CHAPTER -1

ELECTRIC CHARGES AND FIELDS

1. Gauss's theorem is useful in determining the electric field when the source distribution has symmetry.

(a) The electric field intensity at a distance 'r' from a uniformly charged infinite plane sheet of charge is

(i) Proportional to r (ii) Proportional to $\frac{1}{r}$

(iii) Proportional to r^2 (iv) Independent of r

(b) A thin spherical shell of radius 'R' is uniformly charged to a surface charge density σ .Using Gauss's theorem derive the expression for the electric field produced outside the shell. (Score:1+2) **[JUNE-2016]**

2. (a) How much greater is one micro coulomb compared to an electronic charge?

(i) 10^{13} times (ii) 10^{10} times

(iii) 10^{11}times (iv) 10^{6} times

(b) A point charge of 2 μc is placed at the centre of a cubic Gaussian surface of side 0.5 cm. What is the next flux through the surface? (Given ε_0 =8.85 × $10^{-12}C^2/N/m^2$). (Score:1+2) **[MARCH-2016]**

3. In symmetric charge configurations the electric field can be easily calculated using Gauss's law. According to Gauss's law,

a) The electric flux through any closed spherical surface enclosing a charge q is given by

(i) $q\epsilon_0$ (ii)q/ϵ_0

(iii) $\frac{1q}{4\pi \in_0 r}$ (iv) $4\pi \in_0 qr$

b) Obtain an expression for electric field at a point P due to a thin shell of radius R, when the point is at a distance r from the centre of the shell.

c) A sphere of radius 'a' is made of insulating material and has a charge distributed uniformly throughout its volume. Let the charge density be ρ . Find the field due to the charge for r ≤ a.

(Score:1+2+ 2) **[JUNE-2015]**

4. Electric field lines are a pictorial representation of electric field around charges.

(A) State Gauss's law in electrostatics (1)

(B) Using this law derive an expression for the electric field intensity due to a uniformly charged spherical shell at a point

(i) Outside the shell (ii) Inside the shell (2+1)

(C) Suppose you are in a cave deep within the earth. Are you safe from thunder and lightning? Why? (1)

[MARCH 2015]

5. According to Gauss' law the electric flux through a closed surface is equal to $\frac{q}{\varepsilon_0}$ where q and ε_0 have their usual meaning

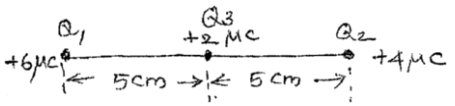
(a) Why is it safe to be inside a bus than sheltered under a tree during lighting?

(Score: 2) **[JUNE 2014]**

6. Conductors are materials which allow the passage of electricity through them

a) When two conductors share their charges what happens to their total energy?

b) 3 charges Q_1, Q_2 and Q_3 are arranged as in figure.



i) Find the force on the charge Q_3?

ii) In which direction will this force act?

(Score: 1+2+1) **[JUNE 2014]**

7. A) All free charges are integral multiple of a basic unit charge e. Then quantization rule of electric charge implies

a) Q=e b) $Q=\frac{1}{e}$

c) Q=ne d) Q=e

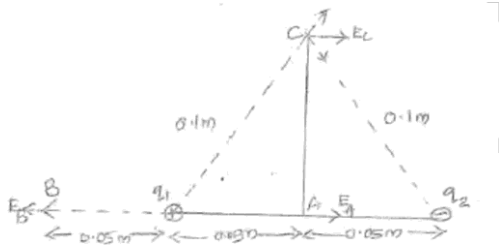
(Score: 1)

B) Match the following quantities in Column A with their units in Column B:

A	B
i) Force	a) Coulomb(C)
ii) Charge	b) N/C or V/m
iii) Electric field	c) Coulomb meter (Cm)
iv) Dipole moment	d) Newton(N)

(Score: 2)

C) Electric field is an important way of characterising the electrical environment of a system of charges. Two point charges q_1 and q_2 of magnitude $+10^{-8}$C and -10^{-8}C respectively are placed 0.1 m apart. Calculate the electric fields at points A, B and C shown in the figure.



(Score: 2) **[MARCH 2014]**

8. "Gauss's law is true for any closed surface, no matter what its shape or size" say the following statements are true or false.

a) Gauss's law implies that the total electric flux through a closed surface is zero if no charge is enclosed by the surface. (Score: ½)

b) This law is useful for the calculation of electrostatic field when the system doesn't possess any symmetry. (Score: ½)

c) In a uniform electric field, we know that the dipole experiences no net force; but experiences a torque having a relation with P and E is given by PEsinθ, where the parameters P and E have their usual meaning. (Score: 1)

[MARCH 2014]

9. The electric flux due to an electric field $\vec{E}$ through a surface Δs is given by $\vec{E}.\Delta\vec{s}$.

a) The SI unit of electric flux is

1. ~~Newton / Coulomb~~
2. Volt
3. Volt x metre
4. $\frac{Volt}{Metre}$ (Score: 1)

b) Imagine that a charge 'Q' is situated at the centre of a hollow cube. What is the electric flux through one side of the cube? (Score: 1)

[MAY 2013]

10. Gauss's law can be used to determine the electric field due to a charge distribution.

a) Below are some statements about Gauss's law. Say whether they are true or false: (Score: 1)

i) Gauss's law is valid only for symmetrical charge distribution.

ii) The electric field calculated by Gauss's law is the field due to charges inside the Gaussian surface.

b) Apply Gauss's law to find the electric field due to an infinitely long plane sheet of charge. (Score: 1)

c) "There can be no net charge in a region in which the electric field is uniform at all points". Do you agree with this statement? Justify your answer.

(Score: 2) **[MARCH 2013]**

11. A) The electrostatic force between two charges is governed by Coulomb's law. On which factors does the electrostatic force between two charges depend and how?

(Score: 1)

B) If the air medium between the two charges is placed by water what change you expect in the electrostatic force and why? (Score: 1)

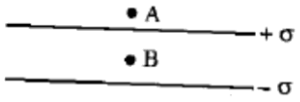
C) An electric dipole is placed in an external electric field. Obtain an expression for the potential energy of the dipole. (Score: 2)

D) Two point charges +16μc and -9μc are placed 8 cm apart in air. You are asked to place a +10μc charge is zero. Where will you place the charge? Make necessary calculations. (Score: 3)

[JUNE 2012]

12. a) Name the physical quantity which has its unit joule.coulomb^{-1}. Is it a vector or a scalar? (Score: 1)

b) Two plane sheets of charge densities + σ and - σ are kept in air as shown in figure. What are the electric field intensities at points A and B?



(Score: 1) **[MARCH 2012]**

13. The idea of 'Electric field lines' is useful in pictorially mapping the electric field around charges.

a) Give any two properties of electric lines of force. (Score: 1)

b) State Gauss's theorem, in electrostatics. (Score: 1)

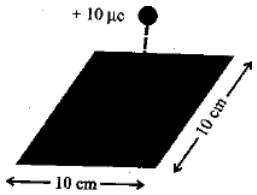
c) Using the theorem, derive an expression for electric field due to a uniformly charged spherical shell

i) at a point outside the shell

ii) at a point inside the shell

(Score:2 ½)

d) A point charge of +10 μc is at a distance of 5 cm directly above the centre of a square of side 10 cm as shown in figure. What is the electric flux through the square? (Score:1 ½)



14. Two equal and opposite charges +q and-q are separated by a small distance '2a'.

a. Name this arrangement.
b. Define its moment. What is its direction?
c. If the above system is placed in a spherical shell. What would be the net electric flux coming out of it?
d. The above system of two charges is placed in an external electric field E, at an angle θ with it. Obtain relation for the torque acting on it.

(Score: 1+1+1+2) **[SAY 2011]**

15. A body of mass m is charged negatively. State whether the following statements are true or false.

a) During charging, there is change in mass of body.
b) The body can be charged to 2.5e where 'e' is the charge of an electron.
c) While charging the body by induction new charges are created in it.
d) The force between two charged objects is less when there is a medium between them (than in vacuum). (½ x 4) **[MARCH-2011]**

16. Draw the electric lines of force surrounding the charges if

a) a `+ q` charge and a `- q` charge are separated at a distance `a` apart in air.
b) Two `-q` charges are placed at a distance `a` apart in air.

(Score: 1+1) **[JUNE-2010]**

17. One can determine the direction of electric field around a stationary charge with the help of electric field lines.

a) What do you understand by the term 'electric flux'? Give its SI unit.
b) State Gauss's theorem in electrostatics and express it in mathematical form.
c) Consider a spherical shell of radius 'R' is uniformly charged with charge '+q'. By using Gauss's theorem, find electric field intensity at a point 'P'.
(i) Outside this spherical shell
(ii) Inside the spherical shell.

(Score: 1 ½ +1 ½+3) **[JUNE 2010]**

CHAPTER -2

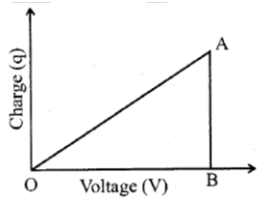
ELECTRIC POTENTIAL AND CAPACITORS

1. (a) You are given two capacitors having capacitances C_1 and C_2 .

Derive an equation for the equivalent capacitance in (i) Series and (ii) Parallel combinations. (Score: 4)

(b) The variations of charge (q) on a capacitor with voltage (V) is shown in the figure given below:

(ii)



The area of the ΔOAB represents

(i) Capacitance (ii) Capacitive reactance

(iii) Electric field between the plates

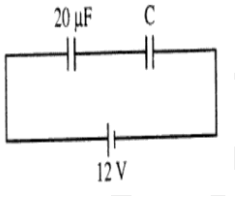
(iv) Energy stored in the capacitor.

(Score: 1) **[JUNE-2016]**

2. An equipotential surface is a surface with constant value of potential at all points on the surface.

(a) What is the amount of work done in moving a 2 μc charge between two points at 3 cm apart on an equipotential surface?

(b) Two capacitors are connected as shown in figure below



If the equivalent capacitance of the combination is 4 μF

(i) Calculate the value of C.

Calculate the charge on each capacitor.

(iii) What will be the potential drop across each capacitor?

(c) Two metallic spheres of same radii, one hollow and one solid, are charged to the same potential. Which will hold more charge?

(i) Solid sphere

(ii) Both will hold same charge

(iii) Hollow sphere

(iv) Cannot predict

(Score: 1+3+1) **[MARCH-2016]**

3. A capacitor is an electronic component having two conductors separated by an insulator.

a) An insulated capacitor with air between its plates has a potential difference of V_0 and a charge Q_0. When the space between the plates is filled with oil, the potential difference becomes V and charge become Q. Which of the following relation is correct?

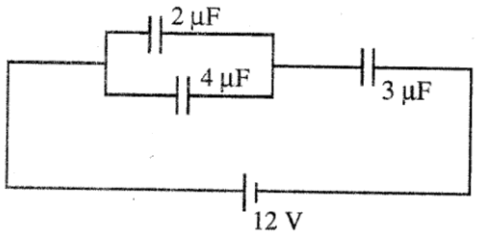
(i) $Q = Q_0$ $V > V_0$

(ii) $Q = Q_0$ $V < V_0$

(iii) $Q > Q_0$ $V = V_0$

(iv) $Q < Q_0$ $V = V_0$

b) Three capacitors are connected to a 12 V battery as shown in figure:



(i) What is the effective capacitance of the combination?

(ii) What is the potential difference across the 2 μ F capacitor?

(Score:1+ ½ + 1 ½) **[JUNE-2015]**

4. (A) A device to store electric charge is called

(a) Transformer (b) Capacitor

(c) Resistor (d) Inductor

(B) What is meant by energy density of a capacitor?

(C) Derive an expression for the energy stored in a parallel plate capacitor.

(D) What is the area of plates of a 0.1μF parallel plate air capacitor, given that the separation between the plates is 0.1mm?

(Score: ½ +1+2+ 1 ½) **[MARCH 2015]**

5. A parallel plate capacitor connected to a cell gets fully charged. After disconnecting the cell, a thin sheet of mica is placed between the plates of the capacitor.

What happens to its

a) Charge b) Capacitance.

(Score: 1) **[JUNE 2014]**

6. A parallel plate capacitor consists of two metallic plate separated by a small distance with a dielectric in between.

a) A parallel plate air capacitor ahs charge densities $+\sigma$ and $-\sigma$ on the plates. Write the expression for electric field between the plates. What happens to the field if the separation between the plates is doubled? (Score: 1)

b) You are given two capacitors. They can be used individually, in series or in parallel in a circuit. Let the four possible values of capacitances be $3\mu F$, $4\mu F$ $12\mu F$ and $16\mu F$. If so what are the values of individual capacitance given to you? (Score: 1)

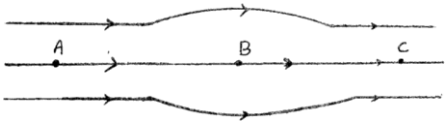
c) Obtain the expression for effective capacitance, when three capacitors C_1, C_2 and C_3 are connected in series. (Score: 2)

d) A parallel plate capacitor with air between the plates has a capacitance of $8\mu F$. What will be the capacitance if the distance between the plates is reduced by half and the space between is filled with a medium of dielectric constant 5?

(Score: 2) **[MAY 2013]**

7. The region around a charge where its effect can be felt is called the electric field.

a) The electric field lines corresponding to an electric field is shown below.



The figure suggests that

i) $E_A > E_B > E_C$

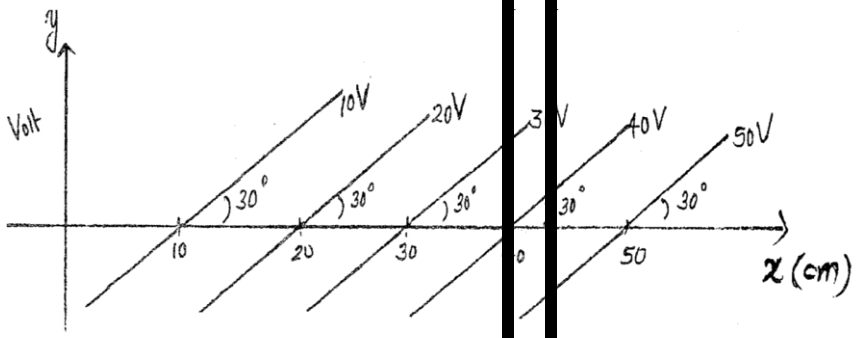
ii) $E_A = E_B = E_C$

iii) $E_A < E_B < E_C$

iv) $E_A = E_B > E_C$

v) $E_A = E_B > E_C$ (Score: 1)

b) Some equipotential surfaces are shown in the figure. What can you say about the magnitude and direction of the electric field?



(Score: 2) **[MARCH 2013]**

8. Capacitor is an arrangement to increase the charge carrying capacity of a conductor.

a) Each plate of a parallel plate capacitor has a charge q on it. The capacitor is now connected to a battery. Pick out the correct statement/statements: (Score: 1)

i) The facing surface of the plates have equal and opposite charges.
ii) The battery supplies equal and opposite charges to the two plates.
iii) The two plates of the capacitor have equal and opposite charges.

b) The plates of a parallel plate capacitor each of area A is charged with charges +Q and –Q. Deduce the force acting between the plates of the capacitor. (Score: 1)

c) Van De Graaff generator is a high voltage generator used to accelerate charged particles.
Draw a labelled schematic diagram of a Van De Graaff generator and state the principle behind its working.
(Score: 2) **[MARCH 2013]**

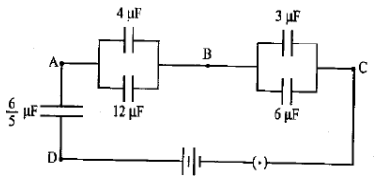
9. Besides its use in storing charge, a capacitor is a key element of most a.c circuits.

a) What are the factors on which the capacitance of a parallel plate air capacitor depends? (Score: 1)

b) Define the term 'dielectric constant' of a medium. (Score: 1)

c) Two capacitors C_1 and C_2 are connected in series. Derive an expression for the capacitance of the combination. (Score:2 ½)

d) Find the equivalent capacitance of capacitors given in the network. (Score:2 ½)



[MARCH 2012]

10. A capacitor is a system of two conductors separated by an insulator.

a. Write down the relation for the capacity of a parallel plate capacitor.
b. The plates of a parallel plate capacitor have area of 90 cm^2 each and are separated by 2.5 mm. What would be its capacity?

$\epsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$

(Score: 1+2) **[SAY 2011]**

11. A capacitor is a device used for storing charges as well as energy. It is based on a property called capacitance.

a) Write the SI unit of capacitance and define it.
b) You are given two capacitors of 2μF and 3 μF. What are the maximum and minimum values of capacitance that can be obtained by combining them?
c) Obtain an expression for the electrostatic energy stored in a capacitor

(Score: 1+2+3) **[MARCH-2011]**

12. For a parallel plate capacitor with each plate of area 'A' separated by distance 'd' in air, its capacitance is given by $C = \frac{\varepsilon_0 A}{d}$

a) Represent the charge 'q' given to a capacitor of capacitance 'C' with potential difference 'V' in a graph. What will be the shape of the curve?
b) If you connect the plates of a parallel plate capacitor by a copper wire, what happens to the capacitor? Justify your answer.
c) Using the above expression, show that energy density of a parallel plate capacitor is $\frac{1}{2}\varepsilon_0 E^2$ where 'E' is electric field between parallel plates.

(Score: 1½ + 1 ½ +3) **[JUNE-2010]**

13. One coulomb charge is initially at rest and is accelerated through a potential difference of I volt. During this process the kinetic energy acquired by the charge is

(a) I J (b) 1.6 x 10^{-19}J

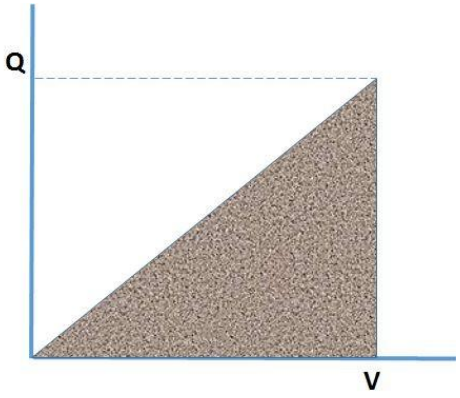
(c) 1.6 x 10^{19}J (d) 10J

(Score: ½ x4=2) **[MARCH-2010]**

14. Capacitors are considered to be the building blocks of all integrated circuits. A Parallel plate capacitor is a simple form of a capacitor.

a) Write down the expression for the capacity of a parallel plate air capacitor in terms of plate area and their separation.
b) Raju found that capacity of a parallel plate air capacitor is 10 μF. Find the capacity of it when he immersed the unit completely in a medium of dielectric constant 2.5.
c) Obtain an expression for the energy stored in a capacitor.
d) Raju charged this capacitor and he plotted a graph between changing potential and charge stored in the capacitor. The graph is shown in the figure.

What does the area of the shaded portion of the graph represent?



(Score: 1 +2+3+ 1) **[MARCH-2010]**

CHAPTER-3

CURRENT ELECTRICITY

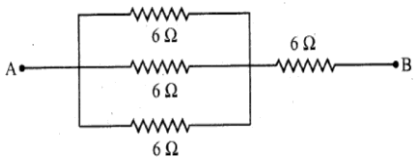
1. Vector form of a law can be written as $\vec{J} = \sigma \vec{E}$. The equation is an equivalent form of famous law. Name the law.

(i) Biot-Savart's law (ii) Ohm's law

(iii)Coulomb's law (iv) Gauss's law

(Score: 1) **[JUNE-2016]**

2. (a) Four equal resistances each of 6 ohms are arranged as shown in the figure given below:



Calculate the total resistance between A and B.

(b) Table given shows the current (I) voltage (V) relationship of a device.

Voltage (V)	Current (I)
1	20
2	30
3	35
4	50
5	55
6	68

Draw V – I graph. With the help of the graph explain whether the device is showing ohmic or non- ohmic behaviour.

(c) Name two devices which do not obey Ohm's law. (Score: 2+2+1) **[JUNE-2016]**

3. (A). (a) Which of the following obeys Ohms law?

(i) Transistor (ii) Nichrome

(iii) Diode (iv) Liquid electrolyte

(b) A wire has a resistance of 10 Ω .It is stretched by 10 % of its original length, what will be the new resistance?

(i) 10 Ω (ii) 11 Ω (iii) 9 Ω (iv)12.1 Ω

(c) With the help of a circuit diagram describe the method to find the value of an unknown resistance using meter bridge arrangement.
(Score: 1+1+4) **[MARCH-2016]**

OR

(B). (a) Which of the following material is used to make wire wound standard resistors?

(i) Manganin (ii) Germanium

(iii) Copper (iv) Carbon

(b) A bread toaster and a bulb are connected parallel in a circuit. The toaster produces more heat than the bulb. Which of the following statement is true?

(i) Resistance of toaster is greater than resistance of bulb.

(ii) Resistance of bulb same as the resistance of toaster.

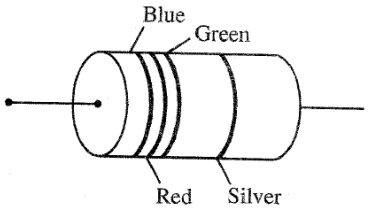
(iii) Resistance of bulb is greater than resistance of toaster.

(iv) Cannot predict.

(c) With the help of a circuit diagram describe the method to find the internal resistance of a cell using potentiometer.

(Score: 1+1+4) **[MARCH-2016]**

4. The following figure shows a carbon resistor:



a) Find its value using colour code.
b) The resistance of a 20 cm long wire is 5 Ω. The wire is stretched to a uniform wire of length 40 cm. The resistance of the wire is

(i) 5 Ω (ii) 10 Ω

(iii) 15 Ω (iv) 20 Ω

c) Which one of the following materials has more than one value for voltage for the same current?

(i) Copper (ii) Mercury

(iii) Gallium Arsenide (iv)Germanium

(Score:1+1+ 1) **[JUNE-2015]**

5. (i) Meter bridge is a practical application of Wheatstone's bridge.

a) With the help of a neat circuit diagram, derive an expression for finding an unknown resistance R.

b) When a resistance of 10 Ω is connected in series with the unknown resistance R, the balancing length is found to be 50 cm. When 10 Ω is removed the balancing length is shifted to 40 cm. What will be the value of unknown resistance R?

(ii) Like resistors, cells can be combined together in an electrical circuit and can also be replaced by an equivalent cell.

a) Derive an expression to find the effective emf of two cells connected in parallel.

b) The potential difference across the terminals of a battery is 8.5 V, when a current of 5 A flows through it from the negative terminal to the positive terminal. When a current of 4 A flows through it in the opposite direction, the terminal potential difference of the battery is 10 V. Find the emf and the internal resistance of the battery.

(Score:2+2+2+2) **[JUNE-2015]**

6. **(A)** Potentiometer measures the potential difference more accurately than a voltmeter, because the potentiometer

(a) does note draw current from the external circuit.

(b) has a wire of high resistance.

(c) draws a heavy current from the external circuit.

(d) has a wire of low resistance.

(B) With the help of a diagram explain the principle of a potentiometer.

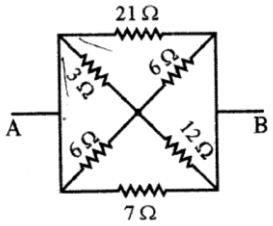
(C) Using a potentiometer how do you determine the internal resistance of a cell?

(Score: 1+ 1 ½ +1 ½) **[MARCH 2015]**

7. Kirchhoff's rules are very useful for the analysis of electrical circuits.

(A) State Kirchhoff's junction rule.

(B) Find the effective resistance of the circuit given below: (Score 1+2)



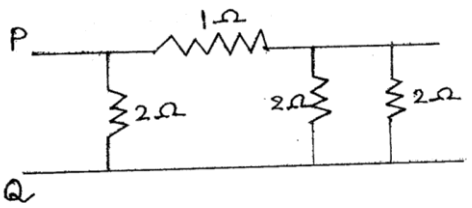
[MARCH 2015]

8. In an electrical circuit resistances can be connected in series or parallel or combination of both.

a) If R_1 and R_2 are two resistors connected in series, what is their effective resistance? (Score: ½)

b) What is the effective resistance when they are connected in parallel? (Score: ½)

c) Calculate the effective resistances between the terminals P and Q in the below diagram. (Score: 2)



[JUNE 2014]

9. There is a flow of current between two charged bodies when they connect together

a) An electric charge produces
i) Electric field only
ii) Magnetic field only
iii) Both electric and magnetic fields

b) Electromotive force represents
i) Force
ii) Energy
iii) Energy/unit charge
iv) Current (Score: 1+1)

[JUNE 2014]

10. You are given a cell whose internal resistance is to be calculated

a) Which instrument do you use?

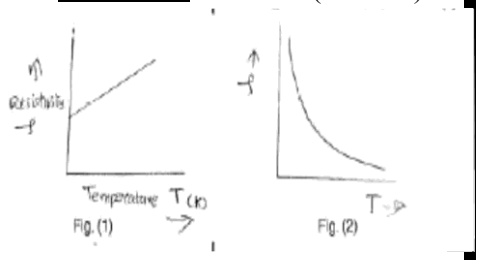
b) Draw the circuit diagram for measuring the internal resistance using this instrument.

c) Obtain an expression for calculating the resistance.
(Score: ½ + 1 ½ + 2) **[JUNE 2014]**

11. a) From the below figures which one corresponds to a typical semiconductor.

(Score: 2)

b) Dimension of temperature coefficient α is _____ (Score: 1)



c) Steady current flows in a metallic conductor of non-uniform cross-section. Which of the following quantities is a constant along the conductor?
A) Current B) Current density
C) Electric field D) Drift sped
(Score: 1) **[MARCH 2014]**

12. Resistors are sometimes joined together and they have several applications in electronics.

a) Draw a series combination of three resistors R_1, R_2 and R_3. (Score: ½)

b) Obtain the expression for the effective resistance in the combination of two resistors R_1 and R_2 in parallel. Sketch the combination also. (Score: 2)

c) Inspite of validity of Ohm's law, it has some limitations. Give one limitation of Ohm's law.
(Score: ½)

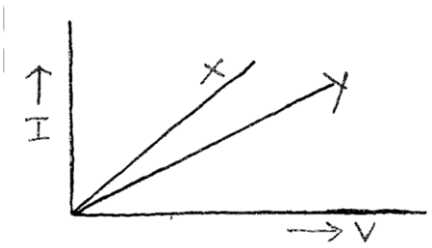
[MARCH 2014]

13. The resistance 'R' of a conductor depends on its length '*l*', area of cross section 'A' and the resistivity ' ρ ' of the material.

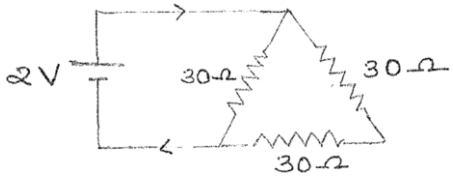
a) Write an expression connecting R, *l*, A and ρ . (Score: ½)

b) What happens to the resistivity of the material if the conductor is stretched to double its length?
(Score: ½)

c) The voltage-current variation of two metallic wires 'X' and 'Y' at constant temperature are as shown in fig.
Assuming that the wires have the same length and the same diameter, explain which of the wires will have larger resistivity. (Score: 1)



d) Three resistances are connected to a battery as shown in the diagram. Find the value of current in the circuit.



(Score: 1) **[MAY 2013]**

14. Kirchhoff's rules are very useful for the analysis of complicated electric circuits.

a) State Kirchhoff's junction rule and loop rule. (Score: 1)

b) Draw circuit diagram off Wheatstone bridge. (Score: 1)

c) Obtain the connection for balance of the bridge. (Score: 2) **[MAY 2013]**

15. a) To construct an electric circuit, you want to select a 470 KΩ resistor with 5% tolerance. Draw a schematic diagram indicating the colour combinations that you will select.

(Score: 1)

b) As the temperature of a metallic resistor is increased; the product of its resistivity and conductivity _____

i) Increases

ii) Decreases

iii) Remains constant

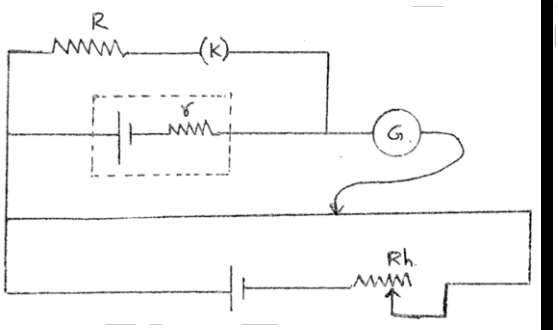
iv) May increases or decreases

(Score: 1)

c) Draw a graph showing the relation between resistivity and temperature of a super conductor. (Score: 1)

d) The circuit diagram of a potentiometer for the determination of internal resistance (r) of the cell.

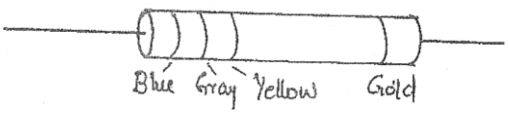
Given R=100Ω, balancing length when key (K) Open =60 cm. Balancing length when key(K) closed =50 cm.



(Score: 2) **[MARCH 2013]**

16. Resistances are used to reduce the current flow in a circuit.

a) A carbon resistor has coloured strip and shown in the figure. What is its resistance? (Score: 1)



b) Resistance can be connected in series and parallel to obtain the required value of resistance. Derive an expression for the effective resistance when three resistors are connected in parallel.

(Score: 2)

c) Kirchhoff's rules are used to analyse the electric circuit. Use it to analyse the Wheatstone Bridge and arrive at Whetstone's condition for balancing the bridge. (Score: 2)

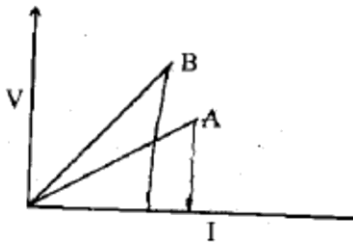
[JUNE 2012]

17. a) The resistance 'R' of a conductor depends on its length 'l', area of cross-section 'A' and resistivity of the material ' ρ ' . the correct expression connecting R, l, A, and ' ρ ' is

(A) $R=\frac{\rho A}{l}$ (B) $R=\frac{Al}{\rho}$ (C) $R=\frac{\rho l}{A}$

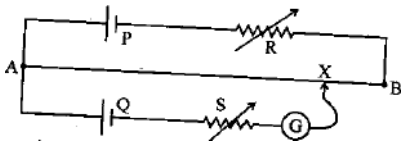
(D) $R=A\rho l$ (Score: 1)

b) The voltage current graphs for two resistors of the same material and same radii with lengths L_1 and L_2 are shown in the figure. If $L_1 > L_2$ state with reason, which of these graphs represents voltage current change for L_1? (Score: 1)



[MARCH 2012]

18. In the potentiometer circuit shown, the balance point is at X.



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

a) Resistance R is increased, keeping all parameters unchanged. (Score: 1)

b) Resistance S is increased, keeping R constant. (Score: 1)

c) Cell P is replaced by another cell whose e.m.f is lower than that of cell Q. (Score: 1)

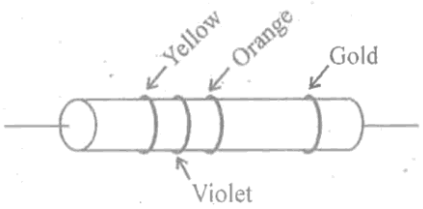
d) You are asked to compare the e.m.f's of two cells using a potentiometer. Draw the circuit diagram for this and explain how you will determine the ratio of

e)m.f's (Score: 2)

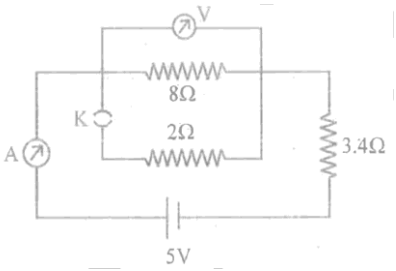
[MARCH 2012]

19. Colour code of the carbon resistor is shown in the figure. What is the value of this resistance with tolerance?

(Score: 1) **[SAY 2011]**



20. In the circuit shown below, what would be the ammeter and voltmeter readings if the key K is closed?



(Score: 1) **[SAY 2011]**

21. A cell consists of electrodes and electrolyte. When it is connected to an external circuit, it sends a current through it.

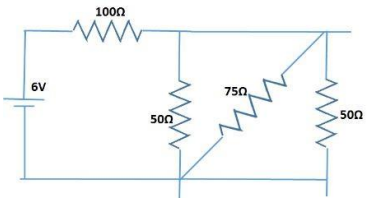
a. What is meant by internal resistance of a cell?

b. What happens to the terminal voltage of the cell when it sends a current through the external circuit?

c. Write down the relation for the determination of the internal resistance of a cell using a potentiometer and explain the symbols.

(Score: 1+1+2) **[SAY 2011]**

22.

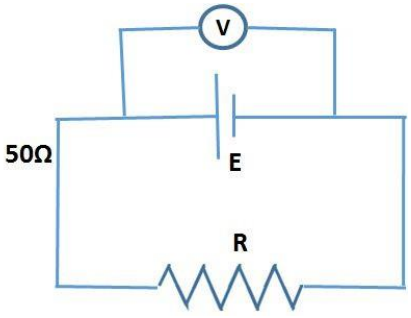


a) Find the equivalent resistance of the above circuit.

b) Determine the current through the 75Ω resistance.

(Score:1 ½ + 1 ½) **[MARCH-2011]**

23. Remya makes the following circuit to measure the emf of a cell.



She says that the voltmeter reading will give the emf of the cell.

a) The physics teacher says that it is not possible to measure the emf of the cell in this way. Justify this statement.

b) Explain with a circuit diagram the method to measure the emf of a cell with a potentiometer if you are given another standard cell (whose e.m.f. is known).

(Score: 1+3) **[MARCH-2011]**

OR

24. The thermal velocity of electron is about 10^6 m/s and drift velocity is about 10^{-3}m/s.

a) What is meant by drift velocity?

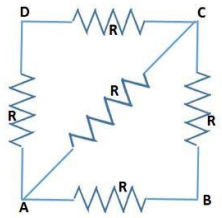
b) Obtain a relation between drift velocity and electric current.
(Score: 1+3) **[MARCH-2011]**

25. a) A carbon resistor of 58 kΩ is marked with rings of different colours for identifying it. What will be the sequence of colours on this carbon resistor?

b) Suppose two wires – one made of copper and another made of germanium are given to you. If you heat these wires, what happens to their resistivity? Give reasons.

(Assuming there is no change in dimension of wires.)

c) Five equal resistances each of value 'R' Ω are connected as a network shown below.



Find the equivalent resistance between point marked 'A' and 'B'.

d) State and explain Kirchhoff's junction rule of an electrical network.

(Score: 1+2+2+2) **[JUNE-2010]**

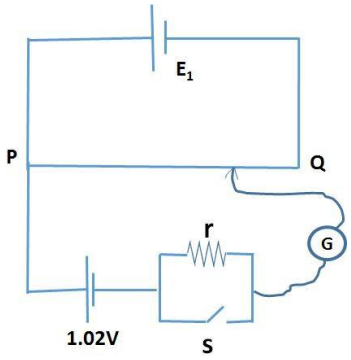
26. Copper is one of the suitable materials to make connecting wires due its low resistivity.

a) What do you mean by resistivity?
b) A copper wire is the form of a cylinder and has a resistance R. It is stretched till its thickness reduces by half of its initial size. Find its new resistance in terms of R.

(Score: 1+2) **[MARCH-2010]**

27. A potentiometer wire PQ of length 1 meter is connected to a standard cell of EMF E_1. Another cell E_2 of EMF 1.02 volt is connected to a parallel combination of resistance r and a key as shown in the figure.

When the switch '**S**' is open, the null point is obtained at a distance of 51 cm from P.



a) What do you mean by potential gradient?
b) Determine the potential gradient across PQ.
c) When the switch s is closed, will the null point move towards P or Q? Justify your answer.
(Score: 1+1+2) **[MARCH-2010]**

CHAPTER 4

MOVING CHARGES AND MAGNETISM

1. (**A**) A current carrying conductor produces a magnetic field in the surrounding space.

(a) Name the law which gives the relation between current and the magnitude of the field it produces.

(b) Using this law obtain the equation for the magnetic field on the axis of a circular current loop. (Score: 1+4)

OR

(B) Depending on the requirement, a moving coil galvanometer can be used as a current detector, an ammeter or a voltmeter.

(a) Write the principle of a moving coil galvanometer.

(b) Using a suitable diagram arrive at an expression for the current sensitivity of a moving coil galvanometer.

(Score: 1+4) **[JUNE-2016]**

2. A moving charge can produce a magnetic field.

(a) How does a current loop behaves like a magnetic dipole?

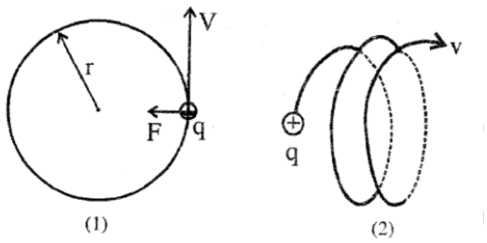
(b) Draw the magnetic field lines for a current loop to support your answer.

(c) (i) What is a cyclotron?

(ii) Write down the expression for cyclotron frequency.

(Score: 1+2+2) **[MARCH-2016]**

3. The following figures represent the path of motion of a charged particle in a uniform magnetic field.



(a) What will be the direction of magnetic field with respect to the velocity of the charged particle?

(i) In figure (1) (ii) In figure (2)

b) With the help of figure (2) explain the term pitch. (Score:1+ 2) **[JUNE-2015]**

4. Moving charges can produce a magnetic field in the surrounding space

a) What is a toroid?
b) A closely wound solenoid 80 cm long has 5 layers of winding of 400 turns each. The diameter of the solenoid is 1.8 cm. If the current carried is 8 A, Calculate the magnitude of field B inside the solenoid near its centre.

(Score:2+1) **[JUNE-2015]**

5. A current carrying wire produces a magnetic field in its surrounding space.

(A) The SI unit of magnetic field density is

(a) henry (b) tesla

(c) Am^2 (d) A-m

(B) With the help of a diagram, derive an expression for the magnetic field at a point on the axis of a circular current loop

(C) Consider a tightly wound 100 turn coil of radius 10cm, carrying a current of 1A. What is the magnitude of magnetic field at the centre of the coil?

(Score: 1+2+2) **[MARCH 2015]**

6. Electric current can produce a magnetic field

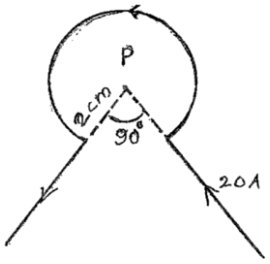
a) Name the law which explains the relation between current and the magnetic field produced by the current. (Score: ½)

b) Derive an equation showing the variation of this magnetic field with distance. (Score: 2 ½)

c) Can you suggest any similarity between the magnetic field produced by electric current and electric field produced by charges? (Score: ½)

d) The wire shown in figure carries a current of 20 A. Find the field at the point P?

(Score: 1½) **[JUNE 2014]**



7. When a charged particle enters perpendicular to a magnetic field it experiences a force.

a) Name the force. (Score: ½)

b) What is the effect of this force on the moving particle? (Score: ½)

c) What is the practical application of this effect? (Score: ½)

d) Explain the working of a device which makes use of this effect with the help of a neat diagram. (Score: 3½)

[JUNE 2014]

8. The relation between magnetic field and current is given by Biot-Savart law.

a) Illustrate Biot-Savart law with necessary figure. (Score: 2)

b) Compare Biot-Savart law with Coulomb's law for electrostatic field. (Score: 2)

c) Give an expression for magnetic field on the axis of a circular current loop. (Expression only) (Score: ½)

d) What is the value of B at the centre of the loop? (Score: ½)

[MARCH 2014]

9. A) A Galvanometer is a device which can be used for measuring the value of current or voltage.

a) How will you convert a Galvanometer in to an ammeter? (Score: 1)

b) A Galvanometer with a coil resistance 12Ω shows full scale deflection for a current of 2.5mA. How will you convert that into an ammeter of range 0-7.5 A? (Score: 2)

c) With the help of diagram, explain the principle and working of a moving coil Galvanometer. (Score: 3)

B) Particle accelerators are used to impart high energy to elementary particles. Cyclotron is such a device.

a) Explain what you mean by magnetic Lorentz force. (Score: 1)

b) Using a diagram explain the working of cyclotron. Hence obtain the expression for cyclotron frequency. (Score: 3)

c) A cyclotron oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons?
[Mass of proton $m_p=1.6\times10^{-27}$; $e=1.6\times10^{-19}$] (Score: 2)

[MAY 2013]

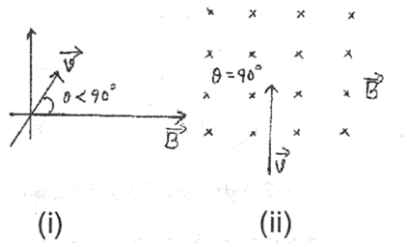
10. Force acting on a charged particle when it moves in a combined electric and magnetic field is known as Lorentz force

a) A charged particle is released from rest in a region of steady and uniform electric and magnetic fields; which are parallel to each other.
What will be the nature of the path followed by the charged particle? Explain your answer. (Score: 2)

b) a rectangular loop carrying a steady current is placed in a uniform magnetic field. Obtain the expression for the torque acting on the loop. (Score: 3)

[MARCH 2013]

11. Direction of velocity of two charged particles in a magnetic field is shown below.



a) Sketch the path traced by the charged particle in each case. (Score: 2)

b) "Magnetic force cannot do any work". Do you agree with this statement? Justify your answer. (Score: 2)

c) According to Bohr atom model electrons are revolving in circular orbits around the nucleus. The movement of electrons can be regarded as a circular current flow. Then derive an expression for the magnetic dipole moment of an orbital electron. (Score: 3) **[JUNE 2012]**

12. Oersted found that moving charges or currents produce a magnetic field in the surrounding space.

a) An electric current is flowing due to south along a power line. What is the direction of magnetic field (i) above it and (ii) below it? (Score: 1)

b) Draw a neat and labelled diagram of a cyclotron. State the underlying principle of its working. (Score: 2)

c) A cyclotron's oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons? e = 1.6×10^{-19}C, mass of proton $m_p=1.67\times10^{-27}$kg. (Score: 2)

[MARCH 2012]

13. A moving charged particle of charge 'q' experiences a force both in electric field E and magnetic field B. This force is called the 'Lorentz force'.

a. Write down the relation for the Lorentz force.
b. A crossed electric and magnetic field is used as .....
c. .....is a cyclic accelerator to accelerate charged particle or ions to high energies.

(Score: 1+1+1) **[SAY 2011]**

14. A current carrying conductor placed in a magnetic field experience a force.

a. Write down a relation for the force per unit length between two parallel conductors carrying current.

b. Use the above relation to define the unit of current. Given that $\mu_o = 4\pi \times 10^{-7}$ H/m.

c. Calculate the force per unit length on a long straight wire carrying a current of 4A due to a parallel wire carrying 6A current. Distance between the wires is 3 cm.

(Score: 1+2+2) **[SAY 2011]**

15. You are sitting in a room in which a uniform magnetic field $\vec{B}$ exists. At the centre of the room a charged particle is suddenly projected horizontally and it starts circular motion in the horizontal plane.

a) What should be the direction of the magnetic field for this to happen?
b) Will there be a change in kinetic energy of the particle due to this circular motion? Why?
c) A cyclotron uses a magnetic field and an electric field to increase the energy of a charged particle. Describe its construction and working.

(Score:1+ 1+3) **[MARCH-2011]**

16. Cyclotron is a device which accelerates charged particles for carrying out nuclear reactions.

a) With a suitable diagram, briefly explain its working principle and how charged particles get accelerated.
b) Find the energy of emergent protons (in MeV) coming from a cyclotron having Dees of radius 2 meters, when a magnetic field of 0.8 T is applied.
(Mass of proton=1.67×10^{-27} kg)
(Score: 3+2)
[JUNE-2010]

17. Ampere's circuital theorem is generally used to determine the magnetic field produced by a current carrying element.

a) State Ampere's circuital theorem.
b) Obtain an expression for the magnetic field produced by an infinitely long straight conductor using Ampere's circuital theorem.
c) A long straight conductor carries 35 ampere. Find the magnetic field produced due to this conductor at a point 20 cm away from the centre of the wire. (Score: 1+2+3)

OR

A galvanometer is used to detect current in a circuit.

a) State the working principle of a moving coil galvanometer.
b) How will you convert a galvanometer into (i) an ammeter (ii) a voltmeter?
c) A galvanometer coil has a resistance of 12 ohms. It shows a full scale deflection for a current of 3 mA. How will you convert this into a voltmeter of range 0-18 V?

(Score: 1+2+3) **[MARCH-2010]**

CHAPTER 5

MAGNETISM AND MATTER

1. Magnetic materials are broadly classified as diamagnetic, paramagnetic and ferromagnetic.

(a) Mention the behaviour of dia and ferromagnetic materials when they are placed in a non – uniform magnetic field.

(b) The temperature at which a ferromagnetic material becomes paramagnetic is

(i) Transition temperature

(ii) Critical Temperature

(iii) Curie temperature (iv) Triple point.

(Score: 2+1) **[JUNE-2016]**

2. (a) State Gauss's law for magnetism?

(b) How this differs from Gauss' law for electrostatics?

(c) Why is the difference in the two cases?

(Score: 1+1+1) **[MARCH-2016]**

3. (a) Which of the following is a suitable material for making electromagnet?

(i)Tungsten (ii) Bismuth

(iii) Copper (iv) Soft iron

(b) The phenomenon of perfect diamagnetism in super conductors is called ----------

(i) Dynamo effect (ii) Hysteresis

(iii) Meissner effect (iv) Faraday effect

(Score:1+1) **[JUNE-2015]**

4. (A) Permanent magnets should have

(a) High retentivity and low coercivity

(b) High retentivity and high coercivity

(c) Low retentivity and low coercivity

(d) Low retentivity and high coercivity

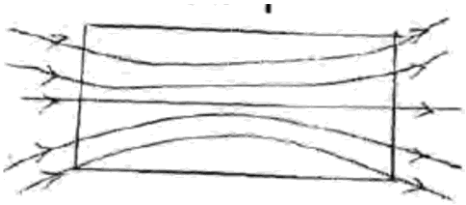
(Score ½)

(B) Distinguish between dia, para and ferromagnetism. (Score ½)

[MARCH 2015]

5. Depending on the magnetic property, the materials are classified in to diamagnetic, paramagnetic and ferromagnetic.

a) The behaviour of magnetic field lines near a magnetic substance is shown in the figure. Which material corresponds to the figure? (Score: ½)



b) State and explain Curie's law. (Score: 1)

c) Compare paramagnetism and ferromagnetism. Give examples of each. (Score: 2) **[MARCH 2014]**

6. Materials are classified into diamagnetic, paramagnetic and ferromagnetic depending on their properties.

a) Which of the following is not diamagnetic?
A) Copper
B) Water
C) Aluminium
D) Silicon (Score: 1)

b) State and explain Curie's law.
(Score: 1) **[MAY 2013]**

7. Earth behaves as a magnet with magnetic poles approximately near the geographic poles.

a) The order of magnitude of earth's magnetic field in tesla is _____
(Score: 1)
b) What do you understand by 'dynamo effect'? (Score: 1)
c) Classify the following materials in to dynamic and paramagnetic
i) Lead
ii) Magnesium
iii) Tungsten
iv) Copper (Score: 1)
[MARCH 2013]

8. Pick out the correct statement/statements from the following sets. (Score: 4)

A) i) The most exotic diamagnetic materials are super conductors.
ii) The core of electromagnets are made of ferrimagnets.
iii) A conductor is an equipotential.
iv) In a compound microscope the intermediate image is virtual, inverted and magnified.

B) i) A potentiometer can be used for more accurate measurement than a voltmeter.

ii) Along the perpendicular bisector of an electric dipole the potential is constant.

iii) Resistivity depends upon temperature and pressure.

iv) The setting sun appears higher in the sky than it really is.
[JUNE 2012]

9. Materials are classified in to ferromagnetic, paramagnetic and diamagnetic according to their magnetic properties.

a) Which of the following is not ferromagnetic?
(A) Cobalt (B) Iron
(C) Nickel (D)Bismuth
(Score:1)
b) Define the term magnetic susceptibility. What is its value for a perfect diamagnet? (Score:1)
c) State the reason why soft iron is used in making electromagnets.
(Score:1) **[MARCH 2012]**

10. When a magnetic needle is suspended by a string it comes to rest in the north-south direction. This shows that earth behaves as a magnet.

a. What is meant by magnetic elements of earth?

b. Define dip at a place.

c. Obtain the relation $B_E = H_{E_2} + Z_{E_2}$ where H_E and Z_E are the components of earth's magnetic field B_E along horizontal and vertical directions.

d. What happens if a magnetic needle is suspended at the magnetic poles?

(Score:1+1+2 ½ + ½) **[SAY 2011]**

11. The captain of ship sailing in the Atlantic Ocean has to travel in the north direction to reach the nearest port. He finds that the magnetic declination of the present position of the ship is $5^0 22'$ East.

a) What is meant by declination?
b) The captain has a magnetic compass needle with him. By how much angle and in which direction should he deviate his ship from the north direction pointed by the magnetic compass needle to reach the port?
a) Suppose the magnetic needle is capable of rotating in a vertical plane about a horizontal axis. If the ship reaches the magnetic pole of the earth in which direction will the magnetic needle point?
(Score: 1+1+1) **MARCH-2011]**

12. Magnetic material are classified as diamagnetic, paramagnetic, and ferromagnetic based on their properties.

a) Write one example for diamagnetic and paramagnetic material.

b) If you place the above three magnetic substances between the pole piece of a magnet, through which magnetic substance magnetic lines of force easily pass through and through which is passes least? Justify your answer. **[JUNE-2010]**

13. A magnetic needle made of iron is suspended in a uniform external magnetic field. It experiences a torque and the needle starts oscillating

a) Write down the frequency of oscillation of the magnetic needle.
b) If this magnetic needle is heated beyond curie temperature while it is oscillating, then its period

(i) increases (ii) decreases

(iii) remains the same

(iv) becomes infinity

(Score: 1+3) **[MARCH-2010]**

CHAPTER 6

ELECTROMAGNETIC INDUCTION

1. (a) State Faraday's law of electromagnetic induction. Write its mathematical form.

(b) Name the factors on which the inductance of a coil depends.
(Score: 2+1) **[JUNE-2016]**

2. (a) The electrical analog of mass is

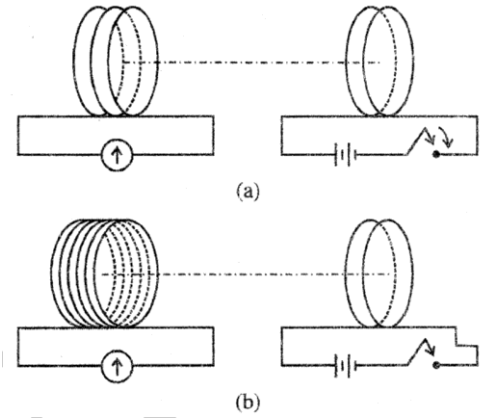
(i) diode (ii) capacitance

(iii) Inductance (iv) resistance

(b) A 2m long solenoid having diameter 6 cm and 2000 turns has a secondary of 500 turns wound closely near its mid – point. Calculate the mutual inductance between the two coils. (Score: 1+2) **[MARCH-2016]**

3. An electronic can be induced in a coil by changing the magnetic flux through the coil.

a) Which of the following galvanometer shows larger deflection when the tapping key is pressed suddenly?



b) Using suitable equation justify your answer. (Score:1+ 2) **[JUNE 2015]**

4. When magnetic flux linked with a coil changes an emf is induced in the circuit.

(A) State Faraday's law of electromagnetic induction.

(B) Mention the physical significance of Lenz's law with an example.

(C) When an electric appliance is switched off, sparking occurs. Why? (Score: 1+1+1)

[MARCH 2015]

5. Michael Faraday observed that whenever magnetic flux linked with a coil changes, an e.m.f is induced in the coil. Suppose a coil of 'N' turns and radius 'R' is kept normal to a varying magnetic field $B=B_0 \cos wt$.

a) what is the flux linked with the coil at any instant't'? (Score: 1)
b) Obtain the e.m.f induced in the coil. (Score: 1)
c) What law helps to detect the direction of induced current?

State the law. (Score: 1)

[MAY 2013]

6. The generation of e.m.f when the magnetic flux associated with a coil changes is known as electromagnetic induction.

a) Mention the factors on which the self-inductance of a solenoid depends. (Score: 1)

b) Calculate the energy stored in an inductor of inductance 50 mH when a current of 2 A is passing through it. (Score: 1)

c) Two identical loops one of copper and other of aluminium are rotated with same speed in the same magnetic field. In which case the

i) Induced e.m.f

ii) Induced current will be more and why? (Score: 2)

[MARCH 2013]

7. The phenomenon in which electric current is generated by varying magnetic field is called electromagnetic induction.

a) Which law helps to detect the direction of induced current? State the law. (Score: 1)

b) Explain what are eddy currents? (Score: 1)

c) Write any two uses of eddy currents. (Score: 1)

[MARCH 2012]

8. A steady current of I ampere is passed through a long solenoid of length l and number of turns N.

a. The flux linked with the solenoid $N\phi_E$ = ...

b. Obtain a relation for the self-inductance of the solenoid.

c. The self-inductance of a coil is 2 mH, if a current of 1A is switched off in a time of one millisecond, what is the induced emf in it?

(Score:1 +3+2) **[SAY 2011]**

9. Sometimes when we switch off electrical equipment, a spark is seen within the switch. This is explained on the basis of electromagnetic induction.

b) What is self-induction?

c) Current is a circuit falls from 5A to 0A in 0.1S. If an average emf of 200V is induced, determine the self-inductance of the circuit.

(Score: 1+3) **[MARCH-2011]**

10. Self-inductance of a coil plays the role of inertia in a circuit.

a) The SI unit of self-inductance is ----------.

b) Current in a circuit falls from 5A to IA in 0.1 second. If an average EMF of 200 volts is induced, find the self-inductance of the coil.

(Score: 1+1) **MARCH-2011]**

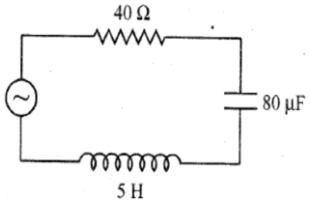
CHAPTER 7

ALTERNATING CURRENT

1. (a) The S.I unit of inductive reactance is

(i) Henry (ii) Ohms (iii) Volt (iv) No unit.

(b) Figure given below shows a series LCR circuit to a variable frequency source.



Determine the source frequency at resonance.

(Score: 1+2) **[JUNE-2016]**

2. (a) The core of a transformer has the following properties:

(i) core is laminated.

(ii) hysteresis loop is narrow.

Explain the significance of each property.

(b) what is meant by resonance in an LCR circuit? (Score: 2+1) **[MARCH-2016]**

3. Power developed in an ac circuit can be expressed as P=VI cos Ø. In certain circuits no power is developed even though current flows through it.

a) Identify such a circuit from the following:

(i) purely inductive circuit

(ii) purely resistive circuit

(iii) inductive and resistive circuits

(iv) resistive and capacitive circuits

b) Which of the following circuit can be used to produce oscillations?

(i) L-R Circuit (ii) LCR Circuit

(iii) LC Circuit (iv) RC Circuit

c) Explain how oscillations are produced in the chosen circuit.

(Score:1+1+ 2) **[JUNE 2015]**

4. Transformers either increase or decrease AC voltage.

(A) State the principle of a transformer.

(B) Explain with a labelled diagram the working of a transformer.

(C) Explain briefly any three energy losses in a transformer. (score: ½ + 2+1 ½)

[MARCH 2015]

5. An A.C generator is used to convert mechanical energy into electrical energy.

a) But what does a transformer do?

b) What are the different types of transformers?

c) What types of energy losses are associated with a transformer? How can we overcome these?

(Score: ½ + 1 + 1½) **[JUNE 2014]**

6. We usually 'tune' the radio to hear a programme clearly

a) By 'tuning' what we are doing actually?

b) What are the essential components in a tuning circuit?

c) What phenomenon can be observed in a tuned circuit?

d) How does it happen?

(Score: 1+1+1+2) **[JUNE 2014]**

7. For many purposes, it is necessary to change an alternating voltage from one value to another. This is done with a transformer.

a) The basic principle behind a transformer is _____

(Score: ½)

b) Give an expression for the voltage and current in a transformer. (Score: 1)

[MARCH 2014]

8. A fascinating behaviour of the series RLC is the phenomenon of resonance.

a) Explain resonance in an LCR circuit?

(Score: 2)

b) Draw a graphical representation of variation of current amplitude i_m with ω.

(Score: 1)

c) What do you mean by sharpness of resonance? Explain it. (Score: 2)

[MARCH 2014]

9. In an A.C circuit the flow of current is opposed by inductors and capacitors. This is called reactance.

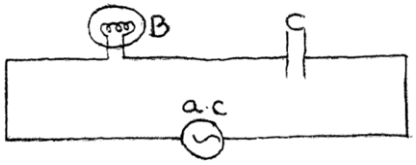
a) Fill in the blanks:

If 'w' is the angular frequency of A.C., then the reactance offered by L and C respectively.

$X_{L=}$ ..... and $X_{C=}$ .....

(Score: 1)

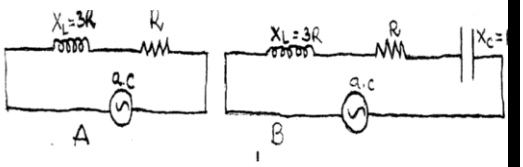
b) An electric bulb 'B' and parallel plate capacitor 'C' are connected in series to an A.C mains shown in the given figure. The bulb glows with some brightness.



How will the glow of the bulb be affected on introducing a electric slab between the plates of the capacitor? Give reasons in support of your answer.

(Score: 1)

d) Given below are two electric circuits A and B.



Calculate the ratio of power factor of the circuit B to that of A. (Score: 1)

[MAY 2013]

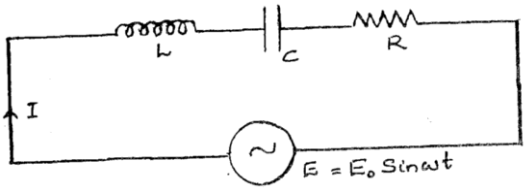
10. Match the following quantities using the analogy between mechanical and electrical quantities.

i)Mass (M)	Charge(q)
ii)Force constant (k)	Resistance (R)
iii)Displacement (x)	Max. charge stored (q)
vi)Velocity (v)	Inductance (L)
v)Amplitude of force oscillation (A)	Reciprocal of capacitance (1/c)
vi)Damping constant (b)	Current (i)

(Score: 1) **[MARCH 2013]**

11. a) An alternating voltage is applied across on LCR circuit as shown below. Draw the phasor diagram for the circuit.

(Score: 1)



b) Prove that an inductor offers easy path to d.c and a resistive path to a.c.

(Score: 1)

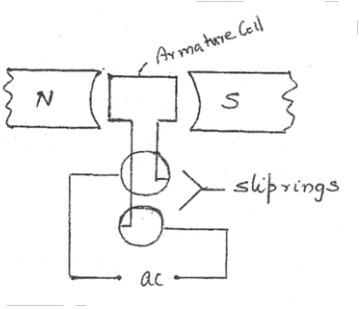
c) In the above circuit if L=100mH, C=100μF, R=120 Ω and E=30sin(100t) find the

i) Impedance
ii) Reactance
iii) Peak current and
iv) Resonant frequency of the circuit.

(Score: 2)

[MARCH 2013]

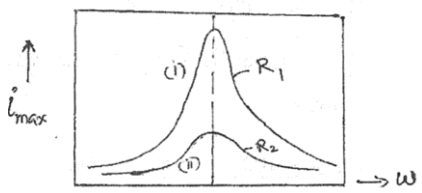
12. The schematic diagram of a generator is shown below.



a) State the law which governs the working of a generator. (Score: 1)

b) An ac voltage is applied to an LCR circuit. Draw the phasor diagram showing the voltages across the components. (Score: 1)

c) The variation of maximum current i_{max} and frequency 'ω' in an LCR circuit for two different values of circuit resistance is shown. What do you know about the values of the resistances? (Score: 1)



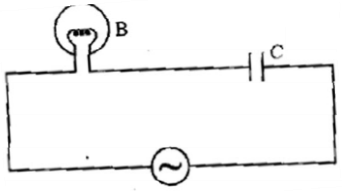
d) The quality factor Q determines the sharpness of resonance of an ac circuit. Obtain a relation that shows the dependence of Q on resistance (R).

(Score: 3) **[JUNE 2012]**

13. A) Fill in the blanks:

If ' ω ' is the angular frequency of a.c., then the reactance offered by inductance 'L' and capacitance 'C' are respectively, X_L=_____ and X_C= _____ (Score: 1)

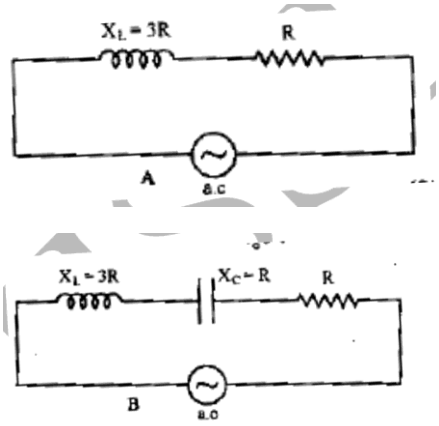
B) An electric bulb 'B' and a parallel plate capacitor 'C' are connected in series as shown in figure. The bulb glows with some brightness. How will the glow of the bulb be affected on introducing a dielectric slab between the plates of the capacitor? Give reasons in support of your answer.



(Score: 1)

C) Given below are two electric circuits A and B. What is the ratio of power factor of the circuit B to that A?

(Score: 2) **[MARCH 2012]**



14. When an alternating current is applied to an electrical element, the current in it leads the voltage by $\frac{\pi}{2}$. Identify the element.

(Score: 1) **[SAY 2011]**

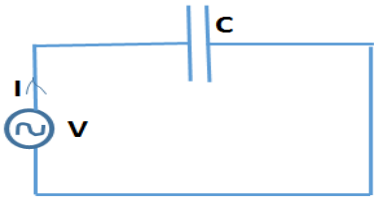
15. A series LCR AC circuit has great practical importance. It is used for tuning radio, T.V. wireless sets etc.

a) Obtain an expression for current in a series LCR AC circuit using phasor diagram.

b) Under what condition, this circuit is used for tuning?

(Score: 3+1) **[MARCH-2011]**

16. A student connects an ac source of emf $V = V_0 \sin \omega t$ to a circuit having a capacitor of capacitance 'C' as shown below



a) If the instantaneous current from ac source is 10 sin (314 t) A, what will be the effective current in the circuit?

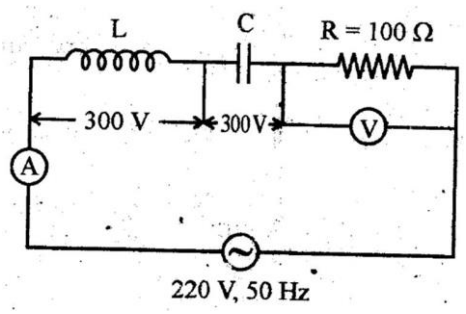
b) If he replaces the ac source by a dc source and connects a bulb in the above circuit, say whether the bulb glows or not. Justify your answer.

c) In the circuit shown above, find the expression for instantaneous current through the capacitor.

d) Find the average power consumed in the above circuit.

(Score: 1+1 ½ +1 ½+2) **[JUNE-2010]**

17. Seema constructed a series LCR circuit in the laboratory as shown in the diagram. She found that the voltages across the inductor and capacitor are equal when the circuit is connected to an ac source.



a) State the condition at which the voltages across L and C become equal.

(b) Obtain an expression for the frequency at which this situation occurs in a series LCR circuit.

(c) Find the voltmeter and ammeter readings in the circuit.

(Score: 1+2+2) **[MARCH-2010]**

CHAPTER 8

ELECTROMAGNETIC WAVES

1. Match the following:

A	B	C
Radio waves	Nuclear reactions	Destroy cancer cells
Ultraviolet rays	Inner shell electron transmission	Detect fake currency notes
	Acceleration of charges in conducting wires	Physical therapy
		Cellular phones

(Score: 2) **[JUNE-2016]**

2. Match the following:

(i) X-rays water purifier

(ii) Infrared Cancer treatment

(iii)Microwave Remote switch

(iv)Ultraviolet Radar

(Score: 2) **[MARCH-2016]**

3. Match the following suitably:

Microwave	Cellular phone
Infrared	Water purifier
Radio waves	Oven
UV rays	Remote switch

(Score: 2) **[JUNE-2015]**

4. (A) The electric field of a plane electromagnetic wave travelling in the positive Z-direction is given by

(a) $Ex = E_0 \sin(kz + \omega t)$

(b) $Ex = E_0 \sin(kz - \omega t)$

(c) $Ex = E_0 \sin(2kz)$

(d) $Ex = E_0 \sin(kz)$

(B) We feel excessive sweating on a cloudy day. Why? (score: ½ + 1)

[MARCH 2015]

5. Sun is a natural source of electromagnetic radiation.

a) Which part of electromagnetic spectrum is termed as 'heat waves'?

b) Different animals are sensitive to different ranges of electromagnetic spectrum. Human eyes are sensitive to which part of the electromagnetic spectrum?

c) Ozone layer in the atmosphere acts as a protective layer for living organisms. Which radiation is prevented by ozone layer from reaching earth?

d) Ozone layer depletion is caused by which gas? (Score: ½ + ½ + ½ + ½)

[JUNE 2014]

6. a) When a low flying aircraft passes over head, we sometimes notice a slight shaking of the picture on our TV screen. Identify the optical phenomenon behind it. (Score: 1)

b) In electromagnetic spectra, the wave length and frequencies are inversely related. A ratio can tune n to any station in the 7.5 MHz to 12MHz band. Determine the corresponding wave length band. (Score: 2)

[MARCH 2014]

7. An important result of Maxwell's theory is that accelerated charges radiate electromagnetic waves.

a) Which of the following is not an electromagnetic wave?

A) X rays B) Υ rays

C) β rays D) Microwaves

(Score: 1)

b) An electromagnetic wave propagates through a medium of permittivity 'ε' and permeability 'μ'. What is the speed of this wave through the medium? Also write the dimensional formula of '$\varepsilon\mu$'. (Score: 1) **[MAY 2013]**

8. Electromagnetic spectrum is an ordinary arrangement of electromagnetic radiations in

Electromagnetic waves	Variation of dipole moment	Proportional to $\vec{E}$
Electromagnetic damping	Electromagnetic induction	Night vision camera
Kirchhoff's junction rule	Relaxation time	Hertz
Infrared ray	Relaxation time	Conservation energy
Drift velocity	Non zero energy density	Electric circuits
Len's law	Conservation of charge	Galvanometer

the ascending order of frequency/wavelength.

a) Arrange the following electromagnetic radiations in the ascending order of frequency.

Visible rays, Infra-red rays, X-rays, Microwaves. (Score: 1)

b) Give one application of infrared and X-rays each. (Score: 1)

[MARCH 2013]

9. Match the following:

(Score: 3) **[JUNE 2012]**

10. A periodic variation in electric and magnetic fields that propagates through space is called electromagnetic radiation.

a) The direction of propagation of an electromagnetic wave is that of

i) $\vec{B}.\vec{E}$ ii) $(\vec{B}\times\vec{E}).\vec{E}$

iii) $\vec{E}\times\vec{B}$ iv) $(\vec{E}\times\vec{B})\times\vec{B}$

b) An electromagnetic wave is entering from one medium to another. Then the property which remains unaltered is

i) Wavelengths ii) Frequency

iii) Velocity

iv) None of these (Score: ½)

[JUNE 2012]

11. The orderly distribution of electromagnetic radiations according to their wavelength or frequency is called electromagnetic spectrum which

i) is used for studying crystal structure.

ii) is absorbed by the ozone layer in the atmosphere.

iii) produces greenhouse effect.

iv) used in medicine to destroy cancer cells. (Score: 2)

[MARCH 2012]

12. Match the following.

I	II	III
a. Microwave	Fracture of bones	Melanin
b. Infrared	Nuclear reactions	Cancer treatment
c. Ultraviolet	Klystron	Cellular phones
d. X - rays	Hot bodies and molecule	Radar
	Ozone layer	Greenhouse effect

(Score: 2) **[SAY 2011]**

13. Name the electromagnetic waves used for the following applications.

a) Imaging of bones of human body.

b) Mobile phone communication.

c) Remote control of T.V. sets.

d) For sterilizing surgical instruments.

(Score: ½ x4=2) **[MARCH-2011]**

14. Considering the electromagnetic spectrum, name the electromagnetic wave which

a) is used to detect fracture in bones.
b) is absorbed by ozone layer of our atmosphere.
c) is produced in nuclear reactions.
d) Arrange the above three waves in increasing order of wavelength.
(Score:2) **[JUNE-2010]**

15. It was James Clark Maxwell who modified Amperes Circuital Theorem by introducing the concept of displacement current.

a) What do you mean by displacement current?

(a) b) The SI unit of $\in_0 \frac{d\phi_E}{dt}$ is

(a) volt (b) ampere
(c) ohm (d) henry
(Score:1+1) **[MARCH-2010]**

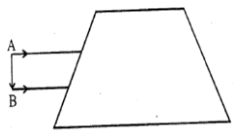
CHAPTER -9

RAY OPTICS AND OPTICAL INSTRUMENTS

1. The refraction of light through the atmosphere is responsible for many interesting phenomena.

(a) How is the atmospheric refraction of sunlight affects the duration of a day?

(b) A Prism shown in the figure is designed to bend the rays by 180^0.



Complete the ray diagram to image formation. (Score:1+2) **[JUNE-2016]**

2. The magnifying power of a telescope depends on the focal length of the objective and that of the eye-piece.

Data of some lenses are given in the table.

Lenses	Power	Aperture
L_1	6D	1 cm
L_2	3D	8 cm
L_3	10D	1 cm

Choose any two lenses which are to be preferred as objective and eye-piece to construct a telescope. Give reason for your selection.

(b) A telescope has an objective of focal length 1.44 m and an eye – piece of focal length 0.06 m. What is the separation between the objective and the eye – piece?

(Score:2+2) **[JUNE-2016]**

3. (A) (a) If the focal length of a double convex lens is 12 cm and radii of curvatures of faces are 10 cm and 15 cm respectively, what is the refractive index of the lens?

(b) (i) Draw the ray diagram showing the formation of image by a compound microscope.

(ii) Show that in order to achieve large magnification in a compound microscope the magnitude of focal length of objective and eye piece should be small. (Score:2+2+3)

OR

(B) (a) What is the structure of an optical fibre?

(b) What is the principle used for transmitting audio and video signals using optical fibre? Explain the principle.

(c) With the help of a neat diagram arrive at an expression for finding the refractive index of a prism. (Score:2+2+3) **[MARCH-2016]**

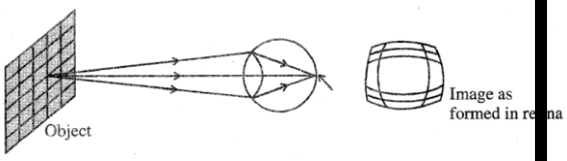
4. When light passes through a triangular prism, it undergoes deviation. (1 +3)

a. What do you mean by angle of deviation?
b. Arrive at the expression:

$$n_{21} = \frac{\sin\left[\frac{A+D_m}{2}\right]}{\sin\frac{A}{2}}$$

(Score:1+ 3) **[JUNE-2015]**

5. When Deepa consulted an eye specialist, the doctor sketched the following figure to explain her vision problem.



a) Can you identify Deepa's vision problem?
b) What causes such a defect?
c) What remedy can you suggest?
(1+ 1+ 1) **[JUNE-2015]**

6. (**A**) A convex lens

(a) is thicker at the edges than at the middle

(b) is thicker at the middle than at the edges

(c) diverges rays of light

(d) is of uniform thickness everywhere.

(B) With the help of a ray diagram sketch the image formation by a convex lens, when the object is between C and F

(C) Derive the Lens Maker's formula

(Score: 1+1+2) **[MARCH 2015]**

7. (A) a ray of light travels from a denser medium to a rarer medium, then the ray

(a) doesn't bend at all

(b) bends towards the normal

(c) bends away from the normal

(d) goes along the normal (Score: 1)

(B) Draw a diagram showing the path of a monochromatic beam of light through a triangular prism. (Score: 1)

(C) Using this diagram obtain the relation

$$n_{21} = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

(Score:2) **[MARCH 2015]**

8. You are given two concave mirrors of different aperture sizes, which one of the two you may select to get a sharper image?

a) i) One with larger aperture size.

ii) One with a smaller aperture size

b) Why do we choose it?

(Score: 1 + 1) **[JUNE 2014]**

9. On hot summer days while moving in a bus the distant spot on highway appears to be wet even though it is not actually wet?

a) What physical phenomenon is responsible for this effect?

b) What is the effect known as?

c) Draw the ray diagram showing this physical phenomenon.

d) How Snell's law is modified in this situation?

(Score: 1+1+2+ 2) **[JUNE 2014]**

OR

10. The image formed in a concave mirror is always erect and virtual whatever be the position of the object.

a) Draw the ray diagram showing virtual image formation in a concave mirror.
b) Derive an equation showing the relation between u, v and f. Where, u, v and f have their usual meaning. Draw the necessary diagram.

c) An object is placed at a distance of 70 cm from a concave mirror of focal length 45 cm.
i) Find he distance at which the image is formed?
ii) What is the magnification produced?

(Score: 1+3+1+1) **[JUNE 2014]**

11. A) Light has several properties like reflection, refraction etc. When light travels from an optically denser medium to a rarer medium?

a) What happens to the light at the interface? (Score: 1)

b) Give demonstration for total internal reflection. (Score: 2)

c) What are the technological applications of total internal reflection in nature? Briefly explain it. (Score: 2)

[March 2014]

12. When light rays enter from one medium to another, refraction takes place. Consider refraction of light at a spherical surface separating two media of refractive indices n_1 and $n_2 (n_1 > n_2)$

a) With the help of a ray diagram show the formation of image of a point object placed in the medium of refractive index n_1. (Score: 1)

b) Using this diagram derive the relation $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$, where u, v, R have their usual meaning. (Score: 1)

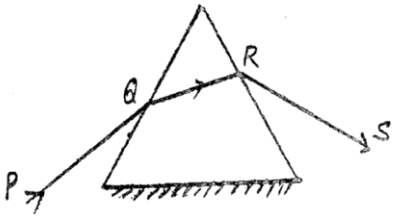
c) In the above case let the first medium be air and the second medium glass of refractive index 1.5. R of spherical surface =20 cm. An object is placed in air 100 cm from the glass surface. At what position the image is formed? (Score: 2) **[MAY-2013]**

13. a) Define power of a lens. What is its unit? (Score: 1)

b) Consider two thin lenses of focal lengths f_1 and f_2 is contact. Obtain an expression for the effective focal length of this combination. What will be the power of this combination? (Score: 3)

c) A convex lens of refractive index 1.5 has a focal length of 20 cm in air. Calculate the change is its focal length when immersed in water of refractive index $\frac{4}{3}$. (Score: 3) **[MAY 2013]**

14. A) An equilateral glass prism is placed on a horizontal surface. A ray PQ is incident on it. For minimum deviation:



i) PQ is horizontal ii) QR is horizontal

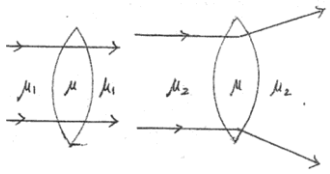
iii) RS is horizontal iv) None of these …..... (Score: ½)

B) A thick lens gives coloured images due to ……..... (Score: 1)

C) In a compound microscope the nature of the intermediate image is …… (Score: 1)

D) Based on refraction and total internal reflection, explain the formation of rainbow. (Score: 2) **[MARCH 2013]**

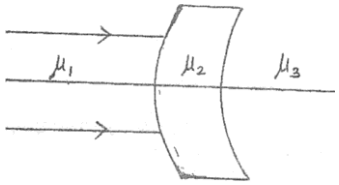
15. The path of light rays through a convex lens when it is placed in two different media is shown in the figure.



a) What is the relation between the refractive indices μ, μ_1 and μ_2? (1)

b) Find the focal length of lens shown in the figure below. The radii of curvature of both surfaces are equal to a R.

($\mu_1 < \mu_2 < \mu_3$) (3)



[JUNE 2012]

16. Using the data given below, state as to which of the given lenses will you prefer to use as

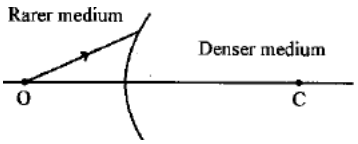
i) an eye-piece and

ii) an objective to construct an astronomical telescope? Give reason for your answer.

Lens	Power	Aperture
L_1	1 D	0.1 m
L_2	10 D	0.05 m
L_3	10 D	0.02 m
L_4	20 D	0.02 m

(Score: 2) **[MARCH 2012]**

17. A spherical surface of radius of curvature R separates a rarer and a denser medium as shown in the figure.



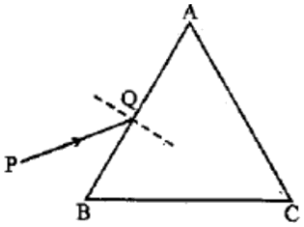
Complete the path of the incident ray of light, showing the formation of a real image. (Score: 1)

b) Derive the relation connecting object distance 'u', image distance 'v', radius of curvature R and the refractive indices n_1 and n_2 of the two media. (Score:2 ½)

c) A thin convex lens of focal length 5 cm is used as a simple microscope by a person with normal near point (25 cm). What is the magnifying power of the microscope? (Score: 1½)

[MARCH 2012]

18. In the figure PQ is a ray incident on a prism ABC.



a) Complete the ray diagram showing the passage of light. Mark angle of incidence i, angle of emergence e, angle of deviation δ and angle of refraction r_1 and r_2. (Score: 1)

b) Using the diagram obtain the relation

$\delta = i + e - A$ (Score:2 ½)

c) The critical angle for diamond is 30^0. What is its refractive index? (Score:1 ½) **[MARCH 2012]**

19.(A) To derive the relevant formula for reflection by spherical mirrors and refraction by lenses, we must adopt sign conventions for measuring distances.

a. State Cartesian sign conventions used in ray optics.

b. Draw the ray diagram for the image formed by a concave lens.

c. Show that $f = \frac{R}{2}$ in the case of concave mirror, where f is the focal length and R is the radius of curvature.

d. Two lenses of power +7D and -3D are combined. The focal length of the combination would be

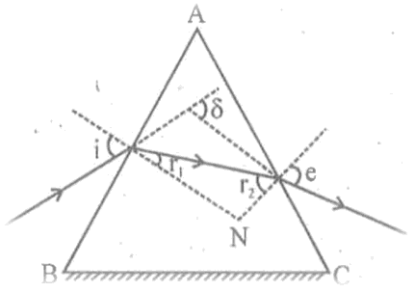
i. -50 cm ii. +25 cm

iii. -25 cm iv. +50 cm

(Score:1 ½ +1 ½+3+1)

OR

B) Raju passed a ray of yellow colour through an equilateral prism and the path of the ray is as shown in the following figures.



a. State the laws of refraction.

b. The refractive index of the material of the prism for yellow colour is 1.5. What would be the velocity of yellow colour through the prism? Velocity of light in vacuum is 3×10^8 m/s.

c. Draw the path of the ray through the prism which suffers minimum deviation.

d. Obtain a relation for the total deviation produced by the prism.

(Score:1 ½ +1 ½+1+3) **[SAY 2011]**

20. Sunlight gets scattered as it travels through earth`s atmosphere.

a. State Rayleigh`s scattered law.

b. During sunset and sunrise, the sun appear red. Explain why.

(Score:1+2) **[SAY 2011]**

21. A lens of a particular focal length is mode from a given glass slab by adjusting radii of curvature. The formula used in this case is lens maker's formula.

a) Write lens maker's formula. (1)
b) Derive lens maker's formula assuming formula for refraction at a spherical surface. (3)
c) Is it possible for a given lens to act as a converging lens in one medium and a diverging lens in another medium? Why? (1)
d) Compare the focal length of a given converging les for the blue light with that using red light are they equal or different? Why? (1)

[MARCH-2011]

22. A microscope is a device used to obtain magnified imaged of small objects.

a) Draw a labelled ray diagram of a compound microscope forming an image at the near point of the eye. (2)
b) Obtain an expression for the magnifications produced by a compound microscope. (2)
c) If the objective lens is immersed in a transparent oil, what will happen to the resolving power of the microscope? Explain. (2)

[MARCH-2011]

23. If a ray of light is incident on a medium of refractive index 'μ_2' from a medium of refractive index 'μ_1'.

a) Under what condition the ray of light gets total internally reflected for these media? (2)
b) Briefly explain how optical fibres transmit light signals. (2)

[JUNE-2010]

24. Refraction of light is the phenomenon of change in the path of light ray when it goes from one medium to another.

a) State the laws of refraction. (1)
b) With the help of a ray diagram derive lens maker's formula for a convex lens of focal length 'f' as $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ 'μ' is the refractive index of material of lens with respect to surrounding medium, R_1 and R_2 are the radii of curvatures of the surfaces of lens. (3)
c) The radius of curvature of each face of a convex lens made of glass of refractive index 1.5 is 30 cm. Calculate the focal length of the lens in air. (2) **[JUNE-2010]**

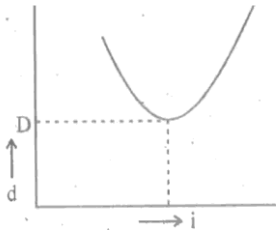
25. Combination of lenses are used in optical instruments to obtain the required power. (1+ 1 ½ + 2 ½)

a) What do you mean by power of a lenses? Express its unit.
b) Draw a neat schematic ray diagram for the formation of image due to a point object placed in front of two thin convex lenses placed in contact.
c) Obtain an expression for the effective focal length of the combination of two

thin convex lenses in contact. **[MARCH-2010]**

OR

26. Figures shows a graph between angle of incidence and the respective deviation of light when it is passed through an optical element. (1+ 1 ½ + 2 ½)



a) Name this optical element.
b) What will happen to the angle of minimum deviation D if it is completely immersed in water? Justify your answer.

c) Obtain an expression for the refractive index of the material of this optical element. **[MARCH-2010]**

CHAPTER -10

WAVE OPTICS

1. (A) Interference and diffraction of light waves produce alternate dark and bright regions called fringes.

(a) Regarding the fringe width choose the correct statement.

(i) Interference fringes are of unequal width

(ii) Diffraction fringes are of same width.

(iii) Interference Fringes are of equal width and diffraction fringes are of different width.

(iv) Both interference and diffraction fringes are of different width.

(b) Using a schematic diagram derive an expression for the fringe width in Young's double slit experiment. (Score: 1+4)

OR

(B) Huygens's principle helps us to find the shape of a wave front emanating from a source.

(a) The shape of the wave front originating from a tube light is

(i) Plane (ii) Circular

(iii) Cylindrical (iv) Spherical

(b) Give Huygens's principle with the help of a ray diagram. Prove the law of reflection.

(Score: 1+4) **[JUNE-2016]**

2. (A) (a) Unpolarised light is incident on a plane glass surface. What should be the angle of incidence so that the reflected and refracted rays are perpendicular to each other?

(b) Using Huygens's concept of wave front, derive Snell's law of refraction.

(Score: 2+3)

OR

(B) (a). Light waves from two coherent sources having intensities I and 2I cross each other at a point with a phase difference of 60^0 . What is the resultant intensity at the point?

(b) With the help of a diagram obtain an expression for finding the distance between two consecutive bright or dark fringes in the interference pattern produced by double slits.

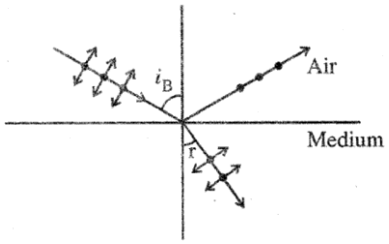
(Score: 2+3) **[MARCH-2016]**

3. In Young's double slit experiment, the slits are illuminated by blue light to observe interference pattern.

a. Sketch the interference pattern. (1)
b. Arrive at an expression for the fringe width. (3) **[JUNE- 2015]**

4. Light undergoes different phenomena like interference, diffraction etc.

a) From the figure given below can you identify the physical phenomena that light undergoes. (Score 1)



b) (i) By what name the angle i_B is known?

(ii) Modify the Snell's law according to the situation depicted in the figure.

(Score ½ + 1½) **[JUNE-2015]**

5. (A) Interference of light from two sources can be observed if

(a) the sources are independent.

(b) the sources are of different frequencies and random phases.

(c) the sources are of different frequency.

(d) the sources are coherent. (Score: ½)

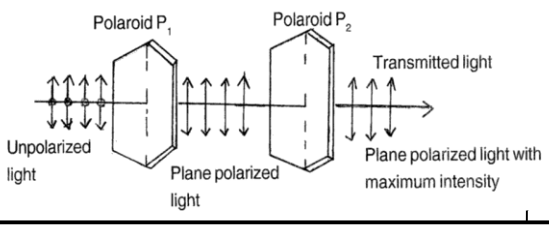
(B) Draw Young's arrangement to produce interference pattern. (Score: 1)

(C) Derive an expression for the fringe width of interference pattern formed on the screen. (Score: 2 ½)

(D) Write the condition to produce good interference bands. (Score: 1)

[MARCH 2015]

6. Figure given below shows the arrangement to test the polarization of light waves.



Draw a graph showing angular dependence of intensity plane polarized light with second polarized P_2.

(Score: 2) **[JUNE 2014]**

7. a) Describe Young's experiment in interference with necessary theory. (Score: 3)

b) Explain the refraction at a spherical surface using a schematic diagram. (Score: 2)

c) Mention the shape of wave front for the portion of wave front of light from a distant star intercepted by the earth. (Score: 1) **[MARCH 2014]**

8. We obtained alternate dark and bright region if we look at the shadow by an obstacle closed to geometrical shadow.

a) Mention the phenomenon behind it. (Score: ½)

b) Differentiate the interference pattern with a coherently illuminated single slit diffraction pattern. (Score:1½)

[MARCH 2014]

9. Match the following:

A	B	C
i)Thomas young	Scattering	Astronomy
ii)Lord Rayleigh	Red shift	Communication
iii)Charles K Kao	Interference	Myopia
iv)Christian Doppler	Polarization	Rainbow
	Optical fiber	Coherent sources
	Diffraction	Colour of sky

(Score: 2) **[MAY 2013]**

10. Wave front is a concept introduced by Huygens to explain various optical phenomena.

a) What type of wave front will emerge from

i) A point source and

ii) Distant source of light

(Score: 1)

b) A plane wave front is incident normally on a convex lens. Sketch the refracted wave front. (Score: 1) **[MAY 2013]**

11. Various phenomena exhibited by light can be explained using the wave theory of light.

a) Name the phenomenon which proves the transverse nature of light. (Score: 1)

b) What are the differences between interference and diffraction? (Score: 2)

c) A plane wave front is incident on a single slit. Discuss the diffraction pattern formed by the slit. Represent the variation of intensity graphically. (Score: 3) **[MARCH 2013]**

12. Wave nature of light is essential to explain phenomena like diffraction, interference etc.

a) What are the conditions to obtain a sustained interference pattern? (Score: 2)

b) Obtain an expression for fringe width in Young's double slit experiment. (Score: 2) **[JUNE 2012]**

13. Match the following:

A	B	C
(i) Doppler	Scattering	Theory of light
(ii)Maxwell	Red shift	Coherent sources
(iii)Rayleigh	polarization	Astigmatism
	Diffraction	Speed of Galaxies
	Electromagnetic waves	Blue colour of sky

(Score: 3) **[MARCH 2012]**

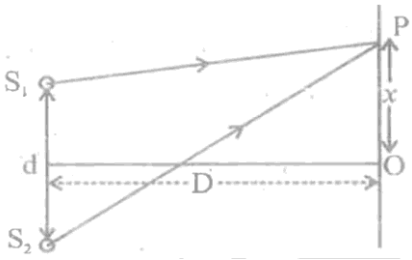
14. In interference and diffraction of light, dark and bright bands are seen on the screen.

a) Do these phenomena violate the law of conservation of energy? Explain.

b) In an interference pattern, the ratio of maximum intensity is 36: 9. Find the ratio of amplitude and intensities of the two interfering waves.

(1 ½ + 2 ½) **[MARCH-2011]**

15. A student performs an interference experiment in the laboratory using two point coherent sources 's_1' and 's_2'seperated by a distance 'd' and obtained the interference pattern on a screen at a distance 'D' from the sources as shown below.



a) What will be the shape of wave fronts coming from sources 'S_1' and 'S_2'?

b) Arrive at the condition such that point 'P' marked on the screen appears bright and hence find its fringe width.

c) If the screen is placed at a distance of 1 metre from sources 'S_1' and 'S_2', width of fringes obtained is 1.5 mm. Find the separation between sources if they produce waves of length 7000A?

16. Match the following:

	I	II	III
(a)	Doppler Effect	Interference	$I = I_o \cos^2\theta$
(b)	Snell's Law	Diffraction	$\beta = \frac{\lambda D}{d}$
(c)	Malus Law	Blue shift	Sin i /sin r
(d)	Single Slit Experiment	Polarisation	$\Delta\lambda = \frac{\lambda u}{c}$
		Refraction	$\theta = \frac{\lambda}{a}$

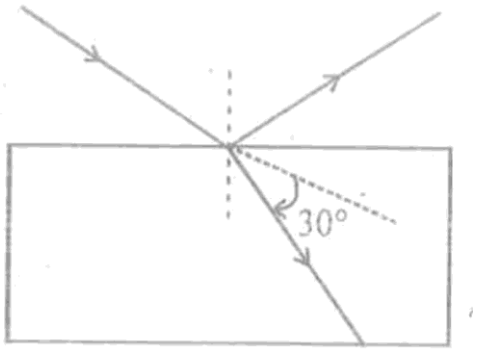
(Score: ½ x 4 = 2) **[MARCH-2010]**

17. Brewster's law gives a relationship between angle of polarisation and refractive index of the material.

a) State Brewster's law.

b) A ray of light is allowed to incident on the surface of a glass plate and it

is found that the reflected and refracted rays are mutually perpendicular as shown in the figure. The refracted ray is deviated from its initial path by an angle of 30^0.



Determine the refractive index of the glass plate.

(Score: 1+2) **[MARCH-2010]**

CHAPTER 11

DUAL NATURE OF MATTER AND RADIATION

1. (A) The wavelength of matter waves is called de Broglie Wavelength.

(a) An α -particle, a proton and an electron having de Broglie wavelengths λ_α , λ_p and λ_e respectively are moving with the same momentum. Then

(i) $\lambda_\alpha > \lambda_p > \lambda_e$ (ii) $\lambda_p > \lambda_e > \lambda_\alpha$

(iii) $\lambda_\alpha = \lambda_p = \lambda_e$ (iv) $\lambda_p = \lambda_e \neq \lambda_\alpha$

(b) The de Broglie wavelength of a ball of mass 0.12 Kg is 2.76×10^{-34} m. Calculate the speed of the ball. [h= 6.625×10^{-34} Js]

(Score: 1+ 2)

OR

(B) Photoelectric current depends on the intensity of incident light.

(a) The maximum current emitted by a photoelectric material is called

(i) Emitter current (ii) Collector current

(iii) Saturation current (iv) Peak current

(b) Work function of caesium and platinum are 2.14 eV and 5.65 eV respectively. Which one of the metals has higher threshold wavelength? Justify.

(Score: 1+ 2) **[JUNE-2016]**

2. (a) The work function a metal is 6eV.If two photons each having energy 4 eV strike with the metal surface.

(i) will the emission be possible?

(ii) Why?

(b) The waves associated with matter is called matter waves. Let λ_e and λ_p be the de Broglie wavelengths associated with electron and proton respectively. If they accelerated by same potential, then

(i) $\lambda_e > \lambda_p$ (ii) $\lambda_p > \lambda_e$

(iii) $\lambda_p = \lambda_e$ (iv) $-\lambda_e = \dfrac{1}{\lambda_p}$

(Score: 2+ 1) **[MARCH-2016]**

3. Electron can undergo diffraction just like waves. What is the wavelength of an electron accelerating in a potential difference of 54 V?

(Score:2) **[JUNE-2015]**

4. When light falls on a certain metals photo electrons are generated.

a) Express the phenomenon in terms of equation.
b) Explain the terms used.

(Score: 1+ 2) **[JUNE-2015]**

5. (A) Work function of a metal is the

(a) energy required by an electron to get absorbed in the metal surface.

(b) minimum energy required by an electron to escape from the metal surface.

(c) energy required by an electron to be retained by a metal surface.

(d) maximum energy required by an electron to escape from the metal surface.

(B) Write Einstein's photoelectric equation and explain the terms involved in it.

(C) All photoelectrons are not emitted with the same energy as the incident photons. Why? (Score: ½ +1 ½ +1) **[MARCH-2015]**

6. (a) What is de Broglie hypothesis?

(b) Write the formula for de Broglie wavelength.

(c) Calculate the de Broglie wavelength associated by an electron accelerated through a potential difference of 100 volts.

Given mass of the electron =9.1 x 10^{-31} kg, h= 6.634 x 10^{-34} JS, 1eV =1.6 x 10^{-19} J

(Score: 1+ 1+ 1 ½) [**MARCH-2015]**

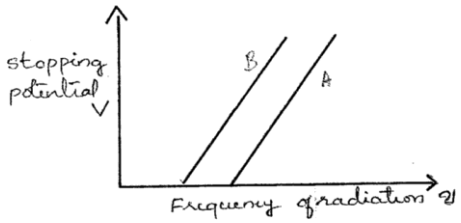
7. According to wave nature of matter, there is a wave associated with every material body.

a) Mention any two differences between light wave and matter wave. (Score: 1)

b) What is the wavelength of electron when it is accelerated by a voltage of 54 V? (Score: 2) **[JUNE-2014]**

8. When photons incident on a metallic surface electric current is produced. The work function of the metal is given by $\phi_0 = \frac{hc}{\lambda_0} = h\nu_0$. Where λ_0 , c, h, ν_0 has their usual meaning.

The graph given below shows the variation in stopping potential **V** with frequency ν of the incident radiation of the materials A and B.



a) Which of the material has higher work function? (Score: ½)

b) Which material is more photosensitive? (Score: ½)

c) What happens to the slope of the graph when intensity of radiation increases? Why? (1) **[JUNE-2014]**

9. Albert Einstein, the great physicist proposed a clear picture to explain photoelectric effect.

a) Explain Einstein's photoelectric equation. (Score: 2½)

b) Name the quanta of light. (Score: ½) **[MARCH-2014]**

10. De Broglie proposed the wave nature of electrons suggesting matter waves.

Find the momentum, speed and De-Broglie wavelength of an electron with kinetic energy of 120 eV. (Score: 2) **[MARCH-2014]**

11. Moving particles of matter should display wavelike properties under suitable conditions.

a) Name the scientist who put forward this hypothesis. (Score: ½)

b) Which experiment established the wave nature of particle? (Score: ½)

c) An electron of mass 'e' is accelerated from rest by a potential difference v. Find the wavelength associated with the electron. (Score: 1½)

e) Calculate the frequency associated with a photon of energy 3.3×10^{-20}J. h=6.6×10^{-34}Js. (Score: 1)

[MAY-2013]

12. Photon is a quanta of light.

a) Who introduced the concept of photon? (Score: 1)

b) Briefly explain the effect of intensity and energy of the incident radiation on the photo electric effect. (Score: 2)

[MARCH 2013]

13. Einstein got Nobel Prize in physics in1921 for his explanation of photoelectric effect

a) Write down Einstein's photoelectric equation. (Score: 1)

b) Draw a graph to show the variation of stopping potential with frequency of incident radiation. How the value of Plank's constant can be determined from the graph? (Score: 2)

[JUNE 2012]

14. Read the following statements and write whether they are TRUE or FALSE.

a) Matter waves are electromagnetic.

b) When wavelength of incident light is decreased, the velocity of emitted photoelectrons increases.

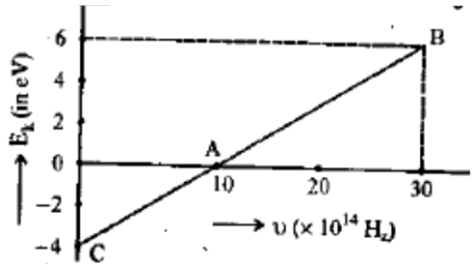
c) Alkali metals are most suitable for photoelectric emission.

d) Davisson-Germen experiment proved the particle nature of electrons.

(Score: 2)

[MARCH 2012]

15. Given below is the graph between frequency (υ) of the incident light and maximum kinetic energy (E_k) of emitted photoelectrons.



a) Define the terms, work function and threshold frequency. (Score: 2)

b) Find the values of

i. threshold frequency and

ii. Work function from the graph.

(Score: 1) **[MARCH 2012]**

16. Einstein was awarded Nobel prize in 1921 for his work on photoelectric effect.

a) What is meant by photoelectric work function?

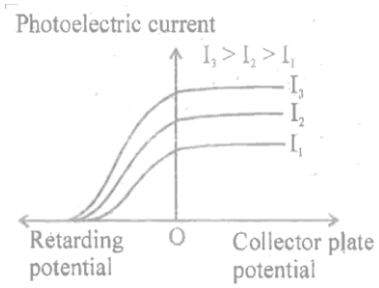
b) Which of the following is not a photosensitive material for visible light?

i. Sodium ii. Magnesium

iii. Rubidium iv. Caesium

c) Write down Einstein's photoelectric equation and explain the symbols.

d) Following graph is obtained in an experiment on photoelectric effect. Which characteristics of incident radiation is kept constant in this experiment?



(Score:1+1+2+1) **[SAY- 2011]**

17. To emit a free electron from a metal surface a minimum amount of energy must be supplied.

a) This energy is called.....

b) State three methods to supply this energy to the free electron.

c) When light of frequency 7.21 x 10^{14}Hz is incident on a metal surface, the maximum speed of the ejected electrons is 6 x 10^5 m/s. Calculate the threshold frequency for the metal.

(Score: ½ +1 ½ +3)[**MARCH-2011]**

18. According to de Broglie, matter exhibits particle as well as wave nature.

a) What will be the de Broglie wave length of a moving particle and that of a photon?
b) Name the experiment which proves the wave nature of electrons. Illustrate the experiment, with a suitable diagram.
(Score: 1½ +3 ½) **[JUNE-2010]**

19. Light meters in photographic cameras make use of photoelectric effect.

a) What is photoelectric effect?
b) Which of the following is a photosensitive material?

(a) Quartz (b) Caesium

(c) Germanium (d) Silicon

c) Represent graphically the variation of photoelectric current with the intensity of incident radiation.
d) Red light however bright, cannot produce the emission of photoelectrons from a clean zinc surface. But even a weak ultraviolet radiation can do.
Do you agree with statement? Why?
(Score: 1 +1 +1 +2) **[MARCH-2010]**

CHAPTER 12

ATOMS

1. The atomic hydrogen emits lines spectrum consisting of various series.

(a) Name the series observed first.

(b) Draw the energy level diagram of hydrogen atom. (Score: 1+ 2) **[JUNE-2016]**

2. (a) List out any two limitations of Bohr atom model.

(b) According to de Broglie's explanations of Bohr's second postulate of quantization, the standing particle wave on a circular orbit for n = 4 is given by

(i) $2\pi r_n = 4\lambda$ (ii) $\frac{2\pi}{\lambda} = 4r_n$

(iii) $2\pi r_n = 4\lambda$ (iv) $\frac{\lambda}{2\pi} = 4r_n$

(Score: 2+ 1) **[MARCH-2016]**

3. It was Bohr who suggested the stable structure of atom with the help of quantum hypothesis. According to him,

a. Where can an electron be observed in an atom?
b. What is the angular momentum of an electron?
c. How spectral lines are produced?
(Score: 1+ 1+1) **[JUNE- 2015]**

4. (a) Obtain an expression for the number of radioactive nuclei present at any instant in terms of the decay constant and initial number of nuclei.

(b) The half-life of radioactive radon is 3.8 days. Find the time during which 1/ 20 of radon sample will remain undecayed.

(Score: 2+2) **[MARCH-2015]**

5. When a vapour is exited at low pressure by passing an electric current through it, a spectrum is obtained.

a) Draw a spectral series of emission lines in hydrogen. (Score: 1)

b) Name the different series of hydrogen atom. (Score: 1)

c) In which region Lyman series is located. (Score: ½)
[MARCH-2014]

6. Rutherford atom model is based on the classical concept that electrons are revolving around a central positive nucleus.

a) Mention the drawback of Rutherford atom model and how it is rectified in Bohr's atom model? (Score: 1)

b) From Bohr's theory obtain the de Broglie wavelength of an electron orbiting around the nucleus. (Score: 2)

c) Give the statement of Heisenberg's uncertainty principle and express it mathematically. (Score: 2)

[MARCH-2013]

7. The wavelength associated with a particle is called the de Broglie wavelength. From Bohr's postulate of quantization of angular momentum arrive at an expression for the wavelength of an orbital electron. Comment on the result. (Score: 2) **[JUNE-2012]**

8. In 1913 Neils Bohr proposed a successful atom model by combining the classical and quantum concepts.

a) Based on Bohr atom model explain the line spectra of hydrogen atom. (Score: 2)

b) Calculate the radius of third Bohr orbit of hydrogen atom and the energy of electrons in that orbit.
($h=6.625\times10^{-34}$ JS, $\epsilon_0=8.85\times10^{-12}FM^{-1}$, $e=1.610\times10^{-19}C$, $m_e\times=9.1\times10^{-31}kg$)
(Score: 3)

[JUNE 2012]

9. Niels Bohr explained hydrogen spectrum based on quantum ideas.

a) Draw the energy level diagram of hydrogen atom. (Score: 1)

b) Name the different series of lines observed in hydrogen spectrum. (Score: 1)

c) Show the transitions between energy levels producing the different series. (Score: 1)

[MARCH 2012]

10. Spectra are produced due to electronic transitions from higher energy level to lower energy level.

a. Name the series spectra produced by hydrogen.
b. Which series lies in the visible region?
c. Write down the Balmer formula for the wavelength of Hα line.
(Score:1+1+1) **[SAY 2011]**

11. Bohr proposed a new model of atom to overcome a problem of Rutherford's atom model.

a) Which specific problem of the Rutherford model was attempted to be solved by Bohr model?
b) What are the basic postulates of Bohr model?
c) The radius of the inner most electron orbit of a hydrogen atom is 5.3×10^{-11}m. What are the radii of then n =2 and n=3 orbits?
(Score:1+3+2) **[MARCH-2011]**

12. If the wavelength ` λ ` of spectral lines emitted by hydrogen atom is generally expressed as $\frac{1}{\lambda} = R\left(\frac{1}{m^2} - \frac{1}{n^2}\right)$

Where R : Rydberg Constant and `n` and `m` are integers. From this,

a) Write down the expression for Balmer series of spectral lines.
b) Find out the shortest wavelength of spectral line emitted in Balmer series.

(Score:1+1) **[JUNE-2010]**

13. The total energy of an electron in the ground state of a hydrogen atom is -13.6eV.

a) What do you mean by ground state of a hydrogen atom?
b) The excitation energy required to raise the electron in the first excited state of hydrogen atom is ..... eV.
(Score:1+1) **[MARCH-2010]**

CHAPTER 13

NUCLEI

1. (A) The force exists the nucleons in a nucleus is called nuclear force.

(a) The nuclear force between two protons, two neutrons and between a proton and a neutron is denoted by f_{pp}, f_{nn} and f_{pn} respectively, then

(i) $f_{pp} = f_{nn} \neq f_{pn}$ (ii) $f_{pp} \neq f_{nn} = f_{pn}$

(iii) $f_{pp} = f_{nn} = f_{pn}$ (iv) $f_{pp} \neq f_{nn} \neq f_{pn}$

(b) What is the meaning of mass defect?

(c) Calculate the energy released in the nuclear reaction shown below:

$${}_1H_2 + {}_1H_2 \rightarrow {}_2He_4 + Energy$$

Mass of $\left({}_1H^2\right) = 2.014102u$

Mass of $\left({}_1He^4\right) = 4.0026u$

1 a.m.u = 931 MeV (Score:1+1+ 2)

OR

(B) (a) What is meant by half- life of radio nucleus?

(b) The half – life of polonium is 140 days. How long will it take to reduce to 1 g. Polonium out of its initial mass of 16 g.

(c) Which one of the following particles can be used for the disintegration of a radioactive nucleus?

(i) Proton (ii) neutron

(iii) Electron (iv) Deuteron

(Score:1+1+ 2) **[JUNE-2016]**

2. (a) what do you mean by Q value of a nuclear reaction?

(b) Write down the expression for Q value in the case of α decay.

(c) Two nuclei have mass numbers in the ratio 1:64. What is the ratio of their nuclear radii? (Score:1+1+ 2) **[MARCH-2016]**

3. Radioactivity was discovered by A. H. Becquerel

a) What do you mean by the term half-life period?

b) A radioactive sample has initially N_0 number of nuclei. The half-life period of this element is 2 years. How much nuclei will be left after 8 years in the sample? (Score:1+1) **[JUNE-2015]**

4. Radioactivity is an accidental discovery by Henry Becquerel.

a) Categorize the following statements related to radioactivity as true or false.

i) All elements present in nature show radioactivity. (Score: ½)

ii) Rate of decay of all radioactive elements can be characterized by their half period. (Score: ½)

b) A certain radioactive elements have a half-life of 10 days. How long it will take for 75% of its atoms originally present to disintegrate? (Score: 2)

[JUNE-2014]

5. Nuclear fusion reaction is responsible for energy generation in stars.

a) What is the principle behind a nuclear reactor?

i) Fission ii) Fusion

iii) Controlled fusion (Score: ½)

b) Which of the following helps to slow down fast neutrons in a reactor?

i) Safety rods

ii) Moderator (Score: ½)

c) In the nuclear reaction what is the element X?

$${}_7N^{14} + {}_2He^4 \rightarrow {}_1H^2 + X$$

i) ${}_8O^{16}$ ii) ${}_7N^{14}$

iii) ${}_9F^{17}$ iv) ${}_{10}Ne^{17}$ (Score: ½)

d) The mass of an atom is expressed in

i) Kg ii) g

iii) u iv) Carats (Score: ½)

[JUNE-2014]

6. Energy generation in stars is due to nuclear fusion.

a) How a nuclear fusion is occurred? (Score: ½)

b) The energy released in nuclear fission process with uranium is of the order of ___ (Score: ½)

c) Three types of radioactive decay occur in nature. Briefly describe them. (Score: 2)

[MARCH 2014]

7. Spontaneous and continuous disintegration of a nucleus of a heavy element with the emission of certain types of radiation is known as radioactivity.

a) The radioactive isotope 'D' decays according to the sequence

$$D \xrightarrow{\beta^-} D_1 \xrightarrow{\alpha} D_2$$

If the mass no. and atomic no. of D_2 are 176 and 71 respectively, what is the

i) Mass number ii) atomic number of D (Score: 1)

b) State radioactive decay law. (Score: ½)

c) Distinguish between half-life and mean life of radioactive element. Write the relation connecting them. (Score:1 ½)

d) Tritium has a half-life of 12.5 years. What fraction of a sample of pure tritium will remain under decayed after 50 years? (Score: 1)

[MAY-2013]

8. In a nuclear reactor the chain reaction is carried out under controlled conditions.

a) Name the material that used as control rods in a nuclear reactor. (Score: ½)

b) Average energy of a neutron produced in fission of $^{238}_{92}U$ nucleus is ___ (Score: 1)

c) Write down the reactions involved in the conversion of $^{238}_{92}U$ to $^{239}_{94}Pu$ in a nuclear reactor. (Score: 1)

[MARCH-2013]

9. Nucleus of an atom consists of protons and neutrons closely packed in to small volume.

a) How will you relate the binding energy and stability of a nucleus? (Score: 1)

b) Explain how energy is released in a fission process. (Score: 2)

c) Nuclear fusion is the source of energy in stars. Write down the reaction involved in a proton-proton cycle. (Score: 2)

[JUNE-2012]

10. (a) In the following nuclear fission reaction, N is the number of neutrons released. What is the value of N?

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{94}_{38}Sr + {}^{140}_{54}Xe + N$$

(Score: ½)

(b) Complete the following nuclear reaction equation.

$$^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{1}_{0}n + \_\_\_\_$$

(Score: ½)

(c) Two nuclei have mass number iin the ratio 1: 8. What is the ratio of their nuclear radii? (Score:1)

[MARCH 2012]

11. A radioactive substance decays to $\frac{1}{32}$ of its initial value in 25 days. Calculate its half life

(Score:2) **[SAY 2011]**

12. Nuclear fission and nuclear fusion represent two types of nuclear reactions. Then

a) Write down one similarity and dissimilarity between nuclear fission and nuclear fusion.

b) For a nuclear reaction, along with masses of nuclei P, Q, R and S taking part in it is given below (1amu = 931 MeV)

$$\underset{(1.003\ amu)}{P} + \underset{(1.004\ amu)}{Q} \rightarrow \underset{(1.002\ amu)}{R} + \underset{(1.0025\ amu)}{S} + \text{Energy}$$

How much energy is released by the reactions (in MeV)?

(Score:1+2) **[JUNE-2010]**

13. The half-life of Radon is 3.8 days.

a) Define half-life.

b) Calculate how much of 15mg of Radon will remain after 14.2 days.

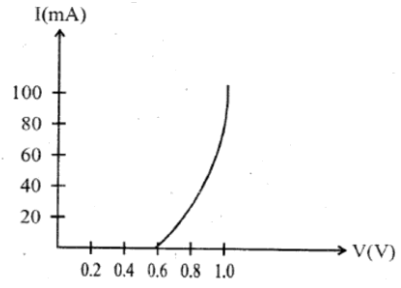
(Score:1+2) **[MARCH-2010]**

CHAPTER 14

SEMICONDUCTOR ELECTRONICS

1. A graph showing the variation of current (I) flowing through a p-n junction with the voltage (V) applied across it is called the V-I characteristics of a p-n junction.

(a) V-I characteristic of a forward biased diode is shown in the figure.

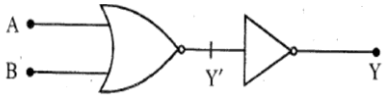


Write any two important features of the graph.

(b) What is a Zener diode? Give its symbol.

(Score:2+ 2) **[JUNE-2016]**

2. A logic circuit is shown in the figure:



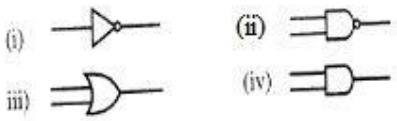
Complete the truth table of the circuit:

A	B	Y'	Y
0	0	1	0

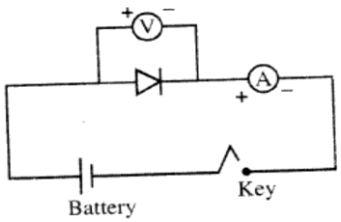
Name the resulting gate formed by the combination of the above gates.

(Score: 2) **[JUNE-2016]**

3. (a) Which of the following symbol represents a universal gate?



(b) Shown below is an experimental set up with a semiconductor diode



(i) identify the experiment

(ii) draw the resulting graph

(c) with the help of a neat circuit diagram obtain an expression for voltage gain of a transistor amplifier in C-E configuration.

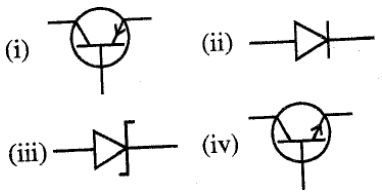
(Score:1+2+ 3) **[MARCH-2016]**

4. Diode is a semiconducting device made up of p-n junction.

a. Diode can be used to convert AC into DC. This process is called----------
b. Draw the circuit diagram of an AC to DC converter using two diodes.
(Score:1+ 2) **[JUNE-2015]**

5. There are different types of semiconducting devices such as diode, transistor etc.

a. Which of the following symbol represents a p-n-p transistor?

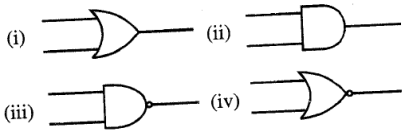


b. Given below is the truth table of a logic gate:

Inputs		Output
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

i. Identify the gate.

ii. Choose its symbol from the following:



(Score:1+1) **[JUNE-2015]**

6. The truth table for a logic circuit is given below:

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

(a) Identify the gate

(b) Draw the logic symbol of the gate

(c) Explain why NAND gate is known as universal gate? (score: ½ + ½ + 1)

[MARCH 2015]

7. (A) Draw a circuit diagram of a transistor as an amplifier in common emitter configuration. (Score 2)

(B) Obtain the expression for the voltage gain. (score 2) **[MARCH 2015]**

8. (A) What do you mean by barrier potential of a diode? (Score 1)

(B) With the help of a diagram explain the working of a full wave rectifier.

(Score 3) **[MARCH 2015]**

9. You are given two p-n junction diodes.

a) Mention the name of an electric circuit which make use of these diodes to convert A.C current to continuous D.C current. (Score: 1)

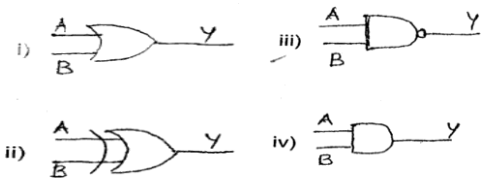
b) Draw the circuit diagram of the above mentioned circuit.
(Score: 2) **[JUNE 2014]**

10. The truth table of a logic circuit is given below:

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

a) Identify the gate? (Score: 1)

b) Which of the following is the logic symbol of this gate? (Score: 1)



[JUNE 2014]

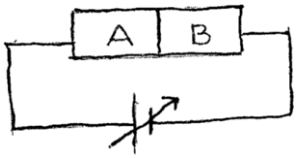
11. a) The following figure represents a ____

(Score: ½)

b) Draw a typical illuminated p-n junction solar cell. (Score: 1)

c) LED converts ____ energy to light.
(Score: ½)
[MARCH 2014]

12. Two semiconductor materials A and B shown in the given figure are made by doping germanium crystal with arsenic and indium respectively. The two are joined end to end and connected to a battery as shown.



a) Will the junction be forward biased or reverse biased? Justify your answer.

(Score: 1)

b) Sketch a V-I graph for this arrangement. (Score: 1) **[MAY 2013]**

13. A gate allows the signals to pass through only when some logical conditions are satisfied.

a) Write the truth table of 'OR' gate. (Score: 1)

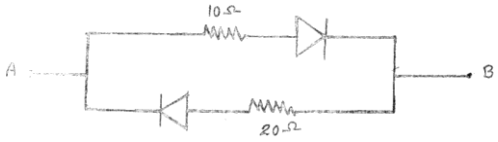
b) The output of a 2-input 'NOR' gate. Draw the logic circuit of this combination of gates and write the truth table for the output of the combination for all inputs. (Score: 2)

[MAY 2013]

14. Biasing is provided for maintaining proper current flow across a p-n junction.

a) In a biased p-n junction the net flow of holes is from 'n' region to 'p' region. (Score: ½)

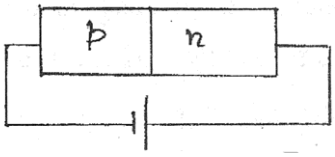
b) For the device shown in below draw the V-I characteristics when the potential is applied between the terminals A and b. (Score: 2)



c) A transistor can be used to amplify voltage or current. Explain how a transistor can be used as a current amplifier. Draw necessary circuit. (Score: 2½)

[MARCH 2013]

15. A p-n junction has various applications as in diode, transistor etc. A p-n junction with a bias voltage is shown below.



a) Comment on the current floe across the junction under this condition. (Score: 1)

b) How a Zener diode is different from an ordinary p-n junction diode? (Score: 1)

c) Draw the reverse characteristics of a Zener diode and an ordinary p-n junction diode. (Score: 2)

d) With a diagram explain the action of a Zener diode as a voltage regulator. (Score: 2) **[JUNE 2012]**

16. Oscillator is a circuit that generates signals of desired frequencies and an amplifier is used to amplify the signals.

a) Why positive feedback is applied in an oscillator? (Score: 1)

b) What are the effects of negative feedback in an amplifier? (Score: 1)

c) Why the common emitter configuration of a transistor is preferred in amplifier? (Score: 1)

d) Draw the circuit diagram to determine the common emitter characteristics of a transistor and sketch a typical output characteristic for two different base currents. (Score: 2)

[JUNE 2012]

17. Given below is the truth table of a 2-input logic gate.

A	B	OUTPUT
0	0	1
0	1	1
1	0	0
1	1	0

A) Identify the logic gate. (Score: ½)

B) Draw its logic symbol (Score: ½)

C) If this logic gate is connected to a NOT gate, what will be the output, when
i) A=1, B=1 and
ii) A=0, B=1?

(Score:1) **[MARCH 2012]**

18. (A) Choose the correct relation between the transistor parameters β and α.

a) $\beta = \frac{1-\alpha}{\alpha}$ b) $\beta = \frac{\alpha}{1-\alpha}$

c) $\beta = \frac{1+\alpha}{\alpha}$ d) $\beta = \frac{\alpha}{1+\alpha}$

(Score: 1)

B) Define the quantities α and β.

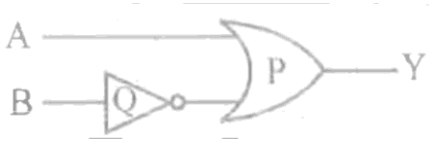
(Score: 1)

C) Give their possible range of values.

(Score: 1)

[MARCH 2012]

19. A logic circuit with inputs A and B and output Y is shown below.

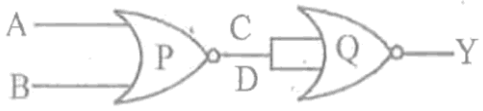


a. Identify the logic gates marked P and Q.
b. Write down the output Y, when A=1 and B=0, and when A= 0 and B= 1.
c. NAND and NOR gates are called universal gates. Why?

(Score:1+1+1) **[SAY 2011]**

20. Fort the working of a transistor as an amplifier, its emitter - base junction should be given a ..... bias and collector -base junction should be given a ..... bias. (Score:2) **[SAY 2011]**

21. Consider the logic circuit using NOR gates given below:



a) Write the truth table for the circuit.
b) Identify the logic operation which this circuit is performing.

(Score:1+1) **[MARCH-2011]**

22. Match the following in 3 columns.

A	B	C
Zener Diode		Conversion of light into electrical energy
Light Emitting Diode (LED)		Rectification
Photodiode		Voltage regulator
Diode		Conversion of electrical energy into light energy

[MARCH-2011]

23. For the logic circuit shown below, with inputs `a` and `b` and output `x`

a) Identify the logic gates marked P & Q.

b) Write down the output `x`,

When a = 1, b = 0 and a = 0, b = 1.

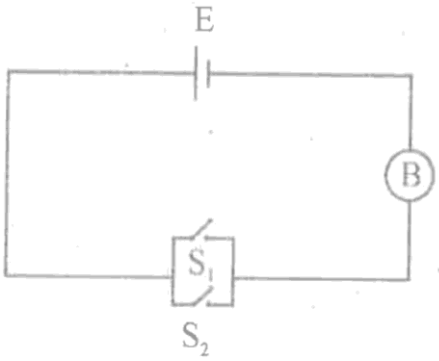
(Score:1+1) **[JUNE-2010]**

24. As you know diodes are inevitable components of electronic circuits to meet specific requirements of our daily life.

a) Name the diode which regulates the output of an unregulated supply. (1)

b) Draw its circuit symbol and general shape of its volt-ampere (V-1) characteristics. (2) **[JUNE-2010]**

25. A student made a circuit as shown in the figure. S_1 and S_2 are switches and B is a bulb.



a) He argues that this circuit is equivalent to an **AND** gate. Do you agree with him? Justify your answer.

b) Write down its truth table. (Score:1+1) **[MARCH-2010]**

26. A photodiode is fabricated from a semiconductor of band gap energy 2.8 eV.

a) Define band gap.

b) Can this photodiode be used to detect a wavelength of 500 nm? Justify your answer. (Score:1+2) **[MARCH-2010]**

OGY ACADEMY PVT LTD

CHAPTER 15

COMMUNICATION SYSTEMS

1. Draw the labelled block diagram of an amplitude modulator for obtaining AM wave

(Score: 2) **[JUNE-2016]**

2. (a) A receiver in a communication system must have

(i) Pick-up antenna (ii) demodulator

(iii) amplifier (iv) all of these

(b) Which of the following statement is wrong?

(i) The attenuation of surface waves increases with increase in frequency.

(ii) The phenomenon involved in sky wave propagation is similar to total internal reflection.

(iii) Space wave mode of propagation is used in satellite communication.

(iv) Sky wave propagation is useful only in the range of frequencies 30 to 40 MHz

(Score:1+1) **[MARCH-2016]**

3. There are two basic modes of communication: point to point and broadcasting. In short wave broadcast service which mode of propagation of radio waves is used?

a. Name any other two modes of propagation of radio waves is used?

b. Draw the frequency spectrum of amplitude modulated signal.

(Score:1+1+ 1) **[JUNE-2015]**

4. (A) Range of an electronic communication system is the

(a) distance to the nearest TV station

(b) distance to the nearest radio station

(c) largest distance that the signal can travel

(d) largest distance between a source and destination up to which the signal is received with sufficient strength (score 1)

(B) If the height of a TV transmitting antenna increases, its coverage increases. Why? (score 1) **[MARCH 2015]**

5. Radio waves are electromagnetic waves used for communication purpose.

a) Name the mode of propagation used for radio waves of frequencies ranging from 30-40 MHz (Score: 1)

b) Name two communication systems that use space wave mode of propagation. (Score: 1)

c) In standard radio broad casting which modulation is commonly used?
(Score: 1) **[JUNE 2014]**

6. In our daily life, modulation plays an important role.

a) Discuss the amplitude modulation. (Score: 2)

b) Give a block diagram of a generalized communication system.
(Score: 1) **[MARCH 2014]**

7. Ground waves, sky waves and space waves are generally used is communication process.

a) Which of the above waves is used in the UHF range? (Score: 1)

b) An AM wave is represented by

$C_m(t) = 6(1 + 0.5Sin12560t)Sin(22 \times 10^5 t)volt$

calculate:

i) Amplitude of carrier wave
ii) Frequency of carrier wave
iii) Frequency of modulating signal
iv) Modulation index

(Score: 2) **[MAY 2013]**

8. Various propagation modes are used in communication

a) Mention two communication systems that use space wave propagation. (Score: 1)

b) Why modulation is necessary in communication? (Score: 1)

c) If a signal of frequency ω_s is used to modulate a carrier wave of frequency ω_c which are the frequencies contained in the modulated signal other than ω_c. (Score: 1) **[MARCH 2013]**

9. In communication, signal is transmitted from a source to a receiver through a medium. Different types of media offer different band widths.

a) What is the approximate band width and upper limit of operating frequency of a coaxial cable system? (Score: ½)

b) What do you understand by amplitude modulation? (Score: 1)

c) Draw the block diagram of an AM receiver. (Score: 1½)
[JUNE 2012]

10. Spectrum allocations for communication are arrived at by an international agreement.

a) Name the agency which administers the present system of frequency allocations. (Score: 1)

b) Draw block diagrams of an amplitude modulated
i) Transmitter and
ii) Receiver (Score: 2)
[MARCH 2012]

11. Which of the following is used for the line-of–sight (LOS) communication?

a. Sky waves b. Ground waves

c. Space waves d. Long waves

(Score:1) **[SAY 2011]**

12. ..... Signals are continuous variations of voltage or current.

(Score:1) **[SAY 2011]**

13. Power radiated by a transmitting antenna is proportional to

a. $(\frac{\lambda}{l})^2$ b. $\frac{l^2}{\lambda}$ c. $(\frac{l}{\lambda})^2$ d. $\frac{\lambda^2}{l}$

(Score:1) **[SAY 2011]**

14. Television broadcast is done by space wave mode of propagation.

a) What is the difference between sky wave and space wave modes of propagation?

b) A TV transmission antenna is 81 m tall. How much service area can it cover if the receiving antenna is at the ground level? (Radius of earth is 6400km)
(Score:1+2) **[MARCH-2011]**

15. Communication is the process of sending information from one place to another by electric signals.

a) Name the two types of electrical signal.
b) Differentiate these signals. giving one example each.
(Score:1+2) **[JUNE-2010]**

16. Modulation is a process employed to superimpose a carrier wave with a signal wave.

a) In amplitude modulation, which of the following will change?
(a) Frequency
(b) Phase
(c) Amplitude
(d) Wavelength
b) A message signal of frequency 10 KHz and peak voltage of 10 volts is used to modulate a carrier wave of frequency 1 MHz and peak voltage of 20 volts.
Determine the modulation index and frequencies of side bands.

(Score:1+2) **[MARCH-2010]**