PREFACE

In the ACs' conference held in July, 2010 at KVS (HQ), New Delhi, issue of Study Material for Board classes was discussed at length and finally decided to provide it to students. Various Regional Offices were asked to prepare the study material in different subjects while the task of its correction and moderation was assigned to various ZIETs of KVS.

KVS, ZIET, Chandigarh received study material in the subjects of Physics, Chemistry, and Biology &Maths for XII, Maths and Science &Tech. for X class, from various Regional Offices. The study material was got reviewed and suitably modified by organising workshops of experienced and competent subject teachers with the co-operation and guidance of AC,KVS,RO,CHD. Corrected study material was sent to all regional offices for providing it to students and also uploaded on the Website WWW.zietchandigarh.org.

Subject teachers, both at the preparation and moderation levels have done a remarkable job by preparing a comprehensive study material of multiple utility .It has been carefully designed and prepared so as to promote better learning and encourage creativity in students through their increased self efforts for solving assignments of different difficulty level. But the teachers and the students must bear in mind that the purpose of the study material is in no way to replace the text-book, but to make it a complete set by supplementing it with this study material so that it may provide requisite and adequate material for use in different ways.

The study material can be effectively used in the following ways:

- **Practice material** to supplement questions given in the textbook.

- **Material for Study Camps:** The purpose of conducting study camps is to inculcate study habits amongst students under active supervision of the teachers. These camps can beorganised within the normal school hours and days. Day wise target will be ascertained and given to the students and reviewed by the concerned subject teacher. If the target is not achieved by any student, it will be added to the next day's target.

- **Master Cards:** The teachers can help students prepare master cards by taking the important questions/topics/points/concepts /reactions/terms etc from this study material for the quick revision for the examination.

❖ **Crash Revision Courses:** The material can also be used for preparing handouts for conducting Crash Revision Courses under the supervised guidance of the teachers just before or in the gaps between papers during examination.

Effectiveness of the study material will ultimately depend upon its regular and judicious use for the above listed purposes both by teachers and students. While attempting the source material, it would be quite useful to mark every time a question done successfully with a tick out (✓) and a question not done successfully with a dot (•). It can be later used as a source of feedback for error analysis and for effective subsequent revisions/remedial work etc. I am sure that this well prepared study material if used sincerely and judiciously will surely bring cheers to all sections of students.

I, also, take this opportunity to extend my most sincere gratitude to our Hon'ble, Commissioner KVS (HQ), New Delhi, and other higher authorities of KVS for providing this opportunity for making some useful contribution to the study material.

I also extend my thanks to all the Assistant Commissioners of various Regions for their in-valuable contribution in preparation of the Study Material in various subjects.

Above all, sincere and dedicated efforts of the subject teachers in preparation of this study material deserve full appreciation. Teacher's observations, suggestions and critical analysis for further improvement of the study material mailed to 'kvszietchd' @gmail.com, will be highly appreciated.

With best wishes to all users of this STUDY MATERIAL.

(HAR GOPAL)

Director

KVS ZIET Chd.

UNIT 1

ELECTROSTATICS

Concepts	Degree of importance	Reference from NCERT	Levels of Assignment	Errors generally committed
Charge conservation	*	P-8	L-1	-ve and +ve sign to be taken care of.
Coulomb's law	***	P-10 Ex1.4 P-13	L-2, L-3	Wrong formula and wrong reasoning
Superposition Principle	**	P-15 Ex1.6 P-16	L-1,L-3	Application of concept not clear for numerical problems
Continuous charge distribution	*	P-32	L-1	Wrong conceptualization of discrete charge and continuous charge
Electric field due to a point charge	***	P-18 Ex1.8 P-21	L-1, L-2,	
Electric field lines	***	P-23-24	L-1, L-2, L-3	Wrong reasoning
Electric Field due to an electric dipole	*****	P-27-28 Ex1.10 P-29	L-2,L-3	
Electric dipole in uniform electric field	****	P-31	L-2, L-3	
Electric flux	**	P-25-26	L-1, L-2	Conceptualization problem
Gauss' Theorem	***	P-33-34 Ex1.11P-35	L-2, L-3	Problem in understanding Gaussian surface concept
Electric field due to long straight wire, charged infinite plane sheet and charged shell using Gauss' Theorem	*****	P-37-39 Ex1.12 P-36	L-2,	Concept of charge density(linear and surface), relation of R and r in case of shell
Electric potential due to point charge	***	P-53-54 Ex2.2 P-58, Ex2.3 P-59	L-2, L-2	Application of the concept, reasoning questions
Electric potential due to an electric dipole	****	P-55-56	L-2, L-3	Equipotential surface
Equipotential surface	****	P-60	L-1, L-2, L-3	
Electric potential energy of system of two charges	***	P-65 Ex2.6 P-67	L-3	
Electric potential energy of an electric dipole in external electric field	****	P-66	L-2, L-3	Stable and unstable equilibrium
Properties of conductors	**	P-68-69	L-1, L-3	
Principle of capacitor	*	P-73	L-1	Explanation of concept
Capacitance of parallel plate capacitor	***	P-74	L-1, L-2,L-3	
Capacitance of parallel plate capacitor with Dielectric	***	P-75 Ex2.8 P-77	L-3	Concept of polarization and electrical susceptibility
Combination of capacitors	***	P-78-79 Ex2.9 P-79	L-3	Application of concept for numerical
Energy stored in a capacitor	****	P-80-81	L-2, L-3	Finding loss of energy
Van De Graff Generator	**	P-83-84	L-2, L-3	

Unit I

Electrostatistics

LEVEL 1

1. State the principle of quantization of electrical charges.
2. What do you mean by relative permittivity? Write its relation in terms of force & electric field. Write its dimensions.
3. Define electric field intensity. Write its expression due to a point charge and find its dimension.
4. Draw electric field lines of an electric dipole.
5. Write three properties of Electric field lines.
6. Define electric dipole moment. What is its unit in SI system?
7. Derive an expression for the torque acting on an electric dipole placed in a uniform electric field and hence find its potential energy.
8. What do you mean by electric potential? Derive an expression for it due to a point charge.
9. Explain three properties of equipotential surfaces.
10. Define electric flux. How is it related to the charge enclosed?
11. State Gauss's theorem and using it derive the expression for electric field due to a uniformly charged spherical shell
12. Write the principle of a capacitor & derive expression for energy stored in a capacitor.
13. Explain the principal and construction of Van de Graff generator with the help of diagram.

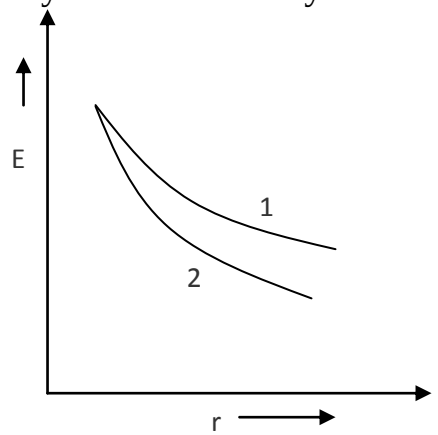
LEVEL 2

1. Write two limitations of Coulomb's law.
2. What are the unit and dimensions of permittivity of free space?
3. Calculate the electrostatic force between two α- particles at a distance of $2x10^{-5}$m between them.
4. Why do electric field lines never cross each other?
5. Derive an expression for the electric field at a point on the equatorial line of an electric dipole.
6. Does an electric dipole always experience a torque, when placed in uniform electric field? Support your answer with reason.
7. How an electrostatic potential is related to the electric field at a point?
8. No work is done in moving a test charge over an equipotential surface. Why?
9. Derive an expression for the potential energy of an electric dipole in an external uniform electric field.
10. What is meant by 'electrostatic shielding'?
11. Derive an expression for the capacitance of a parallel plate capacitor? On what factors does the capacitance of a parallel plate capacitor depend?
12. Define dielectric constant in terms of the capacitance of a capacitor.

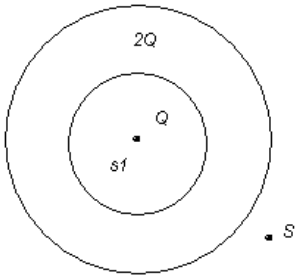
13. In a parallel plate capacitor, how is the capacity affected, when without changing the charge.
    a. The distance between the plates is doubled.
    b. Area of the plates is halved.
14. Derive an expression for the energy stored in a parallel plate capacitor with air as the core material of the capacitor.

LEVEL 3

1. Two point charges of charge values Q and q are placed at a distance of x and x/2 respectively from a third charge of charge value 4q, all charges being in the same straight line. Calculate the magnitude and nature of charge Q, such that the net force experienced by the charge q is zero.
2. The variation of electric fields of two systems with distance from each is shown in the graph. Identify nature of each system of charge.



3. Draw Electric field lines for
    I. Charge q>0
    II. q<0
    III. Two equal & opposite charges.
    IV. Two equal & similar charges.
4. An electric dipole of length 10 cm having charges $\pm 6\times10^{-3}$ C, placed at 30^{o} w.r.t. a uniform electric field experiences a torque of magnitude $6\sqrt{3}$ Nm. Calculate
    a. magnitude of the electric field
    b. the potential energy of the dipole
5. What is the potential energy of an isolated electric charge?
6. s_1 and s_2 are two hollow concentric spheres enclosing charges Q and 2Q respectively as shown in fig.



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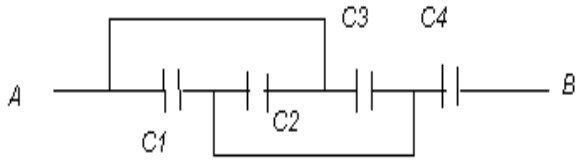
a. What is the ratio of electric flux through s_1 and s_2
b. How will the electric flux through the sphere s_1 change, if a medium of dielectric constant 5 is introduced in the space inside s in place of air?

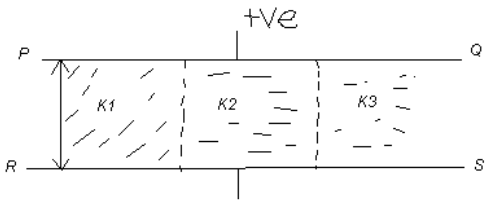
7. A cubical surface encloses a charge of 8.85×10^{-8}C
   a. Calculate the electric flux through one face of the cube.
   b. If the charge is enclosed by a spherical surface of radius 7cm; what is the flux through the spherical surface?
8. If the electric field is given by 6i+3j+4k, calculate the electric flux through a surface of area 20 units lying in Y-Z plane.
9. Show graphically variation of electric field due to a charged conducting sphere with distance and briefly explain it.
10. Explain why the electric field inside a conductor placed in an external electric field is zero.
11. Two capacitors of capacitances 2μF and 2μF are connected first in series and then parallel. What is the ratio of their capacitances?
12. Calculate the equivalent capacitance between the points A and B in the combination shown below



Given C1 = 5 μF; C2= 10 μF , C3= 15μF; C4= 30μF

13. A parallel plate capacitor with each plate of area A and separation d is charged to a potential difference V. The battery used to charge it is then disconnected. A dielectric slab of thickness d and dielectric constant k is now placed between the plates. What change if any, will take place in
    a. Charge on plates?
    b. Electric field intensity between the plates?
    c. Capacitance of capacitor.
14. Two parallel plates PQ and RS are kept distance ‘d’ apart. Area of each plate is ‘A’. The space between them is filled with three dielectrics slab of identical size, having

dielectric constants k1, k2, and k3, respectively as shown below; find the capacitance of the capacitor.



15. Two plates of a parallel plate capacitor are 0.01 metre apart. A dielectric slab of dielectric constant 6 and thickness 0.005m is introduced between the plates parallel to the plates of the capacitor. Determine the distance between the plates such that the capacitance remains the same after suitable adjustments of the plates.

Unit 2

Current Electricity (Concepts)

Concepts	Degree of importance	Reference from NCERT	Levels of Assignment
1Electric current	*	93	Wrong Definition
2 Current Density	**	98	Wrong Definition
3 Drift Velocity	*****	97	Confusion between drift velocity and thermal vel.
4 Dependence of Drift velocity on electric field and temperature.	***	100	Wrong concept of change of drift velocity with temperature .
5 Relation between current and drift velocity.	*****	98	Derivation of drift velocity not required unless asked.
6 Ohm's Law and its deduction and concepts of resistance, resistivity and dependence on geometrical parameters.	****	95	Derivation of result with direct use of current and drift velocity unless asked.. Concept of constant volume on change geometrical parameters.
7 Limitation of ohm's law	*	101	Identification of physical conditions.
8 Carbon resistors.	***	103 (Table 3.2)	Wrong ordering of colours and digits allocation .
9 Combination of resistances	***	105-107	Correct identification of series and parallel from given circuit diagram
10 Effect of temperature on resistivity.	**	104	Concept of directly proportional should be clear.
11 EMF and terminal potential difference.	*****	110	Confusion of emf with force
12 Internal resistance of a cell.	****	110	Exact cause of internal resistance and its effect on emf.
13 Combination of cells	***	113	
14 Kirchhoff's Law	*****	116	Consequences of which principle, wrong signs in loop equation when tracing .
15 Wheatstone Bridge	*****	118	Wrong circuit diagram
16 Meter Bridge	***	120	Wrong placement of unknown resistance and result there after.
17 Potentiometer principle and its applications (1) Comparison of EMF's by Potentiometer (2) Internal resistance of a cell.	*****	122 Fig 3.28 (a) Fig 3.28 (b)	Incorrect circuit diagram with wrong polarity of cells.

Unit II

Current Electricity

LEVEL 1

1. A carbon resistor of 47K is to be marked with rings of different colours for identification. Write the sequence of colours?
2. Will the drift speed of free electrons in a metallic conductor increases or decreases with increase or decrease in temperature?
3. Give examples of elements which do not obey Ohm's Law?
4. Two wires of equal length one of copper and other of manganin has same resistance which wire is thicker?
5. If temperature of a good conductor decreases, how does the relaxation time of electrons in a good conductor changes?
6. Why emf of a cell measured by potentiometer is accurate?
7. When is a wheat stone bridge set to be balanced?
8. What are two practical form of Wheat stone bridge?
9. Which bulb has more resistance? a) 100 W; 200W b) 200W; 60W
10. Which electric bulb has greater heat production; 100W or 200W, assume that both lamps are connected to same supply?
11. Write the basic rules (laws) on which Kirchhoff's laws are based.
12. Write any two points between emf and potential difference of a cell.
13. What are the factors affecting internal resistance of a cell
14. A wire of resistance 10 ohm is stretched to Double its original length at constant temperature. How does its resistance and resistivity change
15. Establish a relation between the current and drift velocity.
16. Discuss Wheat Stone's principle. Use the principle to find the specific resistance of a material of the given wire using metre bridge.

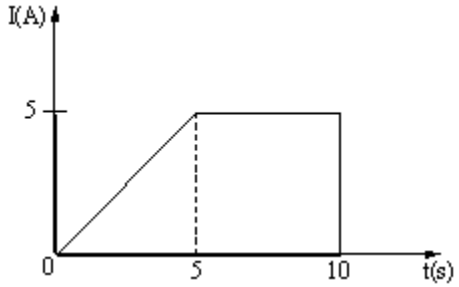
LEVEL - 2

1. What do you mean by relaxation time of free electrons in metals?

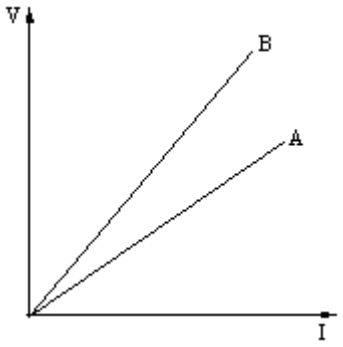
2. Bends in rubber pipe reduce the flow of water through it. How would the bends in a wire affect electrical resistance?

3. In an electric kettle, water boils in 20 minutes after the kettle is switched on. With the same supply voltage if the water is to boil in 10 minutes, should the length of the heating element be decreased or increased?

4. Show a plot of current I through the cross-section of a wire over a time interval of 10 s. Find the amount of charge that flows through the wire during this time period.

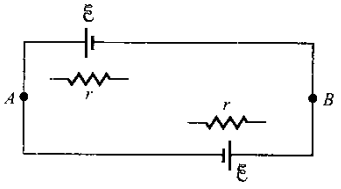


5. V – I graphs for parallel and series combination of two metallic resistors are shown in figure. Which graph represents parallel combination? Justify your answer.



6. A potential difference V is applied across a conductor of length L and diameter D. How are the electric field E and the resistance R of conductor affected when in turn (*i*) V is halved, (*ii*) L is halved and (*iii*) D is doubled? Justify your answer in each case.

7. Two identical storage batteries, each having emf ξ and internal resistance *r*, are connected, as shown in Fig. 3. Determine the potential difference set up between the points *A* and *B*.



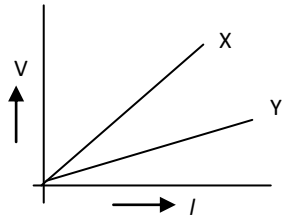
8. Describe with the help of circuit diagram how a potentiometer can be used to compare the e.m.f. of two cells.

9. Define resistivity and state its SI unit. State and explain how the resistivity of a conductor varies with temperature.

10. Two identical cells of emf 1.5 V each joined in parallel provide supply to an external circuit consisting of two resistances of 17 Ω each joined in parallel. A very high resistance voltmeter reads the terminal voltage of cells to be 1.4 V. Calculate the internal resistance of each cell. Q Q11 A negligibly small current is passed through a wire of length 15 m and uniform cross-section 6.0×10^{-7} m^2, and its resistance is measured to be 5.0 Ω. What is the resistivity of the material at the temperature of the experiment?

11. (a) Three resistors 1 Ω, 2 Ω, and 3 Ω are combined in series. What is the total resistance of the combination?
(b) If the combination is connected to a battery of emf 12 V and negligible internal resistance, obtain the potential drop across each resistor.

12. The variation of potential difference V with length *l* in case of two potentiometers X and Y is as shown in the given diagram. Which one of these two will you prefer for comparing emfs of two cells and why?



LEVEL 3

1. For the potentiometer circuit, shown in Fig. 8, points X and Y represent the two terminals of an unknown emf *E.* A student observed that when the Jockey is moved from the end A to the end B of the potentiometer wire, the deflection in the galvanometer remains in the same direction. What are the two possible faults in the circuit that could result in this observation?

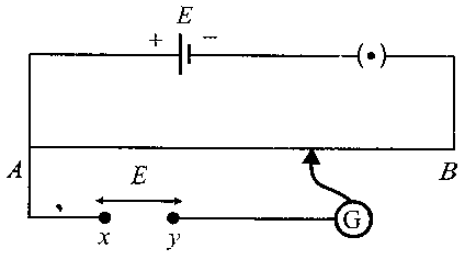


Figure 8

If the galvanometer deflection at the end Bis (i) more (ii) less than that at the end A, which of the two faults, listed above, would be there in the circuit? Give reasons in support of your answer in each case.

2. In the potentiometer circuit shown in fig. 9 the balance (null) point is at X.

State with reason, where the balance point will be shifted when

(i) Resistance *R is* increased, keeping all parameters unchanged.

(*ii*) Resistance S is increased, keeping *R* constant.

(iii) Cell *P is* replaced by another cell whose e.m.f. is lower than that of cell Q.

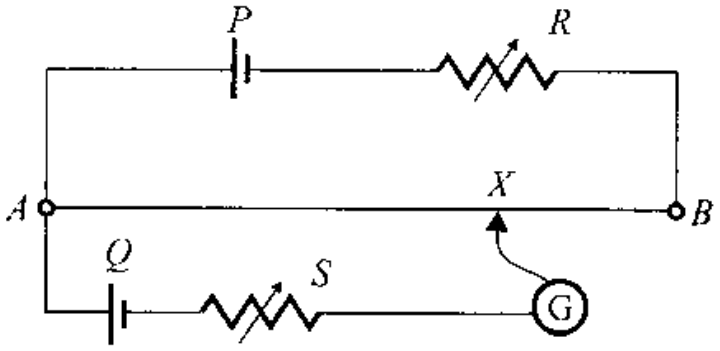
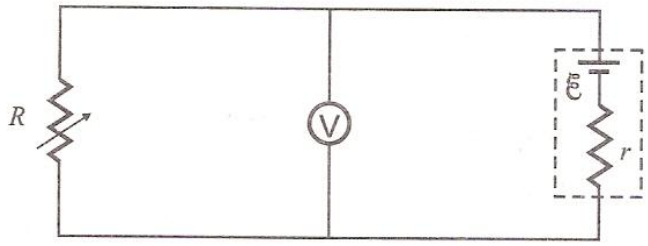


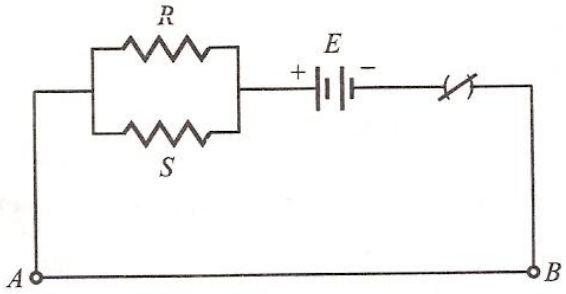
Figure 9

3. At room temperature (27.0 °C) the resistance of a heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117 Ω, given that the temperature coefficient of the material of the resistor is $1.70\times10^{-4}\ °C^{-1}$

4. Fig. shows a cell of emf ξ and internal resistance r, connected to a voltmeter V and a variable resistance R. Deduce the relationship among V, ξ, R and r. How will V vary when R is reduced?



5. A potentiometer wire has a length L and a resistance R_0. It is connected to a battery and a resistance combination as shown. Obtain an expression for the potential drop per unit length of this potentiometer wire.



What is the maximum emf of a 'test cell' for which one can get a 'balance point on this potentiometer wire? What precaution should one take, while connecting this 'test cell' in the circuit?

6. A cell of emf 1.5 V and internal resistance 0.5 Ω is connected to a (non-linear) conductor whose V-I graph is shown in Fig. 5. Obtain graphically the current drawn from the cell and its terminal voltage.

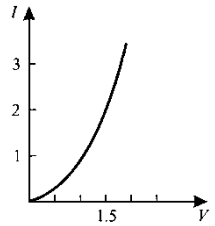
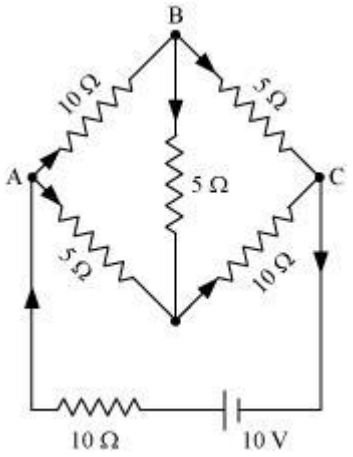
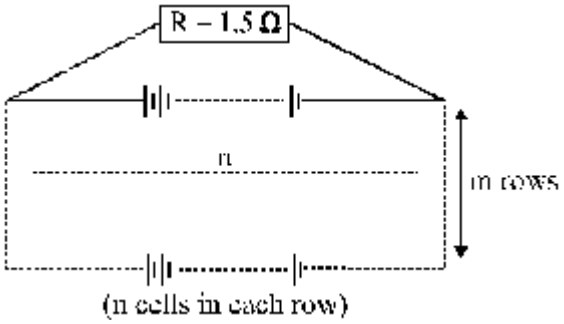


Fig. 5

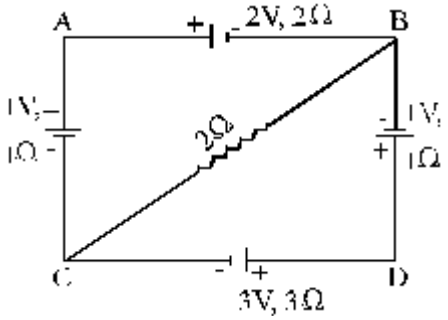
7. Determine the current in each branch of the network shown in fig



8. 12 cells, each of emf 1.5V and internal resistance, are arranged in m rows each containing n cells connected in series, as shown. Calculate the values of n and m for which this combination would send maximum current through an external resistance of 1.5 ohm.



9. For the circuit shown here, calculate the potential difference between points B and D

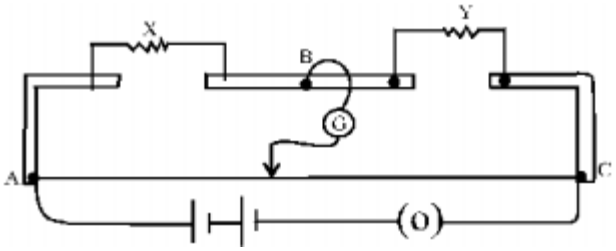


10. A cell of unknown emf E and internal resistance r, two unknown resistances R_1 and R_2 ($R_2 > R_1$) and a perfect ammeter are given. The current in the circuit is measured in five different situations : (i) Without any external resistance in the circuit, (ii) With resistance R_1 only, (iii) With resistance R_2 only, (iv) With both R_1 and R_2 used in series combination and (v) With R_1 and R_2 used in parallel combination. The current

obtained in the five cases are 0.42A, 0.6A, 1.05A, 1.4A, and 4.2A, but not necessarily in that order. Identify the currents in the five cases listed above and calculate E, r,, R_1 and R_2.

11. Describe the formula for the equivalent EMF and internal resistance for the parallel combination of two cells with EMF E1 and E2 and internal resistances r1 and r2 respectively. What is the corresponding formula for the series combination? Two cells of EMF 1V, 2V and internal resistances 2 ohms and 1 ohm respectively are connected in (i) series, (ii) parallel. What should be the external resistance in the circuit so that the current through the resistance be the same in the two cases? In which case more heat is generated in the cells?

12. The given figure shows the experimental set up of a metre bridge. The null point is found to be 60cm away from the end A with X and Y in position as shown.

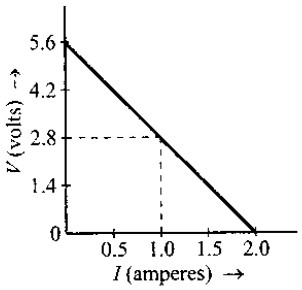


When a resistance of 15Ω is connected in series with 'Y', the null point is found to shift by 10cm towards the end A of the wire. Find the position of null point if a resistance of 3O Ω were connected in parallel with 'Y'.

13. Why is a potentiometer preferred over a voltmeter for determining the emf of a cell? Two cells of Emf E1 and E2 are connected together in two ways shown here.

The 'balance points' in a given potentiometer experiment for these two combinations of cells are found to be at 351.0cm and 70.2cm respectively. Calculate the ratio of the Emfs of the two cells.

14. 4 cells of identical emf ξ, internal resistance *r*, are connected in series to a variable resistor. The following graph shows the variation of terminal voltage of the combination with the current output:



(i) What is the emf of each cell used?

(ii) For what current from the cells, does maximum power dissipation occur in the circuit?

Calculate the internal resistance of each cell.

UNIT-3

MAGNETIC EFFECTS OF CURRENT & MAGNETISM

Concepts	**Degree of importance**	**Reference from NCERT**	**Levels of Assignment**
Lorentz force	*****	Eq 4.3 page 134	Direction between moving charge and magnetic field
Magnetic force	*****	Fig 4.2 page 135	Direction of cross product Pair of perpendicular vectors
Magnetic force on a current carrying conductor	**	Eq 4.4 page 136	Direction of cross product Flemming left hand rule
Motion of a charged particle in uniform mag. field	**	Fig 4.5 & 4.6 page 138	Magnetic force is acting as centripetal force
Motion of a charged particle in combined electric & magnetic field	*	Eq 4.7 & fig 4.7 page 140	Condition at which electrostatic force and magnetic force cancel each other
Cyclotron	**	Fig 4.8 & eq 4.8 page 141	Condition for resonance. Limitations of cyclotron
Biot-Savart's law	****	Fig 4.9 & eq 4.11a&b page 143	Direction of magnetic field intensity using direction of cross product
Magnetic field on the axis of current carrying circular loop	***	Fig 4.11 & eq 4.13 page 145	Common mistake in figure Resolution of d**B**
Magnetic field lines due to current loop	**	Fig 4.12 page 146	Common mistake in the direction of current through the loop and magnetic field lines
Ampere's circuital law	*****	Fig 4.14 & eq 4.17a page 147	Common mistake in mathematical expression and difference between current loop and Amperian loop
Magnetic field lines due to a straight current carrying solenoid	**	Fig 4.17 & page 151	Field lines inside the solenoid should be parallel and equidistant
Magnetic field intensity inside a straight current carrying solenoid	****	Fig 4.18 & eq 4.20 page 151 &152	Magnetic field intensity is zero only just outside to the solenoid
Magnetic field due to current carrying toroidal solenoid	***	Fig 4.19a page 152 & eq 4.22 page 153	Magnetic field is confined inside the toroid
Force per unit length between infinitely long parallel current carrying straight conductors.	*****	Fig 4.20 page 154 & eq 4.25 page 155	Magnitude and direction of Magnetic field intensity due to straight conductor carrying current. Magnitude and direction of force felt by segment of the conductor.
Torque on a current carrying loop in uniform magnetic field	**	Fig 4.22 & eq 4.29 page 158	No torque due to forces on horizontal sides of current loop in horizontal magnetic field.
Magnetic dipole moment of a revolving electron	****	Fig 4.23 & μ_l = evr/2 page 162	M = I A
Moving coil galvanometer	*****	Fig 4.24 page 164 eq	Importance of radial magnetic

		4.38	field
Current sensitivity of moving coil galvanometer		Eq 4.39 page 165	Definition and factors of current sensitivity
Voltage sensitivity of moving coil galvanometer		Eq 4.40 page 165	Definition and factors of voltage sensitivity
Conversion of galvanometer into ammeter	***	Fig 4.25 page 165	Connection of resistance (high/low) in series / parallel
Conversion of galvanometer into voltmeter	***	Fig 2.26 page 165	Connection of resistance (high/low) in series / parallel
The Bar magnet,magnetic field on axial and equatorial line of a bar magnet,Torque on bar magnet in uniform magnetic field,potential energy of bar magnet in uniform magnetic field,bar magnet as an equivalent solenoid,	**	Topic 5.2 pg 174-178	Students use electric field in place of magnetic field
magnetic field lines,gauss's law in magnetism	**	Topic 5.2.1,5.3,solved example 5.6,5.7	Confused in plots of electric & magnetic field lines
The earth's magnetism-cause & characteristics	*	Topic 5.4,fig.5.8	Confusion in geographic & magnetic poles
Magnetic elements	***	Topic 5.2.	Calculation of angle of dip at various places
Magnetisation and magnetic intensity	*	Topic 5.5	Values of permeability & susceptibility for magnetic materials
Magnetic properties of materials	***	Topic 5.6	Properties of magnetic materials
Permanent magnets and electromagnets	***	Topic 5.7	Confusion in names of materials used as permanent magnet , electromagnet & core of transformer

UNIT 3

Level 1

Q1. How much force will be experienced by a moving charge in a magnetic field?

Q2. What is meant by cyclotron frequency?

Q3. What is the effective resistance of ammeter if a shunt resistance S is used across the terminals of the galvanometer of resistance G?

Q4. Which physical quantity has the unit Wb/m^2? Is it a scalar or a vector quantity?

Q5. If magnetic dipole is along the direction of magnetic field. What is the potential energy? If it is rotated by 180°, then what amount of work will be done?

Q6. What is the angle of dip at a place where horizontal & vertical components of Earth's magnetic field are equal?

Q7. Why do magnetic lines of force prefer to pass through iron than air?

Q8. Which material is used for making permanent magnet & why?

Q9. Where is the magnetic field due to a current carrying solenoid remains uniform?

Q10. Which material is used for making electromagnet and why?

Q11. What is the net magnetic moment of an atom of a diamagnetic material?

Q12. Give two points of difference between magnetic properties of soft iron and steel.

Q13. What is the main function of soft iron core used in moving coil Galvanometer?

Q14. What happens if an iron bar magnet is melted? Does it retain magnetism?

Level 2

Q1. A beam of electrons projected along +X axis, experiences a force due to a magnetic field along +Y axis. What is the direction of magnetic field?

Q2. Why should the spring/suspension wire in a moving coil galvanometer have low torsional constant?

Q3. For a Para magnetic material, plot the variation of intensity of magnetisation with temperature.

Q4. A particle with charge q moving with a velocity v moving in the plane of paper enters a uniform magnetic field B acting perpendicular to paper and pointing inwards. Why does the kinetic energy of the charge particle not change while moving in the field?

Q5. How will the magnetic field strength at the centre of the circular coil carrying current change, if the current through the coil is doubled and radius is halved?

Q6.Can moving coil galvanometer be used to detect an a.c. in a Circuit? Give reason.

Q7. Deduce an expression for the magnetic dipole moment of an electron orbiting around the central nucleus.

Q8. Using Ampere's circuital law, derive an expression for magnetic field along the axis of a current carrying toroidal solenoid of N number of turns having radius r.

Q9. Define the terms magnetic inclination and horizontal component of earth's magnetic field at a place. Establish the relation between them.

Q10. A galvanometer has a resistance of 30Ω. It gives full scale deflection with a current of 2 mA. Calculate the value of resistance needed to convert it into an ammeter of range 0-0.3A.

Q11. Derive an expression for magnetic field on the axial line of circular loop of radius 'a' and carrying current I at a distance x from the centre.

Q12. A rectangular coil of N turns and area of cross section A is placed in uniform magnetic field B with area vector making angle with B. Derive an expression for torque on the coil.

Q13. Draw a schematic sketch of a cyclotron. Explain briefly how it works and how it is used to accelerate the charged particle

i) Show that the time period of ions in a cyclotron is independent of both the speed and radius of circular path.

ii) What is resonance condition? How is it used to accelerate the charged particle?

Q14. Two straight long parallel conductors carry currents I_1 and I_2 in the same direction. Deduce an expression for the force per unit length between them.

Q15. a) With the help of a diagram, explain the principle and working a moving coil galvanometer.

b) What is the importance of radial magnetic field and how is it produced.

c) While using moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used. Why?

Q16. Derive an expression for the magnetic field along the axis of air cored solenoid, using Ampere's circuital law. Sketch the magnetic field lines for a finite solenoid. Explain why the field at exterior is weak while at the interior it is uniform and strong.

LEVEL 3

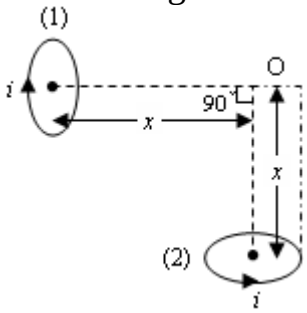
Q1.A charged particle moving in a uniform magnetic field penetrates a layer of lead and thereby loses one half of its kinetic energy. How does the radius of curvature of its path change?

Q2. Why diamagnetism is almost independent of temperature?

Q3. Three identical specimens of magnetic materials nickel, antimony and aluminium are kept in a uniform magnetic field. Draw the modification of field lines in each case. Justify your answer.

Q4. How can a moving coil galvanometer be converted into an ammeter? To increase current sensitivity of a moving coil galvanometer by 50% its resistance is increased so that the new resistance becomes twice its initial resistance. By what factor does its voltage sensitivity change?

Q5.Two small identical circular loops, marked (1) and (2), carrying equal currents, are placed with the geometrical axes perpendicular to each other as shown in figure. Find the magnitude and direction of the net magnetic field produced at the point O.



Q6.Two protons P and Q moving with the same speed enter magnetic fields B1 and B2 respectively at right angles to the field directions. If B2 is greater than B1, for which of the protons P and Q, the circular path in the magnetic field will have a smaller radius?

Q7. An electron and a proton moving parallel to each other in the same direction with equal momenta enter into a uniform magnetic field which is at right angle to their velocities. Calculate the ratio of radii of the circular path.

UNIT-4

ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

S.No.	Concepts	Degree of Importance	Reference from NCERT	Errors generally committed	Additional Information
1	Magnetic Flux	*	Topic 6.3 Page. 206	Confusion in angle & conversion of units	More no. of magnetic lines linked with a coil means more magnetic flux is linked with it and vice-versa.
2	Electromagnetic Induction	***	Topic 6.1 Page. 204	Directions of the induced current	
3	Ways to change Magnetic Flux linked with the coil	**	Topic 6.4 Page. 208	-	
4	Laws of EMI	****	Topic 6.4 Page. 208	Students write only one law	
5	Lenz 's Law	**	Topic 6.5 Page. 210	Application of the law	
6	Self Inductance	***	Topic 6.9.2 Page. 222		
7	Mutual Inductance	**	Topic 6.9.1 Page. 220		
8	Eddy Currents	***	Topic 6.8 Page. 218		
9	rms value of AC	**	Topic 7.2 Page. 235	Confusion in the formula	Difference between AC & DC ,measurement of a.c. is done by hot wire instruments based on rms value.
10	AC circuit containing : 1. R only 2. L only 3. C only 4. LCR circuit	**	Topic 7.2 Page. 234 Topic 7.4 Page. 237 Topic 7.5	Unable to distinguish the phase angles	

			Page. 241 Topic 7.6 Page. 244		
11	Phasor & phasor diagram	***	Topic 7.3 Figure 7.4 Page. 237	Unable to distinguish the phase angles	Although current and voltage are scalars but while analysing ac circuits they are considered vectors .
12	Resistance, Reactance and Impedance	**	Topic 7.6 Page. 244		All have same units i.e.units of resistance
13	Resonance in LCR circuit	***	Topic 7.6.3 Page. 248	Application of the LCR circuit	
14	Q factor	**	Topic 7.6.3 Page. 251	Significance of Q factor	
15	LC Oscillations	***	Topic 7.8 Page. 255	Understanding of the concept	
16	Average power in AC circuit	***	Topic 7.7 Page. 252		
17	Transformer	*****	Topic 7.9 Page. 259	Purpose of laminated core	Use of transformer is advantageous for long distance transmission of electricity.
18	AC Generator	*****	Topic 6.10 Page. 224	Do not draw the graph of AC induced & expression for the induced emf	The word generator is a misnomer as we cannot create or destroy energy but can transform one form of energy to the other.

Level-1:

Q 1.When is Magnetic Flux linked with surface: (i) maximum (ii) minimum.

Q 2. State Faraday's Laws of EMI and express it mathematically.

Q 3. A coil has an inductance of 0.03 H. Determine the emf induced in the coil if current changes at the rate of 150 A/s.

Q 4. How does Self Inductance of a coil change when an iron rod is introduced in it?

Q 5. What is the phase angle between current and voltage in AC circuit containing R only?

Q6. What is the average power dissipated in AC circuit containing L only?

Q7. Determine the expression for Impedance in LCR circuit with the help of phasor diagram.

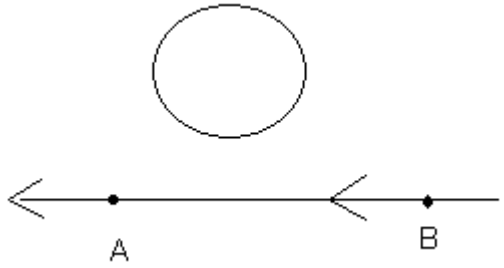
Q8. In which AC circuit, current lags behind the voltage by $\pi/2$.

Q9-Derive an expression for mutual inductance of a long solenoid.

Q10. Draw the graph showing the variation of voltage with frequeny of AC containing (i) Inductor only (ii) Capacitor only

Level-2

Q1. The current in the direction from B-A is decreasing, what is the direction of induced current in the metallic loop kept above the wire?



Q2. How does the self inductance of an air core coil changes when –

(i) no. of lines in the coil is decreased

(ii) an iron rod is introduced in the coil

Q3. Why does the metallic piece become very hot when it is surrounded by a coil carrying high frequency ac?

Q4. Draw impedance triangle of LCR series circuit.

Q5. The magnetic flux linked with the coil at any instant t is given by $\phi = 6t^3 - 80t + 100$. What is the emf induced in the coil at t = 5 sec?

Q6. A sinusoidal emf E=200 sin 314t is applied to a resistor of 10 Ω resistance, calculate

(i) rms value of voltage

(ii) rms value of current

(iii) Power dissipated as heat in watt.

Q7.Why eddy currents are reduced in a laminated core?

Q8. Discuss the phenomenon of resonance in LCR series circuit. A capacitor of 15 Ω and 101.5mH inductor are placed in series with a 50 Hz AC source. Calculate the capacity of capacitor if the current is observed in phase with voltage.

Q9. Self inductance of an air core inductor increases from 0.01mH to 10 mH on introducing an iron core into it. What is the relative permeability of the core used?

Q10. When a.c. is fed to a moving coil galvanometer it shows no deflection. Why?

Level-3:

Q1. A vertical conducting pole falls down through the plane of magnetic meridian. Will any e.m.f. be induced between its ends?

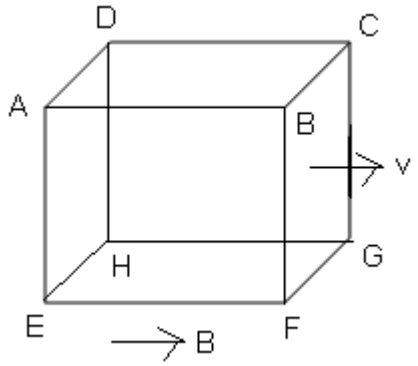
Q2. Write any two differences between impedance and reactance.

Q3. The turns ratio of a transformer is 12.5. If its primary is connected with ac mains of 220V, determine the voltage obtained across the secondary.

Q4. The area of a coil of 25 turns is 1.6 cm^2. This coil is inserted in 0.3 sec in a magnetic field of 1.8 Wb/m^2 such that its plane is perpendicular to the flux line of the field. Calculate the emf induced in the coil. Also calculate the total charge that passes through the wire, if its resistance is 10Ω.

Q5. State the condition for resonance to occur in a series LCR a.c. circuit and derive the expression for resonance frequency. Draw a plot showing the variation of the peak current with frequency of a.c. source used. Define the quality factor of the circuit. Calculate the impedance of the given circuit.

Q6. Twelve wire of equal length are connected in the form of skeleton – cube which is moving with velocity v in the direction of magnetic field B, find the emf in each arm of the cube.



Q7. Self induction is called inertia of electricity. Why?

Q8. State Faraday's law of Electromagnetic Induction Figure shows a rectangular conductor PQRS in which the conductor PQ is free to move in a uniform magnetic field B perpendicular to the plane of the paper. The field extends to X=0 to X=b and is zero for x>b. Assume that only the arm PQ possesses resistance r. When the PQ is pulled outward from X=0 to X = 2b and then moved back to X=0 with constant Speed V. Obtain the expressions for the flux and the induced emf. Sketch the variations of these quantities with distance $0 \leq x \leq 2b$.

Q9. A circuit containing a 80mH inductor and a 60 μF capacitor in series is connected to a 230V, 50Hz. The resistance in the circuit is negligible.

a) Obtain the current amplitude & rms value.

b) Obtain the rms values of potential drop across each element.

c) What is the average power transferred to inductor?

d) What is the average power transferred to capacitor?

e) What is the total average power absorbed by the circuit?

Q10. A wheel with a certain number of spokes is rotated in a plane normal to earth's magnetic field so that an emf is induced between the axle and rim of the wheel, keeping all other things same, number of spokes is changed. How is the e.m.f. affected?

UNIT-4
E.M.WAVES

Concepts	Degree of importance	Reference from NCERT	Errors generally committed
Nature of e.m. waves	***	Topic 8.3.2 Pg 275,276,277	1.Diagram of e.m.waves,2. Direction of e.m.w.
Displacement current& conduction Current	*	Topic 8.2 pg.no.270	Using wrong formula in numerical
Maxwell's eqns.	**	Pg no.273	Surface & line integral in eqn.
Electromagnetic spectrum	****	Topic 8.4 pg.no.280,fig.8.5,Table 8.1	Writing the Ranges of frequency & wavelength ,uses & production of e.m . waves in the spectrum
Speed of e.m.waves	**	Pg.no.276 eqn no. 8.10 & 8.11	Using wrong formula $C=1/\sqrt{(\mu_0\varepsilon_0)}$ $c=E_0/B_o$ in numerical

ADDITIONAL INFORMATION

1. Conduction current and displacement current together have the property of continuity.
2. Conduction current & displacement current are precisely the same.
3. Conduction current arises due to flow of electrons in the conductor. Displacement current arises due to electric flux changing with time.
4. Electromagnetic Wave: - The wave in which there are sinusoidal variation of electric and magnetic field at right angles to each other as well as right angles to the direction of wave propagation.
5. Velocity of EM waves in free space = $C=1/\sqrt{(\mu_0\varepsilon_0)} = 3 \times 10^8$m/s
6. The Scientists associated with the study of EM waves are Hertz, Jagdish Chandra Bose, Marconi.
7. EM wave is a transverse wave because of which it undergoes polarization effect.
8. Electric vectors is only responsible for optical effects of EM waves.
9. The amplitude of electric & magnetic fields are related by $(E_0/B_0)= C$

10. Oscillating or accelerating charged particle produces EMwaves.

11. Orderly arrangement of electromagnetic radiation according to its frequency or wavelength is electromagnetic spectrum.

12. Hint to memorize the electromagnetic spectrum in decreasing order of its frequency.

Gandhiji's X-rays Used Vigorously In Medical Research

13. EM waves also carry energy, Momentum and information.

14. Poynting vector: The total energy flowing perpendicularly per second per unit area into the surface in free space is called poynting vector.

ELECTRO MAGNETIC SPECTRUM ITS PRODUCTION AND DETECTION IN GENERAL

Type	Wavelength range	Production	Detection
Radio	> 0.1 m	Rapid acceleration and decelerations of electrons in aerials	Receiver's aerials
Microwave	0.1m to 1 mm	Klystron valve or magnetron valve	Point contact diodes
Infra-red	1mm to 700 nm	Vibration of atoms and molecules	Thermopiles Bolometer, Infrared photographic film
Light	700 nm to 400 nm	Electrons in atoms emit light when they move from one energy level to a lower energy level	The eye Photocells Photographic film
Ultraviolet	400 nm to 1nm	Inner shell electrons in atoms moving from one energy level to a lower level	Photocells Photographic film
X-rays	1nm to 10^{-3} nm	X-ray tubes or inner shell electrons	Photographic film Geiger tubes Ionisation chamber
Gamma rays	$<10^{-3}$ nm	Radioactive decay of the nucleus	-do-

Unit 5

Level I

1. Write four Maxwell's Equations & write the signification of each equation.
2. Draw labeled diagram of Hertz experimental set up. Explain how e.m. radiations are produced using this set up.
3. Write four properties of electromagnetic waves.
4. Write the expression for the velocity of e.m. waves in terms of permittivity and permeability of the medium
5. Which part of e.m. waves has
   (i) lowest frequency
   (ii) highest frequency

6. Draw a diagram to show transverse nature of e.m. waves.
7. Write the relation of speed of e.m. waves in
   (i) free space
   (ii) medium.
8. Name the Maxwell's equation among the four which shows that the magnetic monopole does not exist.
9. Which of the following quantities are not transported along with electromagnetic waves?
   (i) Energy (ii) Charge (iii) Momentum (iv) Information

Level II

1. What oscillates in e.m. waves? Are these waves longitudinal or transverse?
2. What is the ratio of speed of gamma rays and radio waves in vacuum?
3. Why can light waves travel in vacuum, whereas sound waves cannot do so?
4. Which waves are used
   (i) in mobile phones
   (ii) in look through fog.
   (iii) in radar
   (iv) in geostationary satellites
   (v) To study structure a properties of atoms and molecules.

5. Write two applications each of
   (i) microwaves
   (ii) infrared waves
   (iii) radio waves

6. What role does ozone layer play for human survival?

7. A radio can tune into any station, the 7.5 MHz to 12MHz band. What is the corresponding wavelength band?
8. How does a charge q oscillating at certain frequency produce electromagnetic waves.
9. Which of the following can act as the source of e.m. waves?
    (i) A charge moving with constant velocity
    (ii) A charge moving in circular orbit
    (iii) An accelerated charge
    (iv) A charge at rest
10. Give reason for decrease or increase in velocity of light, when it moves from air to glass and glass to air respectively.

Level III

1. In a plane electromagnetic wave, the electric field oscillates with a frequency of $2 \text{ X } 10^{10}$ per second and amplitude of 40 V m^{-1}.
    (i) What is the wavelength of the wave?
    (ii) What is the energy density due to the electric field?
    [Ans. (i) $\lambda = 1.5 \text{ X } 10^{-2}$ m

    (ii) $U_E = 1/2\varepsilon_0 E_{rms}^2 = 1/4\varepsilon_0 E_0^2 = 3.54 \times 10^{-9} Jm^{-3}$]
2. Why do welders wear special glass goggles or face masks with glass window?
3. A plane e.m. wave of frequency 25 MHz travels in free space along x-axis. At a particular point in space and time, the electric vector is $\vec{E} = 6.3 \text{ Vm}^{-1}$ j. Calculate B at this point.
    [Hint: E = B.C $\vec{B} = 2.1 \text{ X } 10^{-8}$ t $\hat{k}$]
4. Suppose that the amplitude of electric field in an electromagnetic wave is $E_0 = 120$ N/C and its frequency is 50 MHz Determine B_0, ω, k and λ.
5. Suppose that the electric field part of an electromagnetic wave in vacuum is
    E = {(3.1 N/C) cos [(1.8 rad/m) *y* + (5.4 × 106 rad/s)*t*]}^i .
    (a) What is the direction of propagation?
    (b) What is the wavelength λ ?
    (c) What is the frequency ν ?
    (d) What is the amplitude of the magnetic field part of the wave?
    (e) Write an expression for the magnetic field part of the wave.

Unit - 6

Optics

Concepts	**Degree of importance**	**Reference from NCERT**	**Errors generally committed**
Reflection from spherical mirrors	***	P-311,313,314	Ray diagrams-arrows not drawn, sign conventions-sign of u is taken +ve
Refraction	***	P-317 P-316,A9.3 P-316,317 A9.3	Inverted image is taken as +ve, Rays are not drawn straight.
Total internal reflection	***	P-322	Ray incident at i_C is shown as reflected ray and not as grazing ray
Refraction at spherical surface	***	P-323	Ray diagrams-arrows not drawn, sign conventions-sign of u is taken +ve, -ve sign is used in m
Prism	**	P-331	TIR is not correlated for refraction through prism.
Dispersion and Scattering	**	P-335 ,332	Order of colours in spectrum is in reverse order.
Rainbow	*	P-333	Basic reason of formations-involving total internal reflection is not used
Eye defects	**	P-337	Mixing of concepts of myopia and hypermetropia.
Optical Instruments	***	P-335-342	Object is not taken at infinity in a telescope, rays are not drawn straight.
Huygen's Principle	*	P-353,358	Envelope of secondary wavefronts is not properly drawn.i.e. touching all primary WF
Coherent sources	***	P-360,10.4 P-362 A10.5	Reasoning-why coherent sources are required
Interference	***	P-362A-10.5	Concept of constructive and destructive interference is mixed.
Diffraction	**	P-371 A 10.6.2	Reason for coloured spectrum and interchange the position of maxima and minima
polarisation	**	Concept- P-378 P-380, A 10.7.2	Generally straight lines are drawn for Intensity Vs angle between Analyser and polarizer graph, using Malus Law in numericals

QUESTIONS

LEVEL 1

Q.1 What happens to the fringe pattern when YDS experiment is performed in water instead of air?

Q.2 In which direction relative to the normal, does a ray of light bend, when it enters obliquely in a medium in which its speed is increased?

Q.3 A lens immersed in a transparent liquid is not visible. Under what condition can this happen?

Q.4 What will be the colour of the sky in the absence of atmosphere?

Q.5 A ray of light while traveling from a denser to a rarer medium undergoes total reflection. Derive the expression for the critical angle in terms of the speed of light in the respective media.

Q.6 A beam of white light on passing through a hollow prism gives no spectrum. Why?

Q.7 How is a wavefront different from a ray? Draw the geometrical shape of the wavefronts when (i) light reflects from a concave mirror, and (ii) light emerges out of convex lens when a point source is placed at its focus.

Q.8 What two main changes in diffraction pattern of single slit will you observe when the monochromatic source of light is replaced by a source of white light?

Q.9 When the light is polarized by reflection, what is the angle between reflected and refracted rays.

Q.10 What is the nature of image formed by eye lens on the retina?

Q 11 A ray of light passes through a glass slab of refractive index 1.5, making an angle of incidence 45^0. What is its new refractive index if the incident angle is increased by 20^0?

Q.12 Why there is a time difference between actual sunset and apparent sunset?

Q.13 Show the formation of secondary rainbow with the help of a diagram. What is the angular range in which secondary rainbow is seen?

Q 14 Give any two main considerations in the construction of an astronomical telescope.

Q.15 A ray of light falls on a transparent medium (slab) of μ =1.732. If reflected and refracted rays are mutually perpendicular, what is the angle of incidence?

Q.16 What is the ratio of slit width when amplitudes of light waves from them have a ratio$\sqrt{2}$:1 ?

Q.17 The wavelength of light coming from a sodium source is 589 nm. What will be its wavelength in water?(Ref: index of water is 1.33)

Q.18 Consider the interference between two sources of intensities I and 4I. Obtain intensity at a point where the phase difference $\pi/2$.

Q.19 A ray of light strikes a glass plate at an angle of 53^0. If the reflected and refracted rays are perpendicular to each other, find the refractive index of glass.

Q.20 A thin prism of angle 5^0 gives a deviation of 2.5^0. What is the refractive index of the material of the prism?

LEVEL 2

Q.1 Two points A and B are situated at the same distance from the source of light, but in opposite direction from it. What is the phase difference between the light waves passing through A and B?

Q.2 The critical angle between a given transparent medium and air is denoted by i_c, A ray of light in air enters this transparent medium at an angle of incidence equal to the polarizing angle(i_p). Deduce a relation for the angle of refraction (r_p) in terms of i_c.

Q.3 What happens to the shining of diamond if it is dipped in a transparent oil?

Q.4 A lens whose radii of curvature are different is forming the image of an object placed on its axis. If the lens is placed with its faces reversed, will the position of the image change?

Q.5 What happens to focal length of a convex lens, when it is immersed in water?

Q.6 A glass prism is held in water. How is the angle of minimum deviation affected?

Q.7 You are provided with four lenses of focal length 1 cm, 3cm, 10cm and 100cm. Which two would you prefer for a microscope and which two for a telescope?

Q.8 Only the stars near the horizon twinkle while those overhead do not twinkle. Why?

Q.9 No interference pattern is detected when two coherent sources are infinitely close to each other. Why?

Q.10 Radio waves diffract pronouncedly around the buildings, while light waves, which are also e.m. waves do not, why?

Q.11 A light ray suffers minimum deviation, while passing through a prism of refractive index 1.5 and refracting angle 60^0. Calculate the angle of deviation and angle of incidence.

Q.12 In Young's double slit experiment = 500nm, d=1.0mm and D=1.0 metre. Find the minimum distance from the central maximum for which the intensity is half of the maximum intensity.

Q.13 The lower half of the concave mirror's reflecting surface is covered with an opaque non-reflecting material. How the image gets affected?

Q.14 Sun glasses (goggles) have curved surfaces, but they do not have any power. Why?

Q.15 What change in focal length do you expect if monochromatic light of orange colour is replaced by blue light?

Q.16 Far point of a myopic person is 60cm in front of the eye. What is the power of the lens required to enable him to see distant objects clearly.

Q.17 Velocity of light in a liquid is 0.9×10^8m/s. If a ray of light passes from liquid into the air calculate the value of critical angle.

Q.18 A convex lens of f = 20cm and n = 1.5 is immersed in water. What happens to the nature of the lens? Also calculate the new focal length.

Q.19 The bottom of a container is a 4.0 cm thick glass. (μ =1.5) slab. The container contains two immiscible liquids A and B of depths 6.0 cm and 8.0 cm respectively. What is the apparent position of a scratch on the outer surface of the bottom of the glass slab when viewed through the container? Refractive indices of A and B are 1.4 and 1.3 respectively.

Q.20 Give reasons for the following observations on the surface of the moon: (i) Sunrise and sunset are abrupt. (ii) Sky appears dark. (iii) A rainbow is never formed

LEVEL 3

Q.1 What is the colour of the interference fringe nearest to the white central maximum in case of white light?

Q.2 For the same angle of incidence, the angles of refraction in three different media A,B C are 15°, 25°, and 35° a respectively. In which medium will the velocity of light be minimum ?

Q.3 The critical angle for glass-air interface is i_c. Will the critical angle for glass-water interface be greater than or less than i_c?

Q.4 A telescope has been adjusted for the relaxed eye. You are asked to adjust it for the least distance of distinct vision, then how will you change the distance between the two lenses?

Q.5 A ray of light goes from medium 1 to medium 2. Velocities of light in the two media are c_1 and c_2 respectively. For an angle of incidence *i* in medium 1, the corresponding angle of refraction in medium 2 is *i*/2.

(i) Which of the two media is optically denser and why?

(ii) Establish the relationship between *i*, c_1 and c_2.

Q.6 What happens to the interference pattern if the phase difference between the two sources varies continuously?

Q.7 Show that in interference energy is neither created nor destroyed but is conserved.

Q.8 Does hypermetropia imply necessarily that the eye has partially lost its ability of accommodation? If not, what might cause this defect of vision?

Q.9 The direct image formed by the lens (f=10cm) of an object placed at O, and that formed after reflection from the spherical mirror are formed at the same point O. What is the radius of curvature of the mirror?

Q.10 The refractive index of water is 4/3. Obtain the value of the semi vertical angle of the cone within which the entire outside view would be confined for a fish under water. Draw an appropriate ray diagram

Q.11 A right-angled crown glass prism with critical angle 41° is placed before an object AB. Show how it can be used for deviation of (a) 90^0 (b) 180^0 (c) 0^0 with inversion of image.

Q.12 Draw the diagram showing intensity distribution of light on the screen for diffraction of light at a single slit. How is the width of central maxima affected on increasing the

(i) Wavelength of light used (ii) width of the slit.

What happens to the width of the central maxima if the whole apparatus is immersed in water and why?

Q.13 Determine the resultant of two waves given by $\psi_2 = 4\sin 200\pi t$ and

$$\psi_2 = 3\sin(200\pi t + \Pi/2)$$

Q.14 Show that no ray can pass through a prism whose refraction angle A is greater than twice the critical angle for the material of the prism.

Q.15 A man stands in front of a mirror of special shape. He finds that his image has a very small head, a fat body and legs of normal size. What can we say about the shapes of the three arts of the mirror?

Unit 7

Dual Nature of Matter and radiations

Concepts	**Degree of importance**	**Reference from NCERT book**	**Common errors committed**
Photons	***	1.Page 395	1.Rest mass of photon 2.Unable to understand quantum nature of photons
Photoelectric effect	***	1.Page no 388	1.Unable to apply concept of threshold frequency or threshold wavelength
Threshold frequency and wavelength	**	1.Page no 388 and 389	1.Concept of threshold frequency not clear
Work function	**	1. Page no 389	1. Conversion of Joule into eV and vice versa
Experimental study of photoelectric effect	*	1.Page 389 & 390	1.Concept of stopping potential not clear. 2. Effect of intensity and frequency on photoelectric effect.
Laws of photoelectric effect	****	1.Page 392	1.Graphical representation of effect of intensity and frequency not clear
Einsteins Photoelectric equation	***	1.Page 393&394	1.Explanation of laws of photoelectric effect on the basis of Einstein's equation
de Broglie waves	****	1.Page 398 to400	1.Momentum of photon and moving particle
Wave nature of electrons	***	1.Page 401	1.Confusion in formulae to be applied
Davisson and Germer experiment	****	1.Page 403 &404	1.Nature of polar graphs not clear 2. Braggs law not clear.

LEVEL-1

1. What is a photon?
2. What is photoelectric effect?
3. What do you mean by work function of a photo metal?
4. What is threshold frequency?
5. Write down Einstein equation of photoelectric effect?
6. What are matter waves?
7. State laws of photoelectric effect?
8. Is photon a wave or a particle?
9. What is De-Broglie wavelength? Write down its relation?
10. Define one electron volt?
11. Draw the photoelectric current vs time graph.

LEVEL-2

12 Light of wave length 3500 A is incident on two metals A and B. Which metal yield photoelectric effect, if their work function are 4.2 e v and 1.9 e v respectively?

13 If the radiation of wave length 5000 A° is incident on the surface of work function 1.2 eV, find the value of stopping potential?

14 Two metals A and B have work functions 2 eV and 4 eV respectively. Which metal has a lower threshold wave length for photoelectric effect?

15 Why are alkali metal metals most suited for photoelectric emission?

16 If the intensity of incident radiation on a metal surface is doubled, what happens to the kinetic energy of the electrons emitted?

17 Draw graph to show the variation of stopping potential with frequency of incident radiation . How will you find the value of planck's constant using this graph?

18 Derive a relation for De-Broglie wave length.

19 Which is the experiment which depicts the wave nature of electron? Explain it using a labelled diagram ?

20 Find the De-Broglie wave length associated with an electron having a kinetic energy of 54 eV?

21 Explain the laws of photoelectric effect on the basis of Einstein of Einstein equation of photoelectric effect?

22 . Name two phenomena which needs quantum theory for its explanation

23 Sodium and copper have work functions 2.3eV and 4.5eV respectively. Find the ratio of their wave length.

24 What is the approximate time taken by a photoelectron to come out after the photon strikes?

25 The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6eV falls on it is 4 eV. What is the stopping potential in volt?

26 An electron, an α particle and a proton have the same kinetic energy. Which of these particles has the shortest, De Broglie wavelength?

27 A photon and an electron have got same De-Broglie wavelength. Which has greater kinetic energy? Explain

28 a) An X ray tube produces a continuous spectrum of radiation with its short wavelength end at 0.67A0. What is the maximum energy of a photon in the radiation? b) From your answer to (a), guess what order of accelerating voltage is required in such a tube?

29 The work function of a metal is 5.4 eV. a) Find the threshold frequency. b) Find the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential 1.2V.

30 If the frequency of incident radiation on a photocell is doubled for the same intensity, what changes will you observe in (1) Kinetic energy of photo - electron emitted (2) Photoelectric current and (3) Stopping potential. Justify your answer

LEVEL-3

31. The threshold frequency of a metal is ν_o when the light of frequency $2\nu_o$ is incident on a metal plate, the maximum velocity of electron v_1 when the frequency of incident radiation is increased to $5\ \nu_o$, the maximum velocity of electron emitted is v_2 . Find the ratio of v_1 to v_2 . (ans. $v_1 / v_2 = ½$)

32 . The De-Broglie wave length of a photon is same as the wave length of an electron show that the K.E of photon is 2 λmc/h times the K.E of the electron.

33. A proton and an electron have same De-Broglie wavelength, which of them moves fast and which possesses more kinetic energy? Justify your answer.

34. Find De-Broglie wave length of neutron at 127^0 C. Given Boltzmann constant = 1.38×10^{-23} J molecule^{-1}K^{-1} , h= 6.63×10^{-34} j.s , mass of neutron = 1.66×10^{-27} Kg. (ans. 1.264 A^0)

35. Show that the De-Broglie hypothesis of matter wave supports the Bohr's concept of stationary orbit

36 In an experiment on photo electric emission, following observations were made. 1) Wave length of the incident light is 1.98 x 10-7 m. 2) Stopping potential is 2.5 Volt .Find a) Kinetic energy of photo electrons with max. speed b) Work Function c) Threshold frequency

37. Obtain the De-Broglie wavelength associated with thermal neutrons at room temperature (27^0C). Hence explain why a fast neutron beam needs to be thermalised with the environment before it can be used for neutron diffraction experiments.

38. If the kinetic energy of the particle is increased by 16 times, calculate the percentage change in the De-Broglie wavelength.

UNIT -8

ATOMS AND NUCLEI

Concepts	**Degree of Importance**	**Reference from NCERT**	**Errors generally committed**	**Additional Information**
Alpha particles scattering experiment	*	P 415-16	Wrong formula of potential energy, wrong value of the of kinetic energy of alpha particle.	*www..wikipedia.org* *www.phys.virginia.edu*
Rutherford model	*	P 416-17	Error in conclusion of experiment, wrong understanding of the limitations of Rutherford model	*www..wikipedia.org* *www.phys.virginia.edu*
Bohr Model	**	P 422-23 Ex-12.3(Page	Error in calculations, substitution of values, error in the derivation of radius of the	*www..wikipedia.org* *www.phys.virgini*

		420)	electron orbit	*a.edu*
Energy Levels	**	P 427	Error in putting the value of transitional levels, incorrect formula	*www..wikipedia.org* *www.phys.virginia.edu*
Hydrogen Spectrum	***	P 428-29 Ex 12.6 (Page 430)	Incorrect interpretation of spectral series, error in the region of series-their seq etc	*www..wikipedia.org* *www.phys.virginia.edu*
Composition and Size of Nucleus	***	P 441	Wrong formula, wrong calculation	*Nuclear Forces, Meson theory* *www..wikipedia.org* *www.practicalphysics.org*
Atomic masses	*	P 438-39	Incorrect unit, wrong values	*www..wikipedia.org* *www.phys.virginia.edu*
Radioactivity Alpha-Beta-Gamma particles	***	P 446,449,450	Mixing of the characteristics of alpha ,beta and gamma particles.	*www..wikipedia.org* *www.phys.virginia.edu*
Radioactive decay Law & Half Life	****	P 446-47 Ex 13.4 (Page 448)	Wrong use of mathematical formulae of integration and differentiation, error in calculations, incorrect interpretation of graph of exponential decay	*www..wikipedia.org* *www.phys.virginia.edu*
Mass energy relation	*	P 442	In correct Calculation, wrong use of the value of Atomic Mass Unit	*www..wikipedia.org* *www.phys.virginia.edu*
Mass defect	**	P 443	Error in calculations, conversion of electron volt in to Joule.	*www..wikipedia.org* *www.phys.virgini*

				a.edu
Binding energy per Nucleus & its variation with mass No.	***	P 442,444 Ex 13.3 (Page 443)	Error in the plotting of graph, wrong interpretation of graph	*www..wikipedia.org* *www.phys.virginia.edu*
Nuclear Fission & Fusion	*	P 455-56	Confusion with concepts, wrong equations of nuclear reactions.	*www..wikipedia.org* *www.phys.virginia.edu*

UNIT 8

ATOMS & NUCLEI

Level 1

Q.1 Why is neutron treated as effective bullet in nuclear reactions?

Q.2 What is the ratio of the nuclear densities of two nuclei having mass numbers in the ratio 1:4?

Q.3. How is a β-particle different from an electron?

Q4. Write the SI unit for the activity of a radioactive nuclide.

Q5. 'Heavy water is often used as a moderator in thermal nuclear reactors'- Give reason.

Q6. A nucleus of mass number A has a mass defect m. Give the formula for the B. E. per nucleon of this nucleus.

Q.7. Compare the radii of two nuclei with mass numbers 1 and 27.

Q8. Name two quantities which remain conserved during a nuclear reaction.

Q9. Name the most stable nucleus on the basis of the binding energy curve.

Q10. A radioactive substance has a half life of 30 days. What is the disintegration constant?

Level 2

Q1. The decay constant for a given radioactive sample is 0.256 day^{-1}. What is the percentage of the sample decayed in 4 days?

Q2. A 56kg sphere of U-235 constitutes a critical mass. If the sphere were flattened into a pancake shape, would it be still critical. Explain.

Q3. List two advantages of power production by nuclear fusion, over nuclear fission.

Q4. Why carbon is better than lead as a moderator in nuclear reactor?

Q5. Define atomic number and mass number. Distinguish between isotopes and isobars. Give examples.

Q6. Define the terms half life period and decay constant of a radioactive substance. Write their SI units & establish the relationship between the two.

Q7. Sketch a graph showing potential energy of a pair of nucleons as a function of their separation.

Q8. What are impact parameter and angle of scattering? How are the two related to each other?

Q9. Will the neutron to proton ratio increase or decrease for the nucleus of an element during i) beta decay ii) alpha decay.

Q10. In an - particle scattering experiment, the kinetic energy of the particle is reduced to half. What will be the change in the distance of closest approach. Support your answer with necessary formula.

Level 3

Q1. Define the term decay constant of radioactive nucleus. Two nuclei P and Q have equal number of atoms at t=0. Their half lives are 3 hours and 9 hours respectively . Compare their rates of disintegration after 18 hours from the start.

Q2. Describe the process of release of energy is a nuclear reactor.

Q3. Prove that the instantaneous rate of change of activity of a radioactive substance is inversely proportional to the square of its half-life period.

Q4. Calculate the frequency of photon, which can excite the electron to -3.4eV from -13.6eV.

Q5. A 10kg satellite circles earth once every 2 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to satellites, find the quantum number of the orbit of the satellite.

Q6. Explain the source of energy in sun.

Q7. What are thermal electrons?

Q8. State the laws of radioactive disintegration.

Q9. What is binding energy of the nucleus? Explain the significance of binding energy.

Q10. What are nuclear forces? Discuss the important properties.

UNIT 9

SEMI CONDUCTOR DEVICES

S.No	***Concept***	***Degree of Importance (Examination Point of View)***	***References (From NCERT Book) Page No.***	***Errors Commonly Committed by Students***
1.	Energy Bands: Valence Band, Conduction Band and Forbidden Gap.		470	
2.	Distinction between conductors' semi conductors and insulators on the basis of energy band gap theory.	*	468	Incorrect band gap
3.	Intrinsic semi conductors Doping Extrinsic semi conductors	**	472, 474	
4.	n-type and p-type semi conductors: with their energy band diagrams	**	475-477	Donor and acceptor level
5.	P-N junction diode and the concepts of potential barrier and depletion layer	*	478	Confusion between potential barrier and depletion layer
6.	Forward and reverse biasing of the P-N junction diode with circuit diagrams and I-V characteristics curves.	***	480-481	Incorrect circuit diagram and characteristics'
7.	P-N Junction diode as a rectifier (Half wave and Full wave)	***	483-484	Incorrect circuit diagram and characteristics
8.	Special types of diodes(Zener diode, LED, Photo diode, Solar cell	**	487-489	Wrong mode of biasing
9.	Zener diode as a voltage regulator	**	486	Changes occurring at Zener Break down
10.	Junction transistors (NPN and PNP), Transistor action.	*	491-492	Incorrect biasing
11.	Transistor circuit configuration and characteristics (CE)	***	493-495	Wrong circuit diagram and wrong labeling
12.	Transistor as an amplifier (CE):Various gains	***	497-499	Incorrect Biasing
13.	Transistor as a switch	**	496	Explanation through characteristics'
14.	Transistor as an oscillator.	***	500	Improper feed back in circuit
15.	Logic gates (OR, AND,NOT, NOR, NAND)	**	502-505	Realization of gates is usually not prepared

Level-1

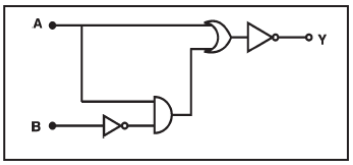
1. Define Conductor, Semi Conductor & Insulator.
2. What are ‘holes’?
3. Define doping
4. What are the minority carriers in the p-type semiconductors?
5. What do you mean by biasing?
6. What do you mean by PN Junction diode?
7. What is a solar cell?
8. What is full form of ‘LED’?
9. Define logic gate.
10. What do you mean by analog and digital signal?
11. Why transistor is called a junction transistor?
12. How is a zener diode different from an ordinary diode?
13. Which has greater mobility - electrons or holes? Why?
14. What is the order of forbidden energy gap in a conductor, insulator and a semiconductor?
15. Which characteristics of semiconductors make them useful in fabrication of electronic devices?
16. Give the symbol of OR, AND and NOT gate.
17. Give two examples each of a pentavalent and trivalent impurity.
18. Why do germanium and silicon are semi conductors?
19. Give symbols of pnp and npn transistors.
20. Give truth table of OR gate and NAND gate

Level-2

1. Distinguish b/w n-type and p-type of semiconductor with suitable energy band diagram
2. Draw characteristics of forward and reverse biased PN-Junction.
3. What do you mean by potential barrier?
4. Why NAND gate is called universal gate?
5. Discuss how the 'OR' gate is realized from the NOR gate.
6. How two-input ' AND' gate can be converted into a 'NAND' gate?
7. In a common emitter circuit ,if V_{CE} is changed by 0.2 V ,collector current changes by 0.004 mA .Calculate the output resistance.
8. What will happen if emitter as well as collector in a transistor are reversed biased?
9. Can a two p-n junction diode placed back to back work as p-n-p transistor
10. Explain the working of zener diode as a voltage regulator.
11. Explain the term dynamic resistance of a diode with the help of V-I graph for a diode.
12. What is the ratio of the negative charge to the positive charge in an n-type semiconductor ?

13. A photodiode is fabricated from a semiconductor with a band gap of 2.8eV. Can it detect a wavelength of 600nm? Justify

14. Write the truth table for the following logic circuit



15. What values of A and B should be used for the expression (A+B) . (A . B) = 1 to be true.

16. The base current of a transistor is 105μA and the collector current is 2.05mA Determine α, β and Ie. If a change in Ib by 2.7μA produces a change of 0.65mA is Ic, determine βa.c.

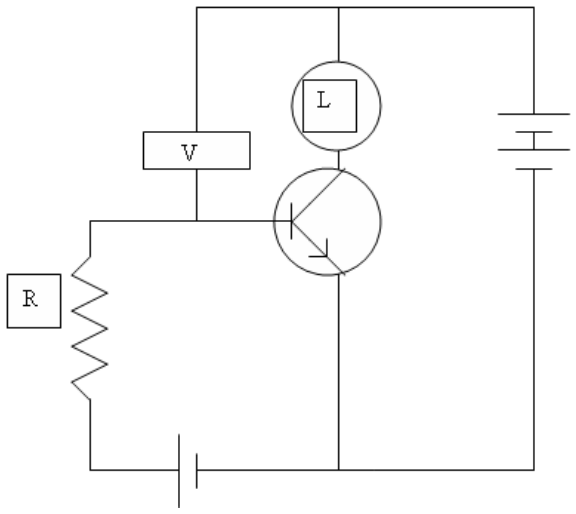
Level 3

1. The output of the two input 'NAND' gate is fed as input to NOT gate. Name the new gate formed and write its truth table.
2. Explain, how 'NOT' gates can be realized using 'npn' common emitter transistor?
3. In a common emitter transistor amplifier, the input resistance of a transistor is 1000Ω, on changing its base current by 10μA, the collectot current increases by 2mA. If load resistance is 5kΩ is used in the circui, calculate

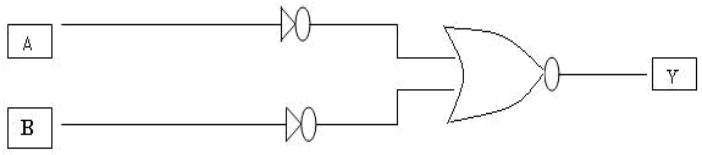
(i) the current gain

(ii) the voltage gain of amplifier

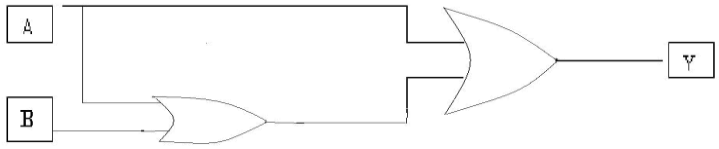
4. In the circuit a voltmeter V is connected across lamp L, what change would occur at lamp and the voltmeter V, if resistance R is reduced in value



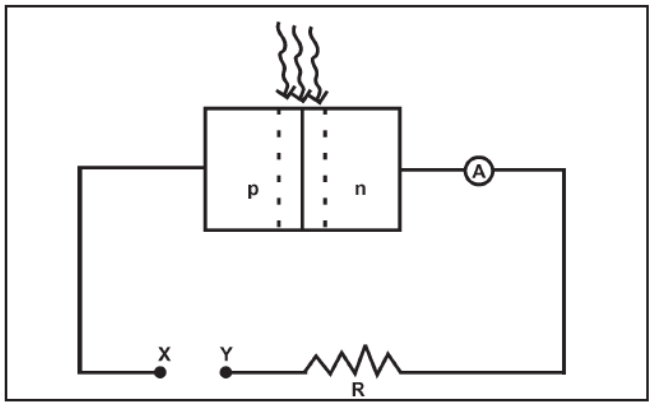
5. Which logic gate is represented by the following combination of logic gate.



6. Express by truth table, the output Y for all possible inputs A and B in the following circuit



7. What is the function of emitter, base & collector in a junction transistor, Explain with suitable diagram, the use of npn transistor as switch.
8. In n-p-n transistor, what are the current carriers inside and outside the transistor circuit.
9. How does the d.c current gain of a transistor change, if the width of base region is increased?
10. The output of an unregulated power supply is to be regulated. Name the device that can be used for this purpose.
11. In a CE transistor amplifier the audio signal voltage across the collector resistance of 2KΩ is 2V. If the base resistance is 1 KΩ and the current amplification factor of the transistor is 100, find the input signal voltage and the base current.
12. In the following diagram:



i) Name the type of the diode used

ii) Should the terminal X be connected to positive or negative terminal fo the battery?

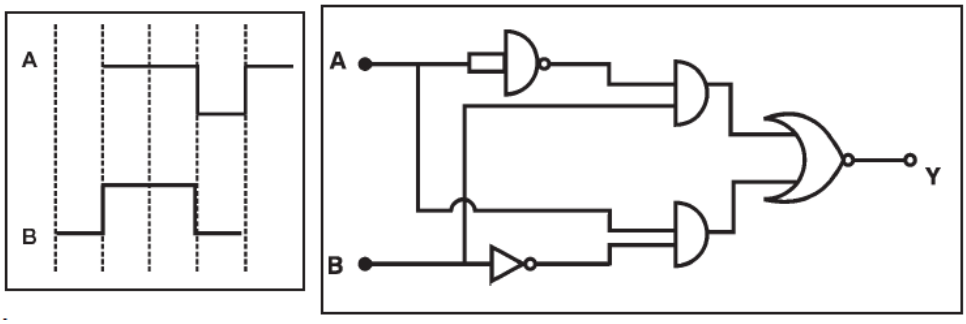
iii)Should the ammeter used be μA or mA?

iv) Draw the typical characteristic curve for the above type of diode.

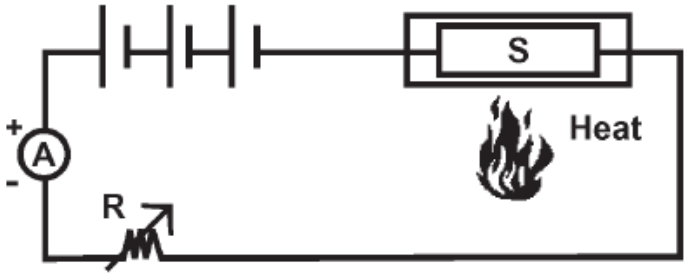
13. Input signals A and B are applied to the input terminals of the given circuit.

Find the final output from the circuit.

Also draw the waveform of the final output signal.



14.'S' is a semiconductor immersed in an oil bath. Should the resistance of variable resistor 'R' be increased or decreased to keep the reading in the ammeter constant if the semiconductor is heated ? Justify your answer



Unit 10 -Communication Systems

Concepts	**Degree of importance (From Examination point of view)**	**Reference (From NCERT) Page No.**	**Commonly committed errors**
Elements of communication system Block diagram and basic definitions of the different elements of the communication system	*	***515***	Wrong identification of elements of communication system in different cases.
Basic terminology used in electronic communication system.	*	***516-17***	Problem in those terms which are not very frequently used.
Bandwidth of signals (Speech, TV and digital data)	**	***517-18***	Difference between frequency and bandwidth
Bandwidth of transmission medium	*	***518***	Less understanding of the concept
Propagation of electromagnetic waves in the atmosphere(Sky and space wave propagation)	**	***519-21***	Can not differentiate between sky wave and space wave
Need of modulation	***	***522***	Problem in understanding the antenna length and wavelength.
Production of amplitude modulated wave	***	***524-26***	Problem in understanding square law device
Detection of amplitude modulated wave	**	***526-27***	Circuit diagram

Level-1

1. What are radio waves?
2. What is Antenna?
3. What is band width of signal?
4. What do you mean by transmission medium?
5. What do you mean by uplink & downlink?
6. What do you mean by communication?
7. What is the condition for a satellite to be geostationary?
8. Show diagrammatically sky wave propagation.
9. What is modulation?
10. How does Effective power radiated by an antenna depend upon wavelength?

Level-2

1 What is height of antenna if transmission frequency is 1 MHz?

2 Show diagrammatically the amplitude modulation.

3 Define guided & unguided transmission medium.

4 What do you mean by maximum line of sight distance (dm)? Write its formula?

5 Why can moon be not used as a communication satellite?

6 A tower has height of 100m. How much population is covered by the T.V broadcast if the average population density around the tower is 1500 Km sq. (radius of the Earth 6400Km)

7 why is ground wave transmission of signal restricted to a frequency of 1500 KHz?

8 What is the significance of modulation index? An audio signal of amplitude one half the carrier amplitude is used in amplitude modulation. Calculate modulation index?

9 What type of modulation is needed for the commercial broadcast of voice signals?

10 Why is the transmission of signals through a coaxial cable not possible for frequencies greater than 20 MHz?

11 Why is short wave band used for long distance radio broadcast?

12 Name an appropriate communication channel needed to send a signal of bandwidth 100 kHz over distance of 8 km

13 Why is FM preferred over AM for transmission of music?

14 Why modulation is needed to transmit signals?

15 State two factors by which the range of the transmission of signals by a TV tower can be increased.

16 How do we make the choice of communication channel?

17 By what factor the height of antenna must be increased in order to double the coverage range? Given radius of earth equal to 6400 km.

18 Which of the following frequencies will be suitable for beyond-the horizon communication using sky waves?

(a) 10 kHz (b) 10 MHz (c) 1 GHz (d) 1000 GHz

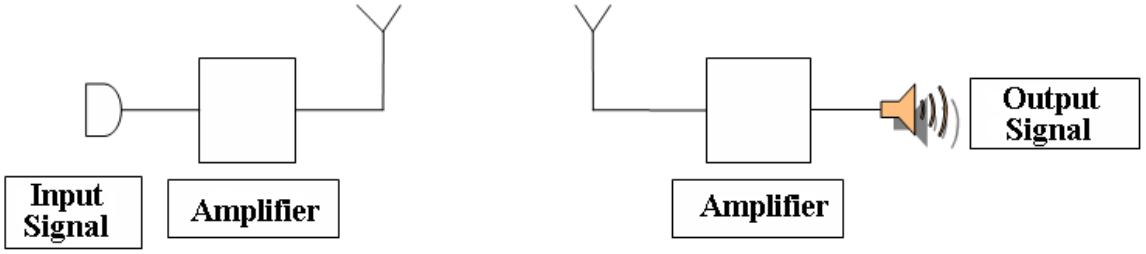
19. Name the type of communication system according to the mode of communication.

20. Name the device which can represent digital data by analog signals and vice versa.

Level-3

1. With suitable diagram describe the detection of amplitude modulated wave.
2. Explain why VHF are not used for sky wave propagation.
3. If maximum value of signal and carrier waves are 4volt & 5volt respectively. Find
   (i) The maximum and minimum value of modulated amplitude in volt.
   (ii) Percentage of modulation
4. A transmitting antenna at the top of tower has height 32m & that of receiving antenna is 50m. What is maximum difference b/w them for satisfactory communication in line of sight mode? (R=6400Km)
5. A radio can tune to any station in 7.5MHz to 12MHz band. What is the corresponding wave length range?
6. What is an active satellite? How is it different from a passive satellite?
7. If 2% part of 10GHz communication is used in unguided communication then how many channels can be adjusted in this frequency range if each channel has a band width of 8 KHz?
8. Give the frequency range used in mobile signal and satellite communication.
9. Explain how will you obtain an AM wave using a square law device? Obtain the expression for the AM wave obtained using such a device.
10. A schematic arrangement for transmitting a message signal 20 to 20 kHz is given below:

    Give two drawbacks from which this arrangement suffers and draw an alternate arrangement overcoming the said drawback.



11 A message signal of frequency 20 KHz and peak voltage of 20V is used to modulate a carrier frequency of 1 MHz and a peak voltage of 25 volts. Determine a) modulation index b) the side bands produced.

12 Name the type of radio wave propagation involved, when TV signals broadcast by a tall antenna are intercepted directly by the receiver antenna.

13 Mention the frequency at which T.V. signals are transferred.

14. Derive an expression for the range upto which signals transmitted by a T.V. tower of height h can be transmitted.

15. Write the function of transducer and repeater in the context of communication system.