resistance r,are connected in series to a cell of emf E and internal resistance r, current supplied by the cell is I. If these resistors are connected in parallel to the same cell then current through the cell is increased to 10 times, find the value of n.

34. Two cells of emf E_1 and E_2 different internal resistances r_1 and r_2 are connected in series and in parallel respectively across an external resistance R.Obtain an expression for equivalent emf and internal resistance of the combination.

35. A series and parallel combination of two resistors is connected across a cell one by one, verify mathematically that in which case potential difference across the cell will be a high value.

36. Four identical cells each of emf 2V and unknown internal resistance are connected in parallel and this combination is connected across a parallel combination two 5 ohm resistances. An ideal voltmeter connected across the cells reads 1.5 volt. Drawing the circuit diagram calculate the value of internal resistance and the current passing through each cell and each 5 ohm resistance.

37. Four identical cells each of emf 2V and internal resistance 1 ohm are connected in series inside a battery. Draw the variation of potential difference across the battery versus current drawn from the battery and mark the intercepts on X and Y axes.

38. Using Kirchhoff's laws to obtain balance condition of wheat stone bridge in terms of four resistances, explain why no current flows through galvanometer when bridge is balanced. What is the effect on the reading of galvanometer if cell and galvanometer are interchanged at balance position in meter bridge experiment.

39. Drawing the circuit diagram explain how will you use balance condition to find unknown resistance and specific resistance of a wire in laboratory. Why do we say that unknown resistance using meter bridge is more accurate when it is calculated mean of values found by connecting it across both left and right gap Can we have one more balance point on a meter bridge wire if the left and right gap resistances are interchanged.

40. In a meter bridge experiment with left and right gap resistances R and S ohm with R>S,balancing is found at a distance l from left end of meter bridge wire, what is the effect on the reading of galvanometer if(i) left and right gap resistances are interchanged (ii) Position of cell and galvanometer are interchanged (iii) Another similar wire of resistance R is connected in series with resistance R (iv) Another similar wire of resistance S is connected across resistance S.

41. In a meter bridge experiment with unknown resistance in left gap and 3ohm resistance in right gap balancing is obtained at a distance 40 cm from left end of meter bridge

wire of resistance 0.1 ohm/cm, a battery of emf 6V and internal resistance 2 ohm is connected across meter bridge wire. Drawing the circuit diagram find the value of unknown resistance and the current drawn from battery at balancing condition.

42. In a slide wire bridge experiment with left and right gap resistances R and S, balancing is obtained at a distance at a distance 30cm from left end. If left and right gap resistances are interchanged balancing is obtained at a distance 120cm from left end, find the value of R/S and length of whole wire of this device.

43 Mention the two possible causes when one sided deflection is obtained in galvanometer in potentiometer experiment while balancing a cell across potentiometer wire. Why do we connect high resistance box in series with experimental cell, does the resistance of this resistance box affect the balance point.

44. Why a potentiometer of long standard resistance wire is mostly preferred to increase it's sensitivity. State why high resistance wire can also be connected in series with potentiometer wire to increase it's sensitivity.

45. A potentiometer wire of length 10m and resistance 20 is connected in series with a wire of unknown resistance and a cell of emf 3 V. Answer for the following parts (i) what should be the value of series resistance so that potential gradient along the wire is 2μv/mm. (ii)What should be the emf of experimental cell which is balanced across 600 cm length of this wire (iii) If the experimental cell is shunted by a resistance of 5 then new balancing length is reduced to 400 cm, calculate internal resistance of experimental cell.

46.Two cells of emf E_1 , E_2 and internal resistances r_1 , r_2 are connected in series and in parallel respectively, obtain an expression for equivalent emf and internal resistance of the combination.

Chap 4: Moving Charges and Magnetism

1. Name the fields which are produced by charge at rest and the charge in uniform and non uniform motion.
2. Write an expression for Biot-savarts law in vector form for magnetic field intensity due to a current carrying element and by a moving charge.
3. A straight long horizontal wire carries a constant current of 5 amp due east.Find the direction and magnitude of magnetic field at a distance 10 cm above and below the wire in same vertical plane.
4. Two straight long parallel wires carrying current of I and 2I in same direction are placed 20 cm apart. At what point lying in between two wires net field intensity will be zero.
5. Obtain an expression for magnetic field intensity or magnetic induction at an axial point of a current carrying circular loop of N coplanar turns with each turn of radius R.Explain how this field at far points is similar to electric field at an axial point of a short electric dipole. Use the result to find magnetic field at the center of this loop.
6. Draw the magnetic field lines pattern of a current carrying circular loop of N turns. How will you justify that loop behaves as a magnetic dipole. Write an expression for dipole moment of this loop and mention it's direction also.
7. Calculate the distance x from the centre of a circular loop of radius R, at which magnetic field intensity is reduced to 1/8 times of it's value at the centre.
8. A current carrying circular loop of one turn is transformed into smaller loop of two turns and passed same current, find the ratio of magnetic field at their centers.
9. Show that magnetic field intensity at far axial points of a current carrying loop is similar to a short bar magnet at far axial point of this magnet.
10. A circular coil of N turns with each of diameter D is transformed into another coil of diameter 2D, If these coils are passed same current, what will be the ratio of magnetic field at their centers and the ratio of magnetic moments.
11. Two circular loops of radii 3cm and 4cm are placed coaxially at a distance7cm between their centre, if net field intensity is zero at a point situated at a distance 4 cm from the centre of smaller loop on the line joining their centre, then find direction and magnitude of current in the bigger loop if it is 1 amp in smaller loop.
12. Two circular coils each of radius R and carrying same current I are placed concentrically in two mutually perpendicular planes.Calculate direction and magnitude of net magnetic field at their common centre.
13. Two circular loops each of radius R and N turns are placed coaxially at a distance 2R between their centers. Calculate the magnitude of net field at the center point of the axial line, if direction of current appears to be same, opposite when observed from the mid point on their common axis.
14. Why do the magnetic field lines form closed loop, justify your statement.Must every magnetic field has north and south pole, if not; give example of such fields.
15. Do the magnetic field lines can also be stated as magnetic lines of forces like electric field lines which can also be also be stated as electric lines of forces. Give one similarity and one dissimilarity between the two fields.
16. Write an expression for vector form of Lorentz force in uniform electric and magnetic field. Use this expression as a velocity selector. What should be the possible directions of electric field, magnetic field and the velocity of positive charge for this to happen. Establish the relation between these.
17. Write an expression for Lorentz force in uniform magnetic field in vector and in scalar form. Define S.I unit of magnetic field using this expression. Which two pairs of vectors are always mutually perpendicular in this expression and state why the magnetic field can not change the speed of the charged particle.
18. If an electron passing through a region of uniform magnetic field is not deflected, are you sure that there is no magnetic field. Use an expression for Lorentz force to show this phenomenon.
19. Name all the possible trajectories of a charged particle moving in a region of uniform magnetic field. State the condition when trajectory of the particle is circular Calculate it's radius and time period.
20. A proton of charge e and mass m accelerated from rest through a potential difference of V volt is moving along X axis in a region of uniform magnetic field along Y axis. Calculate radius of it's path and frequency of revolution in terms of these values and name the plane in which this circular path lies.
21. An electron moving vertically downward in a region of uniform horizontal magnetic field is deflected towards west, give the possible direction of magnetic field. Describe the nature of it's trajectory.
22. An alpha particle and a proton are accelerated from rest through same potential difference of V volt in a normal uniform magnetic field region. Find the ratio of their final speed, K.E, radii of path and frequency of revolution.
23. An alpha particle moving along vertically upward direction with speed v passes un deflected through a region of two mutually perpendicular uniform fields, If the magnitude of electric field is E along horizontal east direction then give the direction and magnitude of magnetic field in terms of these quantities.
24. Two particles of masses m and 4m and charges q and 2q moving in uniform normal magnetic field region experience the force in the ratio of 1:2, Find the ratio of their speeds and the radii of their circular path. (ii)What is the work done by the field on both the particle.

25. An alpha and beta particle moving with same speed enter in a region of normal uniform magnetic field,draw the trajectory followed by these particles,verify (a) which particle experiences more force, (b) which describes the circle of smaller radius (c) which one will have less frequency of revolution and (d) which one will have more K.E.
26. Define the term magnetic dipole moment of a current carrying loop, is it a vector or scalar quantity, give it's S.I unit and the direction. Magnetic field and magnetic moment is produced by a charge in motion, can a neutral atom also produce some magnetic moments,explain.
27. Obtain an expression for direction and magnitude of magnetic moment produced by an electron of mass m moving with speed v in an orbit of radius r, also relate it with angular momentum L of electron. Give the significance of negative sign in this relation.
28. Explain the direction and magnitude of Bohr's magnetron . How does this moment change along a path of constant radius if (a) frequency of revolution of electron is doubled, (b) linear speed of revolution of electron is halved. In place of electron, another particle muon revolves, which is 200 times heavier than electron, then how does magnetic moment change in comparison of electron.
29. A wire of length 12a is wound in the shape of an equilateral triangle, a square and a regular hexagon and passed same current I through each shape. Calculate magnetic field intensity at the centre and magnetic moment associated with each figure.
30. A long solenoid of length L and closely wound N turns with each turn of area A is passed a current I through it ,using Ampere's law derive an expression for magnetic field intensity at the center of solenoid along it's axis. State how you can make field inside the solenoid further stronger. If a Cu bar and a soft iron bar are inserted respectively inside the solenoid or toroid, will the net field be now more or less than in air in two cases.
31. Draw the magnetic field lines pattern of a solenoid and explain how these field lines differ from an electric dipole. State why this solenoid acts like a magnetic dipole and give the direction and magnitude of it's dipole moment.
32. Show that magnetic field at far axial point of this solenoid can be analogous to magnetic field at far axial points of a short bar magnet. Compare the field produced by these two.How does the field produced by solenoid is used in medical science for diagnosis and in making temporary and permanent magnet.
33. Use Ampere's law to find magnetic field inside and outside the core of a toroidal solenoid. In what respect magnetic fields of solenoid and toroidal solenoid are different.Write an expression for their magnetic dipole moment Why the magnetic field lines are completely confined with in the toroid but not in solenoid .Draw the field lines pattern of these two and write an expression for it's magnetic dipole moment.

34. Using Ampere's law to calculate magnetic field intensity inside, outside and on the surface of a thick current carrying long wire of radius a carrying current I, distributed uniformly across the area of cross section of this wire. Will the field be zero on the axis of this wire or not. Plot a graph for the variation of this field with distance from the axis of the wire.
35. Use the above results obtained from Ampere's law, to find magnetic field at a distance a/2 above and below the surface of a thick wire of radius a passing a constant current through it .Explain how these results are modified if the wire is very thin and straight long wire.
36. A current carrying circular loop is placed in a region of uniform magnetic field,obtain an expression for the direction and magnitude of net force and torque produced on the loop. Explain the role of it's torque, Can this external field may turn the loop around itself due to the torque produced on it.
37. A current carrying irregular shape loop made of flexible wire is placed in a region of uniform magnetic field .Why the shape of loop becomes circular .If the loop is free to turn in the field , then in what orientation of loop it will be in stable equilibrium in this field. Show that in most stable equilibrium position flux passing through the loop due to it's own field and due to external field becomes maximum.
38. Two loops one of circular shape and other of square shape respectively are made from same wire and passed same current in a region of same uniform magnetic field .Which loop will experience greater torque, what is the net force on each loop.
39. Obtain an expression for potential energy of a current carrying loop placed in uniform magnetic field. In which position of this current carrying loop placed in uniform magnetic field, torque produced on it is maximum, minimum. In which position loop is in most stable and in most unstable equilibrium.Calculate the work done in rotating it between these two positions.
40. Using an expression for Lorentz force on a moving charge in uniform magnetic field, derive an expression for the force acting on a current carrying straight wire of length L placed in uniform magnetic field B in vector form and also write an expression for the magnitude of this force. Mention the rule to find the direction of this force and state the condition when this force is maximum, minimum.
41. Write an expression for Lorentz force on a current carrying wire placed in uniform magnetic field. Use this expression to find the direction and magnitude of the force per unit length between two straight long parallel current carrying wires carrying current in same and in opposite direction respectively.Define 1ampere using these results.
42. A straight long horizontal wire of length L, linear mass density carrying a current I through it, is found at equilibrium in a region of uniform magnetic field B, give the direction and magnitude of this field in terms the given values. Some mass is suspended from a helical spring,

what will be the position of this mass if some direct or alternating current is passed through this spring.

43. State the principle of working of moving coil galvanometer and show that in radial magnetic field deflection produced is directly proportional to current passing through galvanometer coil. Explain why the radial field is required and how this field is produced.

44. State the reason why the galvanometer cannot be used to measure current and high voltage without modifications in it. Why it is unable to measure alternating current.

45. Mention the pre information which is required to convert a galvanometer into ammeter and voltmeter. Show these modifications with the help of a circuit diagram and evaluate the range of these conversions. Give the value of net resistance s of these conversions in terms of resistance of galvanometer coil Rg.

46. Calculate the maximum range of ammeter and voltmeter formed by using galvanometer, if the current passing through galvanometer at full scale deflection is Ig and resistance of galvanometer coil is Rg. State, out of the milliammeter and ammeter which has less net resistance explain.

47. Explain the terms current and voltage sensitivity related to galvanometer, relate these and suggest how you can increase these. Show that increasing the current sensitivity, does not necessarily increase voltage sensitivity. If current sensitivity of a galvanometer is increased by 50% and resistance is increased to 2 times, state how does it affect it's voltage sensitivity.

48. A moving coil galvanometer of resistance 100 ohm gives full scale deflection when a potential difference of 10mV is applied across it, explain necessary modification in it to measure a maximum current of 5Amp and a maximum potential difference of 2 volt.

49. If you are given two galvanometers and two wires of resistances R_1 and R_2 where$R_1 > R_2$, draw a circuit diagram of ohm's law using these galvanometers as ammeter and voltmeter.

50. An ammeter of resistance 0.8 ohm can measure a current upto 1amp.How will you make it capable to measure a current of 5amp. What is the net resistance of the combination.

51. A galvanometer coil of resistance 78Ù and total 75 divisions shows a deflection of 10 divisions per mA. Calculate the resistance of shunt required to convert it into an ammeter of range 0.3 A. Evaluate the term figure of merit of galvanometer.

52. Explain the principle, construction and working of cyclotron . Evaluate an expression for cyclotron frequency and show that it is independent of radius and speed of the charged particle.

53. Explain the role of mutually perpendicular electric and magnetic field to energize the charged particle in a device cyclotron .Which out of these two fields can increase the speed of the charged particle What is resonance condition in cyclotron, how this condition is used to energize the charged particle.

54. If a cyclotron of frequency 2GHz is used to energize a proton, calculate (i) how many times in 1 sec it energizes the proton (ii) if a potential difference of 5mV is applied between the two Dees calculate the gain in KE in I sec.

55. Obtain an expression for final KE of a charged particle in terms of radius of Dees and magnetic field intensity in cyclotron . Is there an upper limit for this energy, explain

56. If an alpha particle and a proton are released from the center of Dee, can both be accelerated with same cyclotron frequency? if not, which physical quantity is changed for these two .Write two uses and two limitations of cyclotron.

Chap 5: Magnetism and Matter

1. Explain why and how the path of parallel magnetic field lines(uniform magnetic field region) are changed when a diamagnetic,paramagnetic and ferromagnetic materials are placed in this field region, show the change diagrammatically.
2. Which magnetic property of dia,para and ferromagnetic materials distinguishes their behaviour in uniform magnetic field region. What is the basic difference between the atoms of these material. Explain why the elements with even atomic number are most likely to be diamagnetic.
3. Give two example of each type of magnetic material and also explain their behaviour in uniform and non uniform magnetic field region .
4. What is meant by susceptibility of magnetic substance .A soft iron bar is placed in side a current carrying solenoid, obtain the relation between relative permeability and susceptibility for this arrangement.
5. Point out the differences between dia, para and ferromagnetic materials on behalf of their relative permeability and susceptibility .Draw the graph between intensity of magnetization and magnetizing field for dia ,para and ferro magnetic substances, which magnetic property is represented by the slope of the graph, which material shows positive and which shows negative slope.
6. Out of two materials Fe and Cu which has greater susceptibility. Show the variation of susceptibility with temperature for each dia ,para and ferro magnetic material. Explain why susceptibility is independent of temperature for diamagnetic and increases on cooling the paramagnetic substances.
7. Draw the modified field lines patterns when metal pieces of copper, nickel, antimony, aluminum and mercury at very low temperature are placed in a region of uniform magnetic field.
8. Identify the types of magnetic materials and state their two properties whose magnetic susceptibility are 2.6×10^{-5} and -1.4×10^{-6} respectively .
9. What are the three properties of materials required for making temporary (electromagnet) and permanent magnet. Which magnetic property should be high common value in both of these.
10. What are the efficient ways to prepare temporary and permanent magnet . Why do we call these by the name of temporary and permanent.
11. Explain why steel is preferred for making permanent magnet and soft iron for electromagnet. Draw the field lines pattern of bar magnet and solenoid and compare these.
12. A bar magnet of magnetic moment M is divided in to n equal parts perpendicularly to it's length , will each part be a magnet and what will be the new magnetic moment and pole strength of each part.
13. A bar magnet of length L and pole strength m is cut into two identical parts along it's length .Find new pole strength and magnetic moment of each small part. These two parts are now joined to form a cross, find the direction and magnitude of net magnetic moment of this combination.
14. If the two identical magnets of same magnetic moment are placed one over other in a way such that their opposite poles are together .Calculate net magnetic moment of the system.
15. A bar magnet of magnetic moment M is placed in uniform magnetic field, obtain an expression for the direction and magnitude of the net force and torque produced on it. Discus the role of this torque.
16. The same magnet placed at equilibrium position in uniform magnetic field is slightly rotated about it's normal bisector line from the direction of field and released, show that it will execute S.H.M, obtain an expression for time period of it's oscillation if it's moment of inertia about given axis of rotation is I.
17. If you are given two identical metal bars, where only one of them is a magnet how will you identify that which one is magnet. If both of these bars are magnet, with one stronger and other weaker, how will you identify which one is stronger.
18. Earth's core contains iron at very high temp, why it is not considered as the source of magnetism. If the magnitude of earth's magnetic field at a point on the earth's surface in magnetic equatorial plane is 0.3G.Calculate magnetic moment of the induced inner short magnet of earth, given radius of earth is 6400Km.
19. Name and define three elements of earth's magnetism. What is the value of angle of inclination, horizontal and vertical component at magnetic equator and poles if intensity of earths magnetic field at these places are considered same equal to B_e.
20. At which places on earth, a freely hanged bar magnet or a needle of a dip circle compass will be aligned in vertical direction and why. In which direction this needle will align when same compass is placed horizontally at these places.
21. If the horizontal component of earth's magnetic field at a place is equal to vertical component. In which direction would a compass needle be aligned at this place if it is free to rotate in vertical, horizontal plane.
22. A permanent bar magnet of coercivity 4×10^3 amp/m is desired to demagnetize it by placing inside a solenoid of length 12cm and 60 turns. Find how much current should be passed through solenoid.
23. A short bar magnet of magnetic moment 2 Amp-m^2 gives a neutral point at a distance 10 cm from the center of short magnet. Calculate horizontal component of earth's magnetic field.

Chap 6: Electromagnetic Induction

24 .Give the S.I unit and define the term magnetic dipole moment, pole strength and intensity of magnetisation.

1. Explain faraday's laws of electromagnetic induction .State the ways with which induced emf in a single turn conducting loop can be increased when the N pole of a bar magnet is carried away from the loop placed along the axis of magnet.
2. Two identical loops one of copper and other of nichrome are removed from the same uniform magnetic field region in same time interval. Explain in which loop induced emf be more and in which loop induced current be more. Explain how this emf is different from emf of a cell ,give two points in support of your answer.
3. (a) Explain the modification done by Lenz law in Faraday second law. Why the induced emf is called back emf .State how does it explain law of conservation of energy.

   (b)Determine the factors on which total charge passed through a conducting circular loop of N turns and resistance R depends when flux passing through it is changed by an amount in time interval t.
4. Define magnetic flux and its S.I unit. Is it a vector or scalar quantity. A coil of N turns with each of area A is placed in a region of normal uniform magnetic field of flux density B.Discuss the position of coil when flux passing through it is half of maximum value.
5. Discus the various ways to change the flux for the purpose of induce emf in a closed circuit. In what way magnetic flux is different from electric flux, give the two points in support of your answer.State the result of Gauss theorem in magnetism.
6. If the Instantaneous current i_t =6 cos100 t is passed through an inductor of inductance 4mH obtain an expression for instantaneous emf. Also calculate it's inductive reactance and maximum value of induced emf across it.
7. A circular coil of N turns each of area A is placed in a region of normal magnetic field .Give the position of coil when and calculate the magnitude of maximum and minimum flux passing through the coil.Calculate the change in flux and total charge flown when the loop from the position of maximum value of flux is rotated by 180^0 in time interval t.
8. What are called eddy currents ,write it's two advantages and one disadvantage.State how do we decide the direction of these currents. How these currents are helpful in moving coil galvanometer.
9. Derive an expression for induced emf across a conductor of length L, if it is moved with uniform velocity v in a region of normal uniform magnetic field B.Which end of the conductor is at higher potential according to your figure. Is there any emf induced if conductor is moved parallel to the field, if not then why.

10. A conductor of length L, fixed at one end is rotated uniformly with angular speed in region of normal uniform magnetic field B in normally inward direction. Obtain an expression for induced emf across the conductor and mention the rule to find the direction for induced emf.
11. A wheel consisting of N metallic spokes each of radius R is rotated with constant angular speed in a region of normal uniform magnetic field of intensity B_0 . Obtain an expression for the induced emf between axle and rim of the wheel. How will you determine the direction of induced emf.
12. A metal disc of radius 10 cm is rotated about it's axis with angular speed 6 rad/sec in a region of normal uniform magnetic field of flux density 1.5 weber /m^2. Find emf induced between centre and circumference of this disc.
13. A circular coil of N turns with each turn of area A is placed in a region of normal magnetic field varying with time t as B= B_0 cos t, obtain an expression for time varying induced emf across the two ends of this coil. If the coil has resistance R ,find the maximum current induced through it.
14. A coil is removed from the magnetic field region rapidly and slowly respectively, in which case more emf is induced and why. In which case more work is done. Compare the total charges flown in each case .
15. A horizontal wire of length 1.5m along east-west direction is falling with speed 10m/s at some moment. If earth's magnetic field intensity in that region is 0.4G and angle of dip is 30^0. Then find(i) the emf induced across two ends of the wire(ii) which end of the wire is at higher potential.
16. Define self induction Explain S.I unit of self inductance. Why a solenoid is called an ideal inductor. Derive an expression for self inductance of a solenoid of length L with n turns per unit length, when the inner medium is air and when the medium is an iron core. Is the experimental value of self inductance more or less than above calculated value. Give some experimental use of an iron cored inductor.
17. Obtain an expression for total energy stored in an inductor and the energy stored per unit volume. Show graphically how does the flux passing through inductor and energy stored by it varies with increasing current flowing through it. Name the field where this energy is stored.
18. Current passing through an inductor of inductance 2mH varies with time as $I = 2t^2+4$. Show the graphical variation for induced emf vs time and find instantaneous emf at time t=2 sec.
19. Show an experimental way to produce eddy currents with the help of an a.c source.How these currents are minimized in transformer cores. How these eddy current produce damping in metal plate oscillating between two magnetic poles.

20. (a) Define mutual induction, state S.I unit of mutual inductance .State why do we say that mutual induction is not possible without self induction.

(b) Find the mutual inductance of a pair of two coaxial solenoids of same length L and with different number of turns per unit length n_1 and n_2 respectively and the radii r_1 and r_2 where $r_1>r_2$ of each circular turn .Show that M_{12} is equal to M_{21} in this case. State the positions of coil when mutual inductance is maximum and when it is minimum.

21. Discus how the mutual inductance of a pair of two solenoids placed coaxially at certain distance apart is affected when (i) An iron core is inserted in any one of these (ii) an iron sheet is placed between the two solenoids. (iii) separation between the solenoids is increased. (iv) spacing between the consecutive turns of each solenoid is decreased (v) One of the solenoid is inserted into other(vi) both are wound on same soft iron core.

22. On passing a current of 2 amp through first coil a flux of amount 1.5 weber is linked with second coil. How much flux will pass through first coil if a current of 3 amp is passed through second coil.

23. Two circular coil of single turn and radii R and r where R>r are placed concentrically in same horizontal plane. Calculate the mutual inductance between these two. If the smaller coil is rotated by an angle 90^0 about it's diameter what is the new value of mutual inductance. How mutual inductance is affected if the distance between their centers is increased.

Chap 7: Alternating Current

1. Explain rms or effective value of alternating current, which effect of electric current is used to measure an alternating current. An electric lamp connected to an a.c source glows with same brightness as with 220V d.c, calculate the peak value of alternating voltage
2. A solenoid when connected to a d.c source it passes some finite value of current through it .Justify whether the solenoid is purely inductive or not .What will be the effect on current passing through solenoid with d.c and a.c source respectively, if (i)If the gap between successive turns is increased (ii)An iron core is inserted in to it.(iii)Number of turns of solenoid are increased keeping it's length unchanged.
3. A solenoid is connected to an a.c source and a lamp in series with it. Discus the effect on brightness of lamp if following changes are made in the circuit (i) frequency of a.c source is increased slightly (ii) gap between successive turns is increased (iii)An iron core is inserted in to it. (iv) A capacitor is also connected in the circuit (vi) How would it respond if the source is d.c.
4. An electric lamp with resistive filament is connected in series with an inductor and a key to a DC source. How will the the brightness of lamp change: when key is closed, explain with appropriate reason. What will be the effect on final brightness of lamp if an iron core is inserted in to the inductor.
5. An electric lamp with filament of resistance R is connected in series with an inductor and an AC source. What will be the effect on final brightness of lamp if a capacitor of capacitance X_L $=X_C$ is also included in the circuit.
6. An alternating voltage of emf E=100sin(wt – /3) is connected across a series L-C-R circuit passing a current I=10 sin(wt – /3) varying with time as shown .Draw time variation curves of these and calculate the impedance, power factor and total power consumed by the circuit.
7. A series L -C-R circuit is connected to an AC source of instantaneous voltage equation $V_t= V_m$ sinwt. (i)Drawing the phase diagram obtain an expression for instantaneous current and the phase difference between current and effective voltage of the source assuming that capacitive reactance is greater than inductive reactance.
8. Plot the graphs for variation of resistance of conductor, inductor, capacitor and the whole circuit(impedance) with increasing frequency of the source in series L-C-R circuit and mark the frequency on common intersecting point of these graphs.
9. Answer the following regarding a series L-C-R circuit :(i) the phase difference between effective voltages across L and C (ii) Is the algebraic sum of voltages across L, C and R is equal to the instantaneous value of applied source voltage applied.(iii)Determine the frequency of the source at which current and voltage are in same phase (iv)what is the value of power factor at the frequency asked in previous part.
10. If an alternating voltage source $V_t= V_m$ sinwt is applied across a series L-C-R circuit. Obtain an expression for average power consumed by the circuit. Show that power consumed at resonance frequency is maximum and equal to V_m^2 /2R. Also calculate amplitude of current at this frequency.
11. What is the physical significance of the term quality factor in the resonance curve of series L-C-R circuit. Mention the practical use of this value in receiving circuit. Indicate the two frequencies on this graph at which power consumed by the circuit is half of the maximum power consumed at resonance.
12. In a series L-C-R circuit, instantaneous alternating voltage is $V_t= V_m$ sinwt and the equation for instantaneous current is $I_t=I_m$ sin t), deduce an expression for average power consumed by the circuit.
13. Among two a.c circuits first one is purely resistive and the second one is series L-C-R circuit connected to the same source. Mention the condition when r m s current is same in two circuits.Calculate that frequency of the source.
14. Draw the resonance curve for two a.c circuits having values L_1 , C_1, R_1 and L_2, C_2 ,R_2 with same resonance frequency ,given that $R_1 > R_2$. Write the relation between L_1 , C_1 and L_2, C_2 at resonance. Which of the two circuits will be better for fine tuning.
15. An electrical device connected across 220Vsource consumes a power of 2KW, if the phase difference between current and voltage is where tan =3/4.Find the value of (i) current drawn by the load (ii) value of net resistance and reactance of circuit.
16. An element X when connected across an A.C source of voltage V_t=310 sin 314t,current is 4amp and in same phase with applied voltage .Another element Y when connected across the same source current is 5 amp and it lags behind the applied voltage by /2 in phase. Identify the elements X and Y and calculate their values. If both X and Y are connected in series with the same source drawing the phase diagram calculate the (i)impedance (ii) net current in the circuit (iii) phase difference between current and applied voltage.
17. Obtain an expression for frequency of the source in series L-C-R circuit at which current and voltage are in same phase .Using an expression of this frequency state why audio frequency coil are iron cored and radio frequency coil are air cored.
18. State the working principle of A.C generator. Obtain an expression for average and peak value of induced emf across the two ends of this coil in terms of total turns N with each turn of area A placed in uniform magnetic field B and rotated with constant angular speed w. Show the variation of magnetic flux passing through the loop and

induced emf in the coil varying with time t. Show the position of the coil varying with time t assuming initially at t=0 plane of coil is perpendicular to magnetic field. Find the average and r.m.s value of alternating voltage over full cycle time.

19. Explain how does the direction of induced current passing through the load resistance connected to the two ends of an a.c generator changes after each half cycle rotation of this coil .What is the source of output energy of this device .If the energy input is reversed will the output energy also reverse in this device .Why we can not measure alternating current produced by A.C generator using moving coil galvanometer .Besides the coil if a magnet is rotated in a.c generator, will some emf be induced in that case also.

20. If two slip rings at the two ends of an a.c generator coil are connected to a capacitor of capacitance C. Show that current leads the voltage by an angle 90^0 in phase. Also calculate the amplitude of current through capacitor.

21. Answer the following : (i) Why no emf is induced across a conductor moving parallel to the field. (ii)What is the nature of induced electric field in motional emf (iii) State the position of coil in between two magnetic poles when flux passing through coil is maximum, zero. What is the magnitude of induced emf at these instants. (iv) Power factor of a circuit can be improved by the use of a capacitor. (v) Why an emf is induced across a conducting rod in horizontal position when it is allowed to fall in a plane with it's two ends in east –west direction. (vi) On what factors, quality factor of a circuit depends, should it's value be high or low in receiving circuit of a radio.

22. State the working principle of a transformer and draw a labelled diagram of step up transformer.Deduce an expression for the ratio of secondary to primary voltage and current in terms of number of turns in an ideal transformer.

23. If the transformation ratio is greater than one ,is the transformer step up or down . Describe the various type of losses inside the transformer and suggest how these can be minimized, which two losses are minimized using soft iron cores. How we can increase the mutual inductance between the two coils of a transformer.

24. A step up transformer converts low voltage to high voltage, does it violate law of conservation of energy, if not then explain how.Can the transformer be used to step up or step down d.c voltage explain with reason. Show diagrammatically how one can maximize the mutual induction between primary and secondary coil .Which coil of step down transformer should be made of thick copper wire.

25. Explain how the transmission loss of electrical energy is minimized using transformer in grid system. Suggest how the power loss in the transmission line can be further reduced by improving the value of power factor.

26. An ideal step up transformer has 100 turns in its primary coil and transformation ratio is 50.Primary coil is connected to 220V supply and draws a power of 1100W. Calculate (i) number of turns in secondary coil (ii)current in primary coil (iii)Voltage across secondary coil (iv)power in secondary coil.

27. A 60 watt load draws a current of 0.54A through secondary coil of an ideal transformer whose primary coil is connected to 220 V supply. Give the ratings and mention the type (step up or down)of transformer used.

28. Calculate the current passing through primary coil of a step down transformer of efficiency 80% rated at 220V-12V, assume that secondary coil is connected to a load resistance of 6 ohm.

29. A capacitor of capacitance C charged to maximum value Q_0 is allowed to discharge through an inductor of inductance L at t=0. Show that charge executes S.H.M between the two plates of capacitor.Obtain an expression for angular frequency and time period of oscillation of charge in this circuit. Calculate the value of maximum current in the circuit in terms of these values.

30. Explain why L-C oscillations are stopped ultimately in an oscillating circuit. Also show that total energy of the system always remains conserved if circuit has negligible resistance.Maximum charge given to a capacitor of capacitance C is Q_0.Mention the type and the value of initial energy of the system and name the field where it is stored . If the circuit has some resistance R, how much total energy is lost in the form of heat across this resistance.

31. If an L-C oscillating circuit is compared to a mass spring system, which form of energy of L-C circuit is analogous to K.E and P.E of mass spring system .Which out of L and C is corresponding to mass.State two advantages of A.C over D.C. State the working principle of a device known as metal detector used for security purpose.

32. Can the voltage drop across inductor or capacitor in a series L-C-R circuit be greater than applied voltage. Explain why an ideal inductor or capacitor in an a.c circuit does not consume any average power but reduces the current in the circuit.

33. Define watt less current in a circuit .In an a.c circuit voltage applied across the circuit is given by an expression V_t=5sin100 t and the current flowing is I_t=2 cos100 t find the average power consumed by the circuit. Show that circuit is purely inductive or capacitive of this circuit. Define power factor of a circuit, if the value of power factor in an A.C circuit is 0.5,what is the phase difference between current and effective voltage in this circuit.

34. Instantaneous current passing through a capacitor of capacitance 2μF is given by an expression i_t =6 cos100 t. Find(a)rms value (b)frequency of source(c)average value of current over an interval of 1/50 and 1/100 s.

35. Instantaneous emf $E=E_0$ sinwt is applied across a capacitor of capacitance C. Show that voltage lags behind the current by an angle /2 in phase.Write the value of maximum charge on capacitor and maximum current in the circuit.

36. If the Instantaneous current i_t =6cos100 t is passed through an inductor of inductance 4mH.Obtain an expression for

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Chap 8: Electromagnetic Waves

instantaneous emf.Also calculate it's inductive reactance and maximum value of induced emf across it.

1. Write the energy and momentum of a photon in terms of the radiation of wavelength , also relate these two. How will you show that rest mass of a photon is zero.
2. You are given a parallel plate capacitor of capacitance 2μF.Suggest how will you obtain a displacement current of 1mA by changing the potential difference between the plates.
3. Show that magnetic field B at a point situated at a distance r from the centre of circular plates of capacitor during it's charging or discharging is equal to $\frac{\ _0\ \ _0 r}{2}\frac{dE}{dt}$, where $\frac{dE}{dt}$ is rate of change of electric field between the plates.
4. A radio can tune from 7.5 MHz to 12 MH. what is the wavelength band?
5. The magnetic field in a plane electromagnet wave is given by B_y= 2 X 10^{-7} sin(0.5 X 10^3x + 1.5 X 10^{11}t)T(a)What is the frequency and wavelength of the wave. (b) State the direction of propagation of wave (c)write an expression for all the components of oscillating electric field.
6. An A.C source is connected to a capacitor, name the current in the circuit and between the plates of capacitor. Why there is a continuous flow of displacement current. How will the direction and magnitude of displacement current change with time and with decrease in frequency of source.
7. If charge on a parallel plate capacitor changes with time as $Q \quad Q_0 \cos \quad t$.Find the displacement current through it. Evaluate the maximum current.
8. Name the device used to produce microwaves in a microwave oven and explain why the microwave oven can not heat up the completely dry food.
9. (i)A capacitor is charged by a dc source, what are the magnitude of conduction and displacement current when capacitor is fully charged (ii)Why an ideal capacitor flows dc for short time only, but flows ac continuously, write an expression for this current.
10. Obtain an expression for displacement current,show that their magnitude is equal to conduction current. Current in a circuit containing capacitor is 2mA, what is the displacement current and where does it exist.
11. Sketch a diagram for oscillating electric and magnetic field for a E.M moving in +Z direction.
12. For an EM wave moving in x direction electric field is $E \quad 35\,jV/m$, calculate magnetic field at this point if wave is moving along X direction.
13. Name the part of E. M wave whose wave length is in the range of 1mm to 500mm, state the method of production and uses.
14. How does an oscillating charge produces EM wave. What will be the frequency of this wave.
15. Write any four properties and two common properties of all parts of an E.M wave.
16. Identify the E. M waves of given wavelength 1mm, 10^{-12} m and 10^{-8}m. Explain how these are produced and give one use of each.
17. Name the parts of EM wave having following properties (a) produce heating effect (b)Absorbed by ozone layer (c) used to study crystal structure.(d)used in radar and satellite signal transmission(e) To see through foggy condition.(f) Is absorbed by ozone layer (g) In aircraft navigation (h) to maintain earth's warmth (i) In studying crystal structure of solids (j)night vision (k) produced by welding electrodes.
18. Give the approximate frequency and one use of the wave which is produced by magnetron tube , welding electrode.
19. Arrange the following in the increasing order of their frequency, UV rays, X rays, radio wave, blue light, infrared light
20. Which part of E.M wave has largest penetrating power give it's frequency and two uses.
21. What oscillates in an E.M wave of frequency 50MHz, what is it's frequency of oscillation.
22. Write two uses of the part of E.M wave which are produced by radioactive nuclei.
23. If an EM wave is moving along + Y direction , mention the directions in which electric and magnetic field oscillates.
24. Identify the waves which have the frequencies 10^{20} Hz, 10^9 Hz, 10^{11} Hz,
25. Using Gauss theorem verify that E.M wave is transverse in nature.
26. Show that equal amount of energy is stored in equal volume of electric and magnetic field in an EM wave.
27. In an EM wave electric field oscillates with a frequency of 6x10^8 Hz and amplitude of 20v/m.Find(a)wavelength of wave(B)energy density of electric field (c) total energy stored in a cube of edge 10 c.m.
28. Experimental observation about radio waves show that these : (a) travel with speed of 3x10^8 m/s in air or vacuum (b)can be polarized.Which nature of EM wave is represented by these two properties.
29. Why did Maxwell introduce an idea of displacement current in Ampere's law. Mention the situation, when there is(a) only conduction current (b) only displacement current in a circuit.
30. Name the property of EM wave(a) which increases from radio wave to gamma wave, (b) remains same for all parts.
31. Which type of the following charged particle motion can produce EM wave(a) charge moving with constant velocity (b)charge moving in a circular orbit.

32. A capacitor of capacitance 5μF and radius of plate 5 cm is connected to a 220V AC source of angular frequency 300 rad/sec. Calculate(a)r.m.s value of conduction and displacement current(b) magnetic field at a distance 4 and 6cm from centre of plate.
33. On what factors speed of E.M wave in vacuum depends. Show how speed of E.M in a medium other than air or vacuum depends upon relative permittivity and permeability of the medium.
34. A parallel and circular plate capacitor with each plate of radius 15 c.m placed 5mm apart is being charged with a constant current of 0.2 amp. Calculate :(i) rate of change of electric field between the plates (ii)Magnitude of displacement current between the plates and conduction current in the circuit, are these two equal (iii) Is kirchhoff's current law valid for each plate. (iv) Magnitude of magnetic field at a distance 5cm and 20 cm from the centre of the plates.
35. Arrange the following in increasing order of wave length. X rays, infrared rays ,micro waves, yellow light.
36. How we can say that an accelerated charged particle produces E.M wave.
37. An E.M wave is travelling in a medium with speed $2x10^8$ m/s. If relative permittivity of medium is 4, find it's relative permeability.
38. Show that average density of electric field in an E.M wave is equal to average density of magnetic field. Which property of E.M wave led him to decide that light is an E.M wave.
39. What is the ratio of speed of microwave and gamma rays in vacuum. Which of these moves faster in medium glass.
40. How can you verify that sound is not an E.M wave .
41. Why the gamma rays have highest penetrating power .
42. **42.** How does the RADAR helps in finding the distance of far objects.

Chap 9: Ray Optics

1. State Snell's law of refraction and define refractive index of a medium in terms of speed of light in two media.Write it's unit if any. During refraction speed and wave length of light changes but It's frequency remains same,explain why.
2. Does the speed of light in a medium other than air or vacuum also depend upon wave length or colour of light. Will the speed of red colour light in water be more or less than speed in air or vacuum . Does the phenomenon of refraction bring change in energy of refracted wave also.
3. Explain at least three effects of refraction in our daily life . A person inside water at some depth in a swimming pool when looks at a near by person standing outside, will the person looks taller or shorter than his actual height .Establish a relation between real height and apparent height of the person outside assuming he is at nearly normal position inside water. A glass slab placed over a page printed with letters of different colours, then image of all letters do not lie in same plane.
4. Calculate the shift in the bottom of a tank filled with a liquid of refractive index μ up to height H when it is observed from outside at a nearly normal position. Does the apparent depth of tank change if viewed obliquely , will it increase or decrease. Draw a graph showing variation of apparent depth of tank with increasing refractive index of a liquid medium.
5. Mention the conditions and calculate the angle of incidence at which a light ray must pass from denser to rarer medium so that no refraction takes place. Draw the ray diagram for the same and name the angle of incidence.
6. Define and obtain an expression for critical angle for a light ray passing from glass of refractive index 3/2 to water of refractive index 4/3.Can we obtain the same situation for a light ray passing from water to glass.
7. If critical angle of a medium is 30^0 for red colour incident light, is this value be more or less for blue light .State the conditions for total internal reflection to occur , give some examples of multiple total internal reflections in a medium.
8. Name the principle on which optical fiber works, does the transmission of signal through optical fiber depend upon the medium in which optical fiber is placed. Which of the two parts of a optical fiber has a higher value of refractive index. Give two applications of optical fiber. Explain why sending formation through optical fiber is more efficient than through copper wire.Why the efficiency of optical fiber is reduced if some dust particles are deposited on it .
9. Describe with the help of ray diagram, use of a right angled isosceles glass prism $_{a\ g}$ =1.5 to bend the light rays by an angle 90^0, 180^0 and by 0^0. Mention the angle of incidence and the critical angle for it. Give some real life applications of bending at such angles.
10. A point object lying at the bottom of a container filled with some liquid of R. I μ =4/3 upto a height of 20 cm, calculate the maximum diameter of circular part on the surface of liquid through which object is visible from outside.
11. State Raleigh's law of scattering. How does it explain the colour of sky at noon time and at setting and rising time. Why the sky has no colour at moon and why clouds appear white in colour.
12. Three different liquids of refractive indices μ_1 , μ_2 and μ_3 are filled in a container up to the same height h, find apparent depth of container and total shift in the bottom.
13. Write the sign convention and all the assumptions used to establish a relation between object distance (u), image distance (v) and radius of curvature (R) of a convex shape curved surface in terms of refractive index μ_1 and μ_2 of the two media at the two sides of a curved surface.Show the ray diagram to form a real and virtual image by the same surface and mention the necessary condition for it.
14. Using an expression for refraction from curved surface and, establish a relation for focal length of a biconvex lens in terms of refractive index of medium with respect to surrounding medium and the radii of curvature of it's two curved surfaces. Use the result to obtain power of an equi-concave lens what is the significance of the sign of power of this lens.
15. Define power of a lens give it's S.I unit. Using lens maker's formula show that power of a lens in a medium is directly proportional to R.I of material of lens with respect to the surrounding medium in which lens is placed. Draw the plot for variation of power of a lens with wavelength of incident light .
16. Does the power of a lens increases or decreases when it is immersed in a liquid of refractive index greater, less than refractive index of material of lens. State the condition when the lens immersed in a liquid is disappeared.Does it also cause any effect on the power of a mirror when immersed in a liquid.
17. Using lens makers formula, state why the sun glasses are zero power lens .How will you use the lens makers formula to decide the shape of correcting lenses used to remove myopia and hypermetropia. An equi -convex lens of focal length f is cut into two identical parts along the principle axis and normally to this axis .give the new focal length of each cut part.
18. A parallel beam of light of red colour is passed through a equi -convex lens of equal radius of curvature 20cm and refractive index 1.5 for this colour of light. (i) find the focal length of lens placed in air. (ii) Will the focal length be more or less for yellow colour light.
19. What will be the change in focal length and nature of lens in previous question if it is immersed in a liquid of refractive index 5/3. Show using ray diagram for a parallel beam of incident light falling on this lens. An air bubble in water behaves as which type of lens.

20. Draw the ray diagram and obtain an expression for combined focal length, power and magnification of the combination of two thin lenses placed close together if (i) both the lenses are converging in nature (ii)if one is converging and other is diverging in nature.State the condition when this combination neither converges nor diverges

21. A planoconvex and a concave lens have same radius of curvature 20 cm and refractive index of material 1.5. what will be the nature and power of this combination .

22. What should be the distance between three identical convex lenses placed coaxially with each of focal length 20 cm, so that real image of a point object placed at a distance 40 cm from first lens is formed 20 cm behind the third lens.

23. Explain the following phenomena :(i) Sky has no colour at moon and sunrise and sunset are abrupt there.(ii) High R.I of diamond is helpful for diamond cutters(iii)diamond glitters more in brightly lit room only(iv)It glitters less when immersed in water .

24. Explain why white light is split in to constituent colours when it is passed through a glass prism. Which colour is deviated most in a spectrum pattern , and which colour has least speed in material of prism. Hollow glass prism and the rectangular glass slab can not form spectrum, explain why.

25. Explain why(i)the stars bigger than size of sun appear smaller to us(ii)Why we can not see our images in irregular or unpolished reflecting objects.(iii)Image of a point object placed in front of a lens forms it's image on the screen ,If the screen is moved closure or away from the lens ,what will be the shape of spot on the screen at these new positions.

26. Suggest how will you estimate rough focal length of a convex lens, can you use same method for concave lens. Obtain a relation between object distance, image distance and focal length of convex lens for an object placed between F and 2F. Draw the graph between u and v and 1/u and 1/v for this lens ,use the above derived relation to verify nature and position of image in your ray diagram. In which direction image will move if object is moved further away from lens How will intensity and size of image change if lower half of lens is painted black.

27. Use the lens formula to verify the nature of image formed by a concave lens for an object placed in front of a concave lens.Show that nature of image formed is independent of the location of object .

28. If a convex lens of focal length same as concave lens is placed in contact with each other, what will be the effective focal length and power of the combination.

29. In an experimental setup to find the focal length of a convex lens source and screen are at fixed position and position of lens is movable.Show that there are two position of lens for which image is formed at the same distance. If u and v are object and image distances, find the distance between these position of lens and the distance between object and it's image in terms of magnitude of u and v. If height of image at these positions of lens are h_1 and h_2 then find the height of object in terms of h_1 and h_2 .

30. A convex lens of power 5D forms two times magnified virtual image. Calculate object and image distance for this purpose. Draw the ray diagram for the same and calculate linear magnification

31. A square shaped object of side 2cm is placed normally to principle axis at a distance 30 cm in front of a convex lens of focal length 20 cm. Find the areal magnification and draw the ray diagram.

32. Show that focal length of a spherical mirror is half of it's radius of curvature. Does the focal length of a mirror is changed with changing(i) the colour of incident light (ii) by changing the medium in which mirror is placed.

33. Drawing a ray diagram for any position of an object placed in front of a concave mirror for virtual image, establish a relation between u,v and f and an expression for it's linear magnification. Draw the graph between u-v and 1/u -1/v for real image and suggest a way to find focal length of mirror. Use this relation to verify nature and position of image in your ray diagram.

34. An object is placed in front of a convex mirror, derive the mirror formula and linear magnification. Use the mirror equation to show nature of image remains independent of position of object. If the object starts moving towards the mirror with some speed, compare the direction and magnitude of the speed of image in mirror.

35. Use the mirror formula to find length of image of if a thin rod of length 5 cm placed along the principle axis of a concave mirror with one end touching the centre of curvature of this mirror and other end in between F and C.

36. If the radius of curvature of concave mirror is 40 cm then draw the ray diagram and find the diameter of the image of moon if diameter of moon is 10,000 km and the lunar orbit is of radius 1,50,000km .

37. Showing the ray diagram explain how the combination of two prisms can be used to pass a beam of white light without dispersion.

38. A ray of monochromatic light falls on an equilateral glass prism in such a way that angle of deviation of emergent ray is minimum , draw the ray diagram and find an expression for refractive index of material of prism in terms of angle of minimum deviation and angle of prism. Explain why the condition of minimum deviation is used here.

39. Show that angle of incidence is equal to angle of emergence in the case of minimum deviation and refracted ray passes parallel to base of prism. Explain how angle of minimum deviation change if prism is immersed in water.

40. State the condition when alight ray incident on a equilateral glass prism passes parallel to base of prism. Also find the value of angle of incidence, emergence and angle of deviation if refractive index of material of prism is $\sqrt{3}$.

41. Explain why one can not obtain very high magnifying power by using a single lens.While viewing through magnifying glass our eye should be at a short distance away from eye piece lens,does it change angular magnification if eye is moved back .

42. In magnifying glass angle subtended by the object and it's virtual image is same then how does it produce angular magnification. Explain why stars bigger than sun appear smaller to us.

43. Show a labelled diagram for the formation of image in a compound microscope when the image is formed at least distance of distinct vision and at infinity respectively. Calculate angular magnification or magnifying power in each case. Explain why focal length of both the lenses used is small.

44. If D_1 and D_2 are the diameter or aperture of two lenses and f_1 and f_2 are the focal length of objective and eye piece respectively in compound microscope, then compare these for their suitable values in compound microscope.

45. In a compound microscope an object is placed at a distance 6 c.m from an objective lens of focal length 4 c.m , if focal length of eye piece lens is 10 c.m then find the distance between the lenses and magnifying power of microscope assuming that final image is formed at least distance of distinct vision.

46. Where should an object be placed in front of a magnifying lens of power 10 D in order to achieve maximum angular magnification.

47. A small object is seen is seen in blue and red colour of light by a compound microscope,explain in which case magnifying power is high and in which case resolving power is high.

48. Explain, how the working of telescope is different from that of compound microscope in two different ways. Draw labelled diagram to show formation of image of an astronomical object in a telescope if final image is formed at the least distance of distinct vision and at infinity (normal adjustment) respectively.Calculate magnifying power and the distance between two lenses in each case. Write one advantage and one disadvantage in case of normal adjustment.

49. Explain why objective lens is of large focal length and aperture than eye piece in an astronomical telescope Should the difference in their focal length be large or small.

50. A telescope is adjusted for least distance of distinct vision and you are asked to adjust the distance between lenses to form final image at normal adjustment , will you increase or decrease the distance between two lenses. Will the magnifying power of telescope increase or decrease during this change.

51. If the linear diameter of moon is approximately 3000 km and it's distance from earth is 1,50,0000 km.Calculate the diameter of image of moon formed by the objective lens of focal length 20 cm in an astronomical telescope.

52. Write five limitations of refracting type telescope over reflecting type. Draw a labelled diagram of cassegrain type reflecting telescope and write an expression for it's magnifying power.Why do we use parabolic concave mirrors in place of large sized objective convex lens.

53. What is the limit of resolution of an optical instrument according to Raleigh's law. Discus the factors by which we can increase the limit of resolution of microscope and telescope.

54. A 10m long pole situated at distance 100m apart is viewed by an astronomical telescope using objective of focal length 50 cm and eyepiece of focal length 5 cm. If the final image is formed at least distance. Draw the ray diagram for each case and calculate(i) distance between two lenses (ii) Size of image as formed by objective and eye piece lens.

55. If two closely lying far objects make an angle of 2^0, then how far these appear to be angularly separated if these are observed using this telescope in normal adjustment position using objective of focal length 50 cm and eyepiece of focal length 5 cm.

56. Two convex lenses with aperture of size 8cm and 3 cm , and focal length of 100cm and 5 cm respectively are placed 100 cm apart and the combination is used to view far objects in normal adjustment position (i)which of the two lenses should be used as objective and eye piece.(ii)By how much amount distance between the two lenses should be changed for this purpose.(iii)If the size of aperture of objective lens is doubled then by what factor intensity of final image and range of telescope will change if image of same intensity is formed.

Chap 10: Wave Optics

1. Define wave fronts, state a relation between a light ray and a wave front. What is the phase difference between two points lying on the same wave front.
2. Point out one difference between plane and spherical wave fronts and draw their shapes. Discuss the type of wave fronts which are emitted by (i)a point source of light (ii) distant sun and reaching earth's surface (iii)florescent tube (iv)Parallel beam of light passing through rectangular slit.
3. Show geometrically the shape of incident and emerging wave fronts, if (i) a point source of light is placed at the focus point of a convex lens (ii)plane wave front after passing through a convex lens (iii) plane wave front after passing through a prism (iii) plane wave front after reflection from concave mirror and the convex mirror respectively.
4. State Huygen's principle, use it to show propagation of plane wave front from an instant t_1=0 to t_2 = t. Prove laws of refraction(snell's law)using Huygen's principle for a light ray passing from denser to rarer medium ($v_2 > v_1$).
5. When a monochromatic light beam passes from one medium to other.Explain which out of it's speed, wavelength and frequency are changed and which remain constant and why. Define refractive index of a medium in terms of speed of light in two media.
6. Does the change in speed of a wave when it passes from one medium to other also causes change in energy of the wave explain. Light of wave length 6000^0A in air falls on a plane surface, what are the wavelength, frequency and speed of reflected and refracted light if refractive index of the medium is 3/2.
7. State the principle of superposition of light waves, use it to evaluate the amplitude and intensity of a resultant wave produced by superimposition of two light waves coming out from two coherent sources.
8. Explain interference of light.What do you mean by constructive and destructive interference of two light sine waves of different amplitude meeting in same or in opposite phase, show it diagrammatically also. Give one example showing the phenomenon of superposition of light wave and sound wave.
9. Using an expression for resultant intensity and amplitude derive the necessary condition of path difference between the two waves in terms of wavelength of the waves which are going to interfere constructively, destructively.
10. State two essential conditions for sustained interference of light to occur in Young's double slit experiment. Does this phenomenon violate law of conservation of energy. If not, then explain how the energy remains conserved in this phenomenon. Explain the term that light added to light can produce darkness regarding energy conservation in light.
11. With the help of schematic diagram, obtain an expression for for path difference between the two waves coming out from two slits in Young's experiment, in terms of distance y of a point from the center of screen, distance between two slits d and the distance D of the screen from the plane of two slits. Explain the necessary assumption to obtain the relation.
12. What are coherent sources of light, how these are produced practically in Young's double slit experiment. Draw the geometrical set up of this experiment and write essential condition to produce sustained interference on the screen .What is the resultant intensity on the screen if two light sources producing light of same colour are placed on the back side of two slits S_1 and S_2.
13. Give some example of interference of light wave and sound wave respectively in everyday life, is the colour produced by reflected white light on thin oil film on the surface of water a result of interference or dispersion.
14. Two narrow slits in young's experiment are illuminated by same source slit S of monochromatic light, will it produce sustained interference pattern on the screen. Draw the intensity pattern and state why do we always require two narrow slits in Young's experiment.
15. With the help of a schematic diagram obtain an expression for the positions of nth bright and dark fringes on the screen in Young's experiment in terms of wavelength and other known values.Using this result obtain an expression fringe separation. Also find the angular position and angular width of nth bright fringe.
16. Draw a graph for variation of resultant intensity on the screen along Y axis and the linear distance y of bright and dark fringes from the center of screen and also in terms of path difference x .Draw the changed pattern when one of the slit is closed.Name the phenomenon which is common in both pattern.
17. In Young's experiment ,if a be the size of source slit and b is the distance between the source slit and plane of two slits ,then write the criterion to obtain clear interference pattern on the screen .If the net intensity at all points on the screen is same and equal to $I_1 + I_2$, then nature of two light sources are coherent or incoherent.
18. Discuss the effect on : (i) angular position of a fringe if distance between two slits is increased (ii) angular width of a fringe if distance between slits and screen is increased. (iii) interference pattern if one of the two slits is covered with a paper to pass the light of half intensity. (iv) interference pattern if one of the two slits is covered with an opaque sheet.(v)interference pattern if distance between two slits is reduced. (vi)interference pattern if whole apparatus is immersed in water. (vii) interference pattern if monochromatic source is replaced with white light. (viii) interference pattern if wave length of light is reduced (ix) interference pattern if source slit is moved closure to the plane of two slits (x)interference pattern if two slits are

infinitesimally close to each other and when infinitely are far apart from each other.

19. Ratio of intensity of bright and dark fringes on the screen in young's experiment is 49:1.Calculate the ratio of amplitude, intensity of two waves and ratio of width of two slits.

20. In Young's experiment amplitude of two wave are same equal to A and intensity is I. Calculate the resultant amplitude and intensity at points on the screen where the two waves are meeting at (a) phase difference of 90 degree (b) at a path difference of 2 .

21. In young's experiment using light of equal intensity I , resultant intensity at a point where the path difference between the two waves is zero is K unit, what will be the resultant intensity in terms of K at a point on the screen where path difference is /3.

22. In young's experiment two slits are placed 0.3 mm apart and screen is placed 1.5 m apart. If light of wave length 600nm is used then calculate (a) linear and angular width of fringes (b)Linear distance and angular position of 4^{th} maxima and third minima from central maxima.How would the above calculations are affected if whole apparatus is immersed in water of refractive index 4/3.

23. Light consisting of two waves of wave length 520 nm and 600 nm are used in young's experiment ,calculate the ratio of fringe width of two waves also find the least distance from the centre where the bright fringes due to both the waves coincide.

24. Amplitude of two waves in Young's experiment are A and 2A.Calculate the magnitude of resultant intensity at the centre of screen if intensity of first wave is I, give your answer in terms of I.

25. If intensity at the central maxima in Young's experiment is I_0, calculate the intensity at a point on the screen situated at a distance equal to 1/3 of fringe width from centre.

26. Mention the necessary conditions to obtain sustained interference of light.Why do the two slits in Young's experiment are known as coherent sources.

27. What is diffraction of light. State the essential condition for diffraction of light to occur. Explain why diffraction of sound is very common but diffraction of light is rare. If a small size of obstacle is placed in the path of light its shadow is not formed or light can be seen on other side but if large size object is placed in the path of light some shadow is formed on other side, explain why.

28. Use Huygen's principle to explain diffraction of light of wave length from a narrow rectangular slit of size a Obtain a general expression for consecutive maxima and minima.Sketch intensity pattern on the screen with different angle of diffraction. Draw the new intensity pattern on the screen if the slit is circular in shape.

29. Evaluate an expression for the angular position of first minima and first maxima of a light wave of wave length passing from a rectangular slit of size 'a'. Show that linear width of central maxima is double that of other consecutive maxima. Explain why the intensity of consecutive maxima goes on decreasing on either side of central maxima of single slit diffraction pattern.

30. Explain in what way diffraction from each slit is related to interference pattern of double slit, mention the four important differences between double slit interference and single slit diffraction pattern. Does the energy conservation holds good in both interference and diffraction pattern .

31. If light of wavelength is passed through a slit of size a and intensity pattern is obtained on the screen placed at a distance D apart .Calculate angular width and linear width or the central maxima ,also find the distance between two dark bands on either side of central maxima.All your answers should be in terms given values only

32. Discuss the effect on intensity pattern on the screen in single slit diffraction pattern if (i)size of slit is doubled (ii) wave length of light is halved (iii) distance of screen from slit is doubled.

33. Are the diffraction and interference pattern on the screen possible without each other. In young's experiment two slits are placed 2mm apart and screen is placed 1.5 m apart. What should be the width of each slit to accommodate 10 maxima of double slit pattern within the central maxima of each singe slit diffraction pattern.

34. If the wavelength of light is 600 nm and distance of screen from slit is 1m. What should be the width of a slit in a single slit pattern so that first maxima falls at an angle 30^0 . Also calculate the linear distance of first minima and first maxima from the centre in terms of these.

35. A parallel beam of light of wavelength 500 nm is passed from a slit and diffraction pattern is obtained at a distance 1m from the screen, if linear width of central maxima is 5 mm ,find size of the slit.

36. What is meant by un polarized and linearly polarized light .Distinguish them with the help of a figure and state the way to identify these with the help of polaroid.What are polaroids and describe how light can be polarized using polaroids.

37. State three applications of polarization in our life. State the reason why polarized sun glasses are better than coloured sun glasses.Light from an ordinary lamp is passed through a polaroid P_1 and transmitted light further is passed through another Polaroid P_2 .Show graphically the variation of transmitted light from P_1 and P_2 changes with rotation angle of these polaroids which is changed continuously .

38. Explain why light can be polarized and sound can not be. Describe how one can prove transverse nature of light using polarization. Name some natural Polaroid and their function.

39. Explain with the help of diagram only (i) polarization by scattering (ii)Polarization by reflection.

When unpolarized light passes from one medium to other reflected light becomes plane polarized, state the condition related to it and find the value of angle of incidence (Brewster or polarizing angle) and angle of refraction

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during this condition. Does the polarizing angle depends upon wave length of incident light.

40. Polaroid A is placed in front of monochromatic source of unpolarized light and now another Polaroid B is also placed in front of A to pass maximum light and rotated till no light passes through second Polaroid. Describe the positions of two Polaroids at these instants.Is it possible to increase the intensity by using third Polaroid C placing it in between A and B at their cross position.State the angular position of Polaroid C when this intensity of final light is maximum.

41. Why do the two polaroids placed infront of unpolarized light are called polarizer and analyser respectively.Obtain an expression for the variation of intensity of light coming out from analyser varying with angle between two polariser and analyser and show this variation graphically also.How do we decide that natural light emitted by sun is unpolarized.

42. A polaroid C is placed coaxially in between two crossed polaroids A and B, making an angle 30^0 with the polaroid A.Calculate intensity of light coming out from polaroid A, B and C If the intensity of un polarized light falling on Polaroid A is I_0.Also describe the nature of light passing through these polaroids.

43. At what angle of incidence light should a light ray fall on a transparent medium of refractive index $\sqrt{3}$ such that reflected and refracted light are mutually perpendicular and reflected light is plane polarized. Show the plane of polarization of reflected light.

44. Two polaroids are placed in cross position in front of unpolarized light,calculate the angle through which second polaroid be rotated so that intensity of light from this polaroid is reduced to 25% in comparison to un polarised light .

45. Explain the term resolving power of an optical instrument what is Raleigh's criterion in regard of resolving limit. Give the relation between resolving limit and resolving power. How does diffraction limits the resolving power of an optical instrument.

46. Explain the term resolving power of compound microscope, discuss the effect on it if (i) refractive index of medium between object and objective lens increases (ii) wave length of light is increased (iii)diameter of objective lens is decreased (iv) focal length of objective lens is increased .

47. Discus the factors on which resolving limit and resolving power of telescope depends. Why the objective lens of telescope is of large focal length and large diameter or aperture in comparison to eye piece lens.

How intensity of final image is affected by increasing aperture of objective lens of telescope. Light of wave length 600nm falls on a objective lens of diameter 100 cm. Calculate the limit of resolution and resolving power of telescope.

Chap 11: Dual Nature of Matter and Radiation

1. State de Broglie hypothesis, draw the shape of these waves for the particles of definite and indefinite momentum .Explain why these waves can be observed easily for microscopic particle only and not for macroscopic particle used in our daily life.Show graphically the variation of wave length of this wave with speed and momentum and kinetic energy.
2. Show that de Broglie wavelength of photons is equal to wavelength of the wave to which these belong. Find the momentum of photons in terms of . Show that Bohr's postulate for stable orbits is in accordance with de Broglie wave hypothesis.
3. Express de Broglie wave length of a fundamental particle of charge q, mass m in terms of it's speed (v), kinetic energy (E) and accelerating potential difference(V). Also plot the graph between de Broglie wavelength verses each of above physical quantities.
4. Prove that de Broglie wavelength of electron in unit Angstrom is given by an expression $12.27/\sqrt{V}\ A^0$,also deduce an expression for proton which is also accelerated through same potential difference.
5. Plot the suitable graph for de Broglie wave length vs reciprocal of square root of potential difference $1/\sqrt{V}$ for electron and proton respectively .Find the slope of these graphs.A particle of charge Q when accelerated through a potential difference of V volt has de Broglie wavelength , what will be the new value of the wavelength when potential difference is 9 V volt.
6. An electron and proton have same de Broglie wave length, justify which has greater kinetic energy.Two particles electron and photon have same de Broglie wavelength , verify which one is moving faster. Show that energy of photon is 2 mc/h times the energy of electron where m is the mass of electron.
7. Calculate momentum and de Broglie wavelength of an electron accelerated through a potential difference of 100 volt. An alpha particle and a proton are accelerated from rest through same potential difference, find the ratio of their de Broglie wavelength.
8. What is the significance of Davission and Germer experiment, state the observation drawn from this experiment, why intensity at different angle of scattering are different and show the variation of intensity of scattered beam at different angle of scattering.
9. Calculate the linear momentum, kinetic energy and de Broglie wave length associated with motion of a proton accelerated through a potential difference of 100 Volt.
10. What is meant by the term threshold frequency, work function of a metal surface .Explain how does the K.E of emitted electrons, stopping potential and photoelectric current varies in photoelectric effect with increasing (i) frequency (ii) intensity of incident radiations respectively.
11. Write Einstien photoelectric effect equation and mention three basic features of photoelectric effect. If every metal has definite work function then explain why the K.E .of all the emitted photo electrons is not same.
12. What is the energy and momentum of photons associated with radiation of wave length . Radiation of wavelength is incident on a metal surface of negligible work function. If de Broglie wave length of emitted electrons is $_1$, then show that $\frac{2mc}{h}\ {}_1^{\,2}$.
13. If the stopping potential of emitted electrons is 2 volt, what is the maximum KE of emitted electrons in electron volt and joules. State why does stopping potential of emitted electrons vary for a given metal surface. Two metals have work function 2.3eV and 4eV respectively, which metal can show photoelectric effect with visible light.
14. Which type of metals are most suitable for photo electric effect and why. Which nature of charge on a neutral metal plate is developed after the emission of photo electrons. Do all the electrons in metal which absorb photons come out from metal surface.
15. Define stopping potential of a metal surface. State how does stopping potential of emitted electrons vary for a given metal surface if (i) intensity of incident radiation is increased (ii) Distance between a light source and the metal surface is increased (iii) frequency of incident radiation is increased (iv)potential difference between two electrodes is increased (v) metal of low work function is used.
16. Mention the three factors which affect the photoelectric current. Is photoelectric effect possible for E.M wave radiation of all frequencies.Why the wave theory can not explain photoelectric effect.
17. State Hallwach and Lenard observation regarding photoelectric effect. Which out of these radiations microwave, ultraviolet and infrared will be more suitable for photoelectric effect.
18. Draw a plot for the variation of stopping potential with frequency of incident radiation. Find the value of Plank constant using the slope of the graph. Mark the intercepts on X and Y axis of this graph .Which of these intercepts can not be the part of the graph and why.
19. Is the photoelectric effect possible for wavelength greater than threshold wavelength, justify your answer. If green colour of light shows photoelectric effect but yellow light can not, then what will happen with violet and red colour of light.
20. If the intensity of incident radiation on a metal surface is doubled then how does it affect photoelectric current and maximum K.E of emitted electrons.
21. Plot a curve for the variation of photoelectric current with anode or collector potential for some radiation of different intensity but of same frequency and others of same intensity but different frequencies.

22. Plot two variation of $K.E_{max}$ of emitted electrons with frequency of incident radiation on two metal surfaces of different work function. Do these graph represent equal slope, find the slope of each graph. Explain which of these graphs emits electrons of more maximum K.E if frequency of incident radiation are same.
23. Show the variation of photoelectric current with intensity of incident radiations. If the distance of a light source from a metal plate is decreased, how would it affect photoelectric current.
24. Two sources of light each of power 100W emit radiation of wavelength 1nm and 5000A respectively, calculate the number of photons emitted per sec by each source.
25. An electron and proton are moving with same K.E, find the ratio of their speed and de Broglie wave length.

    Radiation of wavelength 4000A fall on a metal plate of work function 2eV. Calculate (a) Threshold frequency and threshold wave length of metal (b) Energy of incident photon in electron volt.(c) maximum and minimum speed of emitted electrons (d) Stopping potential (e) If the wavelength of incident radiation is doubled, will the emission of electron take place or not.

26. Explain the following with reason:

(i)Photoelectric current in a photocell increases with increase in intensity of incident radiation.

(ii) Stopping potential increases linearly with frequency of incident radiation.

(iii) Maximum kinetic energy of photo electrons is independent of intensity of incident radiation.

Chap 12: Atom

1. Describe all the observation and related conclusions drawn from Geiger-Marsden or Rutherford particle scattering experiment, draw a rough diagram for this experiment. Show the term impact parameter b and angle of scattering in this diagram.
2. Draw a plot for number of particles versus angle of scattering. State the reason for the large value of angle of scattering $>90^0$.
3. Explain why thin gold foil is used in Geiger Marsden experiment. How one can conclude on the behalf of this experiment that whole mass of an atom is concentrated in a very small volume, what are the value of impact parameter b for the two values of angle of scattering $=0^0,180^0$ in this experiment.
4. Write the two approximate values of impact parameter representing atomic and nuclear size. Why does the value of impact parameter decides the trajectory of particle. Name the force responsible for large angle of scattering of in this experiment.
5. How will you determine the distance of closest approach R of an particle holding kinetic energy E approaching a thin foil of an element $_zX^A$. Name the form of energy conversion which takes place at this distance and explain why this distance does not give actual size of nucleus. What will be the magnitude of repulsive force at this distance.
6. Is the distance of closest approach greater or less than radius of gold nucleus. If the distance of closest approach for an particle is of magnitude R, what will be it's value for a proton approaching the same foil with kinetic energy E/2.
7. Describe three postulates of Bohr's model, use these to obtain an expression for radius of nth orbit, speed of an electron in this orbit and it's time period of revolution.
8. According to classical electromagnetic theory of Rutherford model show that the value of initial frequency of radiation emitted by an electron in ground state of H atom is $6.6\text{x } 10^{15}$ hz and radius of this orbit is $0.53A^0$.
9. According to classical theory of Rutherford model if an electron in an orbit radiates energy. Can this action of an electron in an atom make it to be a stable atom.What will be the shape of the path. Will the frequency of radiation emitted changes continuously.
10. Mention the four drawbacks of Bohr's model. Would the Bohr's expression for the radius, speed and time period remain same if the new charge of proton is considered to be +3/4e and that of electron is -4/3e.
11. Using Bohr's model, derive an expression for kinetic energy, potential energy and total energy of an electron in terms of radius of the orbit and also establish a relation between these energies. What are the values of kinetic energy, potential energy and total energy of an electron in highest energy state.
12. Using Bohr's postulate calculate total energy of an electron in unit electron volt in terms of number n of the orbit of a H atom. What is the significance of negative value of total energy.Write the least and maximum value of total energy of an electron in this atom.
13. Explain how does the total energy of electron in an orbit and the energy gap between these successive orbits vary if an electron moves from inner orbits to outer orbits. What would happen if total energy of an electron in an orbit were a positive value, explain.
14. If the K.E of an electron in a H atom is 1.59eV, what will be the value of potential energy and total energy in the same orbit. Which excited state of H atom an electron holds this energy.
15. If total energy of an electron in an orbit is -0.85eV. Find the energy required by this electron to move into next excited state. Also calculate the energy required to remove the electron of this orbit from the pull of nucleus.
16. Give the direction and magnitude of angular momentum of an electron in an orbit where it's total energy is -0.85eV. Calculate the total number of wave length of emitted radiation during transition of electron to ground state via intermediate states .Find which transition corresponds to minimum and maximum value of wavelength and calculate these values.
17. How does the de-Broglie hypothesis explains the Bohr's postulate of quantization of angular momentum.
18. State the methods and the conditions when an electron in an atom moves to excited state of higher energy. If an electron in ground state of H atom absorbs energy of12.5 eV. Estimate which excited state does it move by absorbing this energy. Calculate the total number of wavelength which it can emit during it's transition to ground state via intermediate states.
19. What do you mean by emission spectrum of H atom. Using Bohr's postulate obtain an expression for the frequency and wavelength of emitted radiations during the transition of electron from higher energy orbit n_2 to lower energy orbit n_1. Name the series and mark the region of E.M wave in which these spectral lines lie.
20. Estimate the wavelength of incident photon after absorbing it an electron in the ground state of H atom could reach to third excited state .
21. Which lines are known as H , H and H lines of H atom and calculate their wavelengths using the value of Rydberg constant R .
22. Draw the energy level diagram showing all the lines corresponding to Paschen series of H atom. Find the minimum and maximum wavelength of this series using the value of Rydberg constant R.
23. Calculate the ratio of energy of photons emitted by an electron during it's transition from second orbit and from highest energy orbit to first orbit.
24. Calculate the wave length of first ,second and last line of the series which lie in U.V and visible region of H spectrum. Which line shows least frequency and which one least wavelength of this spectrum.

Chap 13: Nuclei

1. How does the radius surface area and density of a nucleus of an element $_zx^A$ varies with it's mass number A. Compare the radius , surface area , volume and density of nuclei of element $_1H^1$ and $_{13}Al^{27}$.
2. Draw the curve showing the variation of potential energy between the nucleon versus distance between the nucleons. Which part of this curve shows stable and unstable nuclei. At which point of this curve nucleus is in most stable state.
3. Which physical quantity is represented by the slope potential energy curve of nucleons. Draw the graph for nuclear force vs distance curve corresponding to potential energy curve. Which part of the potential energy curve shows repulsive and attractive nature of nuclear force. At what distance between the nucleons, nuclear force changes it's nature.
4. Explain the four important properties of nuclear force. Write the two differences between electrostatic and nuclear force. What is called the saturation property of nuclear force. Is the potential energy of nucleons maximum or minimum when the nature of this force changes.
5. How will you find an average atomic mass of chlorine in a sample of it which has two isotopes of atomic masses 34.9u and 36.9u which are in abundance of 75.4% and 24.6%.
6. Define isotopes, isobars and isotones also give an example of each. Write three isotopes of hydrogen, which of them can not be found in natural state .In the composition of isotopes of an element, do these differ in number of protons or number of neutrons. Why do the isotopes of an element have same chemical properties.
7. Out of neutron and proton which is stable in free state and why, show the decay of unstable particle out of these two with the help of a nuclear reaction .Are the same particle stable or unstable for their presence inside nucleus.
8. Define and estimate the value of mass of 1amu or 1 u in kilogram. Using mass energy relation, calculate the energy equivalent to this mass in Kilo joule and in million electron volt.
9. Explain the term mass defect of a nucleus and state why energy is required to break a nucleus to carry it's nucleon at infinite distance apart from each other, is the converse true (energy released) during the formation of a nucleus.
10. What do you mean by the term binding energy of a nucleus, how it is related to the term mass defect. If the binding energy of a nucleus is high, does it mean nucleus is less tightly bound or more tightly.
11. Given that m_e is the mass of an electron and m_p is the mass of a proton in a nucleus of an element $_{13}Al^{27}$, then calculate the real mass of this nucleus if the binding energy of this nucleus is E and C is the speed of light.
12. Draw the curve between binding energy per nucleon and mass number. Draw the graph between binding energy per nucleon and mass number. Describe main features of this graph and state why the binding energy per nucleon is constant for elements of mass number lying between 30 and 170. How will you describe nuclear fission and fusion on the basis of this curve .
13. Is it easier to break the nucleus or not, explain. Out of given two elements $_1H^3$ and $_2He^3$,explain which has greater binding energy and why. State the reason why these reactions are exothermic in nature. Which two main factors influence the stability of a nucleus.
14. Although total number of protons and neutrons are conserved in both chemical and nuclear reaction then how do we decide about exothermic and endothermic nature of nuclear reactions. What are the sources of energy in chemical and nuclear reaction. Is the value of mass defect higher in nuclear or in chemical reactions.
15. Write the two similarities and dissimilarities between nuclear and chemical reactions. In what sense these two types of reactions are balanced and unbalanced on both side.
16. Write an equation of nuclear fission of $_{92}U^{235}$ and explain why energy is released in this reaction .On the behalf of this equation show that one kg of uranium produces 10^{14} joule of energy.
17. Verify whether the given nuclear reaction $_1H^1 + _1H^3 = _1H^2 + _1H^2$ is exothermic and endothermic . Given that masses of nuclei of $_1H^1$=1.007825 u , $_1H^2$=2.014102u , $_1H^3$=3.016049u. Calculate the Q value from given reaction.
18. Give an example of nuclear fusion reaction. Why the fusion reaction are initiated at very high temperature only (so called thermonuclear fusion).
19. Write a reaction for nuclear fission of most fissionable $_{92}U^{235}$ producing $_{56}Ba^{144}$, $_{36}Kr^{89}$ and three neutrons .Calculate the energy released in this reaction if B.E/nucleon of parent and daughter nuclei are 7.6 MeV and 8MeV,8.2MeV respectively. Explain why this reaction becomes chain reaction.
20. Which type of nuclear reaction takes place in nuclear reactor. Are these reactions controlled or uncontrolled in nuclear reactor and in nuclear bomb respectively.
21. Among two isotopes of uranium $_{92}U^{235}$ and $_{92}U^{238}$ which is most fissionable and and which is most abundant. What is the use of moderator in nuclear fission reactions and why it is necessary in nuclear reactor. State the principle of the working of these moderator, name two moderators.
22. Using the given fission reaction: $_1H^2 + _1H^2 = _2He^3 + _0n^1$+3.2MeV. Calculate how long a power of 1KW can be obtained with the use of 2 kg of deuterium.

23. Explain the phenomenon of radioactivity and state the law related to it .Why does radioactivity takes place and give it's S.I unit .Relate 1 curie with S.I unit.
24. Using the law of radioactivity obtain an expression for un decayed amount varying with time, show it's graphical variation. Obtain the value of half life and average life using this expression and relate these two.
25. State how does rate of decay or activity of a radioactive element varies with time t, show it's graphical variation. If half life of a radioactive element is T, then calculate the time in which activity is reduced to 6.25%, denote it on the graph also.
26. What are the products of a radioactive decay. Which of them (a) is not affected by external electric field (b)is similar to X rays (c)easily absorbed by matter (d) have highest ionizing power (e)is similar to cathode rays (f) have highest speed.
27. Write the reactions for radioactive decay of , particles and radiation, electron capture for same parent nucleus $_ZX^A$. State the condition when decay of a nucleus takes place .Discus the effect on neutron to proton ratio of parent nucleus after the decay of an , particle respectively.
28. Explain why the kinetic energy of particle is continuous .Plot theenergy distribution curve. Explain how an electron in the form of a particle is emitted from the nucleus Write an equation of and *and* decay. In given reaction $_6C^{11}$ $_5B^{11}$ .Show that maximum kinetic energy of particle is 0.96 MeV if mass of $_6C^{11}$ =11.01143U,mass of$_5B^{11}$ =11.009305U .
29. If half life of a radioactive element is 20 min then find the time interval after which (a) it's activity is reduced to 3.125% (b) 15/16 part of original amount is decayed.
30. Show anhilation of an electron and positron pair for the production of two photons also state how momentum and energy is conserved in this reaction. Find the wavelength of each photon.

Chap 14: Solid and Semiconductor

1. Name some elemental and compound form of semiconductors. Does the nature of motion of electrons in an isolated atom change when several atoms are brought close together to form a solid state crystal, explain.
2. Explain energy band formation in solids with the help of a suitable diagram, show the variation of relative energy of electron with changing the inter atomic spacing between the atoms. What are called energy bands in solids, define valance band, conduction band and forbidden energy gap. In which of these bands free electrons and hole move freely for conduction.
3. Draw energy band diagram of intrinsic semiconductor at absolute temperature T =0K and at T>0K. What are the status of valance band and conduction band in energy band diagram at these temperatures. How does the size of energy gap change with nature of material and it's temperature. Write the order of this energy gap in conductors, semiconductors and insulators. On the basis of magnitude of energy gap explain why the resistance of semiconductors is less than insulators.
4. In a pure form of semiconductor crystal show the formation of thermally generated free electrons and holes in a group of semiconductor atoms at temp. T>0K, also explain the motion of these holes. Is the motion of holes a way to define the motion of bound charges.
5. Arrange carbon, germanium and silicon semiconductor crystal on the basis of increasing magnitude of energy gap and ionization energy and explain why the carbon is not used as a semiconductor element. Among these tetravalent elements Sn, C, Ge and Si explain why Sn is a conductor, carbon is an insulator while Ge and Si are semiconductors.
6. State the reason for adding impurity atoms in pure form of semiconductor, what is this process and impurity atoms are called. Define intrinsic charge carrier and their concentration in pure form of semiconductor, how it is related to free electrons and holes concentration in pure form of semiconductor.
7. What do you understand by term doping in ppm. Does this doping change the total charge of doped semiconductor material. Name three pentavalent and three trivalent impurity elements atoms.
8. Give the four point of differences between n and p type extrinsic semiconductor. How much is approximate energy is required in electron volt in n type semiconductor to make donated electron free, is this energy greater or smaller than energy required by an electron to jump the forbidden energy gap in intrinsic semiconductor.
9. A pure form of silicon semiconductor has 5 10^{16} free electrons per unit volume and has 10 10^{30} atoms per cubic meter. Now it is doped with 2ppm impurity atoms of arsenic. Calculate intrinsic concentration also find the new free electrons and holes concentration after doping. Name the type of extrinsic semiconductor prepared after doping. Explain why the new holes concentration in a doped n type semiconductor is less than the previous holes concentration before doping.
10. Define the term majority and minority charge carriers in a doped semiconductor. Name these charge carriers in n and p type extrinsic semiconductor .State the reason why the n and p type semiconductors are electrically neutral.
11. Draw the energy band diagram for intrinsic and extrinsic semiconductors of n and p type semiconductor. Indicate the energy levels of Ev , E_c ,E_D and E_A , also represent the magnitude of energy gap in terms of these energy levels.
12. Explain with the help of a suitable diagram how a junction is formed in p-n junction diode .Can we form it by simply joining p and n type materials ,if not then justify it. Show the direction of drift and diffusion motion of electron and holes and explain the role of these current during the formation of depletion layer.
13. Explain why the potential difference across depletion layer is also known as barrier potential,can we measure it with the help of sensitive voltmeter connected across depletion layer. Show the variation of barrier potential across the depletion layer and the direction of electric field across the depletion.
14. With the help of the circuit diagram, explain forward and reverse biassing. Draw the corresponding V-I characteristic and mark the threshold voltage, break down voltage on this graph. At what minimum value of forward biassing voltage current starts flowing through Ge and Si junction diode. State the reason why the applied voltage is mostly dropped across the depletion layer during forward biassing.
15. Compare graphically the variation of barrier potential across depletion layer with no biassing and with forward and reverse biassing. Show that in forward biasing current is mainly diffusion current and in reverse biassing it is drift current. Explain why the reverse bias current remains nearly constant before the break down occurs.
16. State the range of meters used to read forward and reverse bias current. Discus the effect on width of depletion layer during forward and reverse biassing. Explain why the current increases very sharply after the break down voltage. What is the significance of small slope of reverse bias characteristic before the break down occurs.
17. State the reason why a p-n diode is called unidirectional device. What is the working principle behind the use of diode in rectification. Draw the circuit diagram and explain the working of a half wave rectifier. Draw the shape of input and output signal. If the frequency of input A.C signal of each is 50 Hz then what is the frequency of output signal.

18. Draw a circuit diagram of a full wave rectifier with input and output signal. If the frequency of input A.C signal of each is 50 Hz then what is the frequency of output signal. Draw another circuit diagram which does not require a center tap transformer.Though the output signal of a full wave rectifier is unidirectional but it is not a steady value. Which arrangement you shall use to obtain a steady output, draw it's circuit diagram and show the output waveform.

19. Name the p-n junction diode which emits light spontaneously when forward biassed. Describe the function of L.E.D and name the type of biassing used in it's working. Explain how does the intensity and colour of light emitted by L.E.D can be changed .Draw the V-I characteristic and explain in what way V-I characteristic of L.E.D is different from a simple junction diode.

20. Which material is used to form L.E.D, what should be necessary characteristic of this material and why we can not use semiconductor in element form to produce visible light using L.E.D. Why do we prefer L.E.D over conventional electric lamps, give three points in support of your answer.

21. Calculate the range of energy of photon emitted by L.E.D which is emitting light in visible region. What should be the approximate band gap for the L.E.D which is used in remote control system.

22. State the function of photodiode and draw the circuit diagram to explain it's construction and working. Mention the necessary condition used to detect the incoming optical signal. Explain why always reverse biassing is used to describe the change in current according to intensity of incident radiation.

23. Draw V-I characteristic of photo diode according to increasing intensity of incident light. Explain how this current increases with increasing intensity of incident light. Can a photodiode of energy gap 3.2 eV detect light of wavelength 600 nm.

24. Draw the symbol and V-I characteristic of a diode which is used as voltage regulator. Draw it's circuit diagram and explain it's action as a voltage regulator with the help of this diagram.

25. What is the use of heavy doping of p and n region in preparing a zener diode. Explain the working principle of this device and the type of biassing used to explain the process of field emission to pass large current through it.

26. Explain the working action of solar cells in three steps and name the places where these cells are used. Do we always require sunlight for the working of these cells if not then justify. What should be the most suitable energy gap of the semiconductor used for the preparation of solar cells and why.

27. Write the three important characteristics of the material used for the fabrication of solar cells and state the reason why do we prefer Si and Ga As material for the preparation of these cells. Draw the V-I characteristic of solar cell and explain why does it lie in fourth quadrant. Explain the intercepts made by this graph on x and y axis and indicate the point where the cell is operated on this graph. Name the p-n junction diode whose working is similar to solar cell.

28. Draw the symbols of n-p-n and p-n-p transistor and indicate the physical quantity which is represented by the arrow used in it's symbol. Which type out of n-p-n and p-n-p is preferred for the use of a transistor as an amplifier and why. Name the semiconducting material Ge or Si is preferred for use of transistor as an amplifier, give the reason.

29. How many depletion regions are formed in a transistor and mention the function of base region in transistor. Which layer of a transistor is heavily doped and which layer has maximum surface area, give the suitable reason for it .Explain why the base region of a transistor is least doped and made very thin also.

30. Which type of biassing of input and output junction are used for the action of transistor in active state .Show with the help of circuit diagram, working of n-p-n and p-n-p transistor in common emitter mode and show the path followed by majority and minority carrier.

31. Explain how Kirchoff's law are valid during the active working of a transistor and explain how I_E ˜I_C is maintained. Name the factors on which collector current depends in a transistor. In a n-p-n common emitter transistor of d.c current gain 50, collector current is 20 mA, calculate base and emitter current, also find what % of electron emitted by emitter region recombine with the holes of base region.

32. Drawing the circuit diagram explain the amplifying action of n-p-n and p-n-p transistor as an amplifier. Draw the shape of input and output signal and explain phase relation ship. Why do we mostly use common emitter configuration during amplifying action of a transistor.

33. What is the source of high power out put signal across the load resistance during the use of transistor as an amplifier. Why do we connect load resistance at the collector terminal and two capacitors in the input and the output of this transistor. Can we not increase the voltage gain to a very large value by increasing the value of load or collector resistance to any high value, if not justify. What is the significance of negative sign in an expression of voltage gain.

34. What are merits and demerits of a transistor in common emitter mode. Write an expression for input resistance, output resistance, A.C current gain, A.C voltage gain, power gain and trans conductance. Why do we have high power gain in common emitter mode.

35. In a common emitter transistor amplifier output voltage across collector resistance of 4KÙ is 2V. If A.C current gain of transistor is 100, then find the value of input base resistance if the change in input voltage is 2mV.

36. Draw a circuit diagram used to sketch input, output and transfer characteristic curves of a transistor in a common emitter mode. Why it is sufficient to draw only one input

characteristic and at what constant value. What is the significance of the slope of non linear part of input and output characteristic.

37. In which region active or saturation region transistor is found when the applied input voltage is less then threshold voltage(0.6V). Mark the saturation and active region in output characteristic of a transistor in common emitter mode. Why do we obtain different output characteristic curve for different values of I_B .

38. What are different D.C and A.C parameters we obtain using different output characteristic curves. What is the significance of small gradient of linear part of output characteristic curve. Draw two transfer characteristic between input current vs output current, input voltage vs output voltage and indicate the active and saturation region here.

39. State the main difference between analog and digital signal, how many discrete values each signal can posses and draw their shapes.What are called logic gates, in what way we define their functions and realize them in practice .State two applications of logic gates.

40. Which combination of logic gates are known as universal gate, draw their truth table and explain how do we use them to produce basic gates. Prepare a logical relation $Y \quad A\,B \quad A\,B$ using AND, OR and NOT gate.

41. Two inputs A and B are inverted using NOR gate and their output are again fed as two inputs of NOR gate again, write it's output and name the type of gate produced by complete circuit.Output of an OR gate is connected to both the inputs of NAND gate, draw the logic circuit of this combination and write the truth table.

Chap 15: COMMUNICATION

1. What are the two basic modes of communication in a communication system ,define each one. Name the three basic units of a communication system in block diagram. Which basic unit of communication system is affected by the noise.
2. Define analog and digital signal, show these graphically. Show the formation of rectangular wave or digital signal using sine wave. Explain why the digital signals have large band width. How does this large band width helps in communication process.
3. Define amplification, why it is necessary in a communication system. Name the energy source on behalf of which signal is amplified What do you mean by noise in a communication system.
4. State the role of an antenna in a communication system, what are the length of dipole and linear antenna if human voice signal of maximum frequency 20 Khz are converted in to E.M wave to propagate up to long distance.
5. What is repeater, what is it's use in a communication system. Give an example of a repeater station in space Define the role of communication channel(transmission media) in a communication system, give an example of each type.
6. What do you mean by the term band width .What are the band width of following transmission media: (a) coaxial cable (b) optical fiber. State the principle of working of an optical fiber, explain why do we mostly prefer optical fiber as transmission media.
7. State the frequency range of transmission of : A.M broad cast, F.M broad cast, T.V signal transmission without satellite, Mobile signal transmission, satellite transmission. explain how the mixing of different signals is avoided in our surrounding
8. What do you mean by the term attenuation. Explain why high frequency signal can not be transmitted using ground wave or surface wave propagation. Give the two factors on which range of this transmission depends.
9. Explain why the sky wave propagation is also known as short wave band and how the long distance communication is possible using this mode. What is the use of ionosphere in radio wave propagation. Write an expression for critical frequency for a ionospheric layer. Why the T.V signals can not be transmitted up to long distance using ionospheric layer.
10. Which out of 4Mhz and 9 Mhz signal will travel longer distance along the earth if these are sent from the same point on the earth via sky wave propagation. What is the maximum electron density of a ionospheric layer whose critical frequency is 36M hz.
11. What is space wave propagation, which two mode of communication are included in this mode of propagation. Give some example where this mode of propagation is used .Explain why the communication using line of sight is possible for frequency above 40 Mhz only.
12. What is the maximum range a transmitting tower of height h assuming $h<R_e$. Also calculate the area covered. Suggest three ways to increase the range of transmission in line of sight propagation.
13. Define modulation, mention three needs for modulation. Explain why do we require a carrier wave of very high frequency .Obtain a mathematical expression for amplitude modulated signal.
14. Define analog or amplitude modulation, show graphically how the message signal is superimposed in this type of modulation, explain why $A_m < A_c$. Give some advantages and disadvantages .Why A.M transmission is more noisy then F.M transmission.
15. Draw the amplitude versus ù plot and indicate lower and upper side band frequencies. If the maximum and minimum amplitude of a modulated signal are a and b respectively then find the value of modulation index.
16. Draw the block diagram of an A.M modulator and demodulator or detector, also describe the function of band pass filter in A.M modulator.
17. Which two type of modulation are required for radio and T.V broad cast. Why frequency modulation is preferred over amplitude modulation. What do you mean by point to point and broad cast communication, give an example of each.
18. Explain the following in communication system (a) Transducer (b)I.F.T stage (c)Antenna (d)Tuned amplifier(e)Atteneuation (d).