A
/\/\
/ |
/ |
/ |
/ |
F / | B Fy
/ |
/ |
/ |
/ @ | B
O /————> X
Fx

The line AB represents its vertical component and it is denoted by Fy.The line OB represents its horizontal component and it is denoted by Fx. Now in the triangle AOB
Sin@= AB/OA {sin@= Perpendicular/Hypotonuse}
or sin@= Fy/F
or Fy= Fsin@
Similarly

Cos@= OB/OA {sin@= Base/Hypotonus}
or Cos@= Fx/F
or Fx= FCos@
For the triangle
Tan@= AB/OB {Tan@= per/hyp}
or Tan@= Fy/Fx
or @=Tan-1=Fy/Fx

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SUBTRACTION OF A VECTOR

"It is defined as the Addition of A to the negative of a B is called the subtraction of a vector (A-B)"

OR

“The rate of change of distance is called speed.”

FORMULA
Speed = Distance/Time
or V = S/t

UNIT
The S.I unit of speed in M.K.S system is Meter/second.
or m/s

Kinds Of Speed

1. Uniform Speed

If a body covers an equal distance in equal interval of time so the body is said to be in uniform speed.

2. Variable speed

If a body does not cover an equal distance in equal inteval of time so the body is said to be in variable speed.

VELOCITY

“The distance covered by a body in a unit time in a particular direction is called velocity.”

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OR

“The rate of change of displacement is called speed.”

OR

“Speed in a definite direction is called velocity.”

FORMULA
Velocity = Displacment/Time
or V = S/t

UNIT
The S.I unit of Velocity in M.K.S system is Meter/second.
or m/s

Kinds Of Velocity

1. Uniform Velocity

If a body covers an equal distance in equal interval of time in a Constant direction so the body is said to be in uniform Velocity.

2. Variable Velocity

If a body does not cover an equal distance in equal interval of time in a particular direction so the body is said to be in variable velocity.

ACCELERATION

“The rate of change of velocity is called acceleration.”

hole C and get line CC’.
The lines AA’, BB’ and CC’ intersect each other at a point. It is our required point, i.e.e the centre of gravity. We can use this procedure with any irregular shaped body and find out its centre of gravity.

EQUILIBRIUM

A body will be in equilibrium if the forces acting on it must be cancel the effect of each other.
In the other word we can also write that:
A body is said to be in equilibrium condition if there is no unbalance or net force acting on it.

Static Equilibrium
When a body is at rest and all forces applied on the body cancel each other then it is said to be in static equilibrium.

Dynamic Equilibrium
When a body is moving with uniform velocity and forces applied on the body

cancel each other then it is said to be in the dynamic equilibrium.

CONDITIONS OF EQUILIBRIUM

FIRST CONDITION OF EQUILIBRIUM

“A body will be in first condition of equilibrium if sum of all forces along X-axis and sum of all forces along Y-axis are are equal to zero, then the body is said to be in first condition of equilibrium.”
(Fx = 0 Fy = 0)

SECOND CONDITIONS OF EQUILIBRIUM

“A body will be in second condition of equilibrium if sum of clockwise(Moment) torque must be equal to the sum of anticlockwise torque(Moment) then the body is said to be in second condition of equilibrium.”
Sum of torque = 0

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STATES OF EQUILIBRIUM

There are following three states of Equilibrium:

1. First State (Stable Equilibrium)

A body at rest is in stable equilibrium if on being displaced, it has the tendency to come back to its initial position.
When the centre of gravity of a body i.e. below the point of suspension or support, then body is said to be in stable equilibrium.

2. Second State (Unstable Equilibrium)

If a body on displacement topples over and occupies a new position then it is said to be in the state of unstable equilibrium.
When the centre of gravity lies above the point of suspension or support, the body is said to be in the state of unstable equilibrium.

3. Third State

If a body is placed in such state that if it is displaced then neither it topples over nor does it come back to its original position, then such state is called neutral equilibrium.
When the centre of gravity of a body lies at the point of suspension, then the body is said to be in neutral equilibrium.

Kinds of Lever

1. First Kind of Lever

In the first kind of lever, the fulcrum F is in the between the effort P and Weight W.

Examples
Physical Balance
Handle of Pump
Pair of Scissors
See Saw

2. Second Kind of Lever

In the second kind of lever, the weight W is in between the fulcrum F and effort P.

Examples
Door
Nut Cracker
Punching Machine

3. Third Kind of Lever

In the third kind of lever, the effortP is in between the fulcrum F and weight W.

Examples
Human forearm
Upper and Lower Jaws in the Mouth
A Pair of Forecepes

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Inclined Plane

Definition
A heavy load can be lifted more easily by pulling it along a slope rather than by lifting in vertically. Such a slope is called an Inclined Plane.

Mechanical Advantage
M.A = W/P = l/h = Length of Inclined Plane/Perpendicular Height

Pulley

A pulley consists of a wheel mounted on an axle that is fixed to the framework called the block. The wheel can rotate freely in the block. The groove in the circumference prevents the string from slipping.

Fixed Pulley

If the block of the pulley is fixed then it is called a fixed pulley.

Mechanical Advantage of Fixed Pulley
In a fixed pulley, the force P is the applied force and weight W is lifted. If we neclect the force of friction then:
Load = Effort
In the given case:

Following are some types of stress:
1. Tensile Stress: It is a stress tending to stretch a body.
2. Bulk Stress: It is an overall force per unit area, also known as pressure.
3. Shear Stress: It is a stress tending to produce an angular deformation.

Strain

Definition
Stress can produce a change in shape, volume or length in an object. This change in the shape of an object is called strain.

Formula
Mathematically,
Strain = Change in Length/Length or Strain = Change in volume / volume

Units
Since strain is a ratio between two similar quantities, it has no unit.

Types of Strain

Following are some types of strain.
1. Tensile Strain: It is a change in length divided by original length.
2. Bulk Strain: It is the change in volume divided by original volume.
3. Shear Strain: It is equal to the angular displacement produced.

Hook's Law

Introduction
An English Physicist and Chemist Robert Hook discovered this law in 1678.

Statement
"Strain produced is proportional to the stress exerted within the elastic limit."

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Elastic Limit
The point at which a material becomes plastic is called elastic limit on yield point.

Yield Point
the yield point is the point at which the material begins to flow. It is also the point between elastic region and plastic region.

Elastic Region
When the material obey's Hook's Law, it is said to be in Elastic Region.

Plastic Region
When stress is applied beyond the elastic limit, the graph is no longer a straight line. In this case stress produces a permanent change in the material. The material is said to be in its Plastic Region.

Breaking Point
The material breaks at a certain point called the Breaking Point of the material.

Young's Modulus

The image that can be seen on a screen is known as a real image.

14. Virtual Image

The image that cannot be seen on a screen is known as a virtual image.

15. Magnification

The ratio between the image height and object height is known as magnification.

or

The ratio between the image distance to the object distance is known as magnification.

Reflection of Light

Definition
"The process in which light striking the surface of another medium bounces back in the same medium is known as Reflection of Light."

Laws of Reflection

1. The angle of reflection, is equal to the angle of incidence: n 2. The incident ray, reflected ray and normal, all lie in the same plane.

Kinds of Reflection

There are two types of Reflection:
1. Regular Reflection

Definition
When parallel rays of light strike a surface and most of them are reflected in a same particular direction or same angle, they are said to be regularly reflected and the phenomenon is known as regular reflection.

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Regular reflection occurs when parallel rays of light strike with an ideal smooth plane surface. In regular reflection parallel rays remain parallel after reflection.
(Diagram)

2. Irregular Reflection

Definition
When some rays of light strikes a surface and the reflected rays scatter in different directions, this type of reflection is called irregular reflection.

It occurs when parallel rays strike with an irregular rough surface. In this case rays does not remain parallel after reflection and they scattered.
(Diagram)

Advantages of Irregular Reflection

- **Due to this reflection, sunlight reaches us before sunrise and persists for some time even after the sunset.**
- **Due to this reflection we get sufficient light in our rooms and other places where sunlight do not reach directly.**

Refraction of Light and Optical Instruments

CHAPTER – 14

Definitions

1. Emergent Ray

The ray after passing the second medium comes again in the first medium. It is called emergent ray.

2. Emergence Angle

The angle formed by the emergent ray and normal is called emergence angle denoted by <e.

3. Optical Center

The middle point of the lens is called optical center. The ray passing through this point does not bend.

4. Accommodation

The ability of the eye to change the focal length of its lens so as to form a clear image of an object on its retina is called is power of accommodation.

5. Persistence of Vision

When an object is seen by an eye, its image forms on retina. If the object is removed, the impression of image persists in the eye for about 1/10 second. This interval is called Persistence of Vision.

6. Power of Lens

The power of the lens is the reciprocal of the focal length measured in meter. Its unit is Dioptre.

Refraction of Light

Definition
"The change in the direction and velocity of light as it enters from one medium to another is known as Refraction of Light."

Laws of Refraction

- **The incident ray, refracted ray and the normal at the point of incidence all lie in the same plane.**

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As we know a prism disperses sunlight into a series of seven colours. When rain falls, raindrops behave like a prism and white light entering the raindrop splits up into seven colours on refraction. These are appeared as Rainbow.

Spectrum

After the dispersion of light or any electromagnetic wave, a band of colours is formed, which is known as a spectrum.

Electromagnetic Spectrum

Electromagnetic spectrum is a result obtained when electromagnetic radiation is resolved into its constituent wavelength.

Waves of Electromagnetic Spectrum

<u>Radio Waves</u>
It has a large range of wavelengths from a few millimeters to several meters.

<u>Microwaves</u>
These radio waves have shorter wavelength between 1mm and 300 mm. Microwaves are used in radars and ovens.

<u>Infrared Waves</u>
It has a long range. Its mean wavelength is 10 micrometers.

<u>Visible Waves</u>
It has a range of 400 nm to 700 nm.

<u>Ultraviolet Waves</u>
Their wavelength ranges from 380nm onwards. These are emitted by hotter start (about 25000 K).

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- Resistance is small or less than all combined resistance.
- Total resistance is given by the formula $1/R(E) = 1/R1 + 1/R2 + 1/R3$

Derivation
(Diagram)
By the help of properties of parallel combination:
$I = I1 + I2 + I3$
According to Ohm's Law, $V = IR$ and $I = V/R$ then we say that:
$V/R(E) = V/R1 + V/R2 + V/R3$
$\Rightarrow V/R(E) = V\,(1/R1 + 1/R2 + 1/R3)$
$1/R(E) = 1/R1 + 1/R2 + 1/R3$

Difference between AC and DC

Alternating Current
1. AC is obtained by a resistor that is connected in series with a source of alternating current.
2. Its direction continuously changes.
3. It is obtained by a generator.
4. Its transportation from one point to another point is very easy.
5. It has a frequency about 40 Hz to 60 Hz.
6. No voltage drop takes place in the time of transportation.
7. It is not too dangerous.
8. It is cheaper than DC.
9. It changes very high to low or vice versa.
10. It changes its direction continuously as +y and -y.

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Direct Current
1. DC is obtained by connecting the two ends of a conductor to the terminals of a batter.
2. Its direction remains unchanged.
3. It is obtained by a chemical reaction.
4. Its transportation is very difficult.
5. It has no frequency.
6. Great voltage drop takes place in the time of transportation.
7. It is too dangerous.
8. It is expensive.
9. It cannot change easily.
10. It has no direction.

Joule's Law

<u>Statement</u>
The heat produced by an electric current I, passing through a conductor of resistance R for time t is equal to I2RT. (2 represents power).
The heat produced per unit time in a given conductor is proportional to the square of the current.

<u>Derivation</u>
According to this law:

W < I2t (Here 2 represents the square of current) => W = I2Rt(Here 2 represents the square of current)

Power

The rate of doing work is called Power.

Mathematical Form

P= W/T
=> P = I2Rt/t
=> P = I2R
Substituting the value of I from Ohm's law in the above equation:
=> P = {V2/R2} R
=> P = V2/R
=> P = V2/V/I
=> P= VI

Difference between Resistance and Conductance

Resistance
1. Resistance is the measure of opposition by the conductor to the flow of charge.
2. It is the reciprocal of the conductance and is measured in volt per ampere or ohm.

Conductance
1. Conductance of a wire is the ease with which current flows in it.
2. It is the ratio of current and potential difference. Its unit is ampere per volt or seimens.

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1.Hammering

Magnets can be partially demagnetized by hammering them when they are pointing in the east or west direction.

2. Heating

Magnets loose their magnetism when they are heated strongly.

3. Electrical Method

The most efficient method of demagnetizing a magnet is to use n alternating current. Take a solenoid and place it in the east west direction. Pass an alternating current (about 12 V) through it. Now, put the magnet in the solenoid from one end and pull it out from the other. While the current is still flowing. The magnet will loose its magnetism.
Alternating current reverses its direction at a rate of 100 times per second and hence causes the magnetism of the material to reverse the polarity at the same rate. Due to this rapid reverse in the polarity, the magnet looses its magnetism.

Magnetic Effect of Current

When an electric current passes through a straight wire a magnetic field is created which consists of field lines in concentric in concentric circles with the wire at their center.

Right Hand Rule

The direction of the magnetic field can be determined by the following rule:
"Imagine the wire to be grasped in the right hand with the thumb pointing along the wire. The direction of the fingers will give me direction of the magnetic lines of force."

Solenoid

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A coil of insulated copper wire in the form of a long cylinder is called a solenoid.

Magnetic Field of a Solenoid

When an electric current is passed through a solenoid a magnetic field is produced which is very similar to that of a bar magnet. One end of the solenoid acts as the north pole and the other as the south pole. The magnetic field inside a solenoid is very strong because the lines of force are parallel and close to one another. The magnetic field outside the solenoid is very weak.

Electromagnet

If soft iron is inserted in the core of a solenoid, the magnetic field due to the current in the solenoid is multiplied by thousands. When the current is switched off, the magnetic field disappears. Such a magnet which can be energized by an electric current is called an electromagnet.

Applications of Electromagnets

Industry

They are used to transport heavy pieces of iron and steel safely from one place to another. With the help of electromagnets, iron from mixture is separated.
They are used to produce strong magnetic fields for high power motors and generators.

1. Electric Bell

Construction

An electric bell consists of an electromagnet. One end of the winding is connected to a terminal (T1). The other end is connected to a spring, which is mounted on a soft iron strip called “Armature.” A rod is attached to the armature with its free end having a small hammer that can strike against the bell. a very light spring is attached to a contract adjusting screw which is joined to the second terminal (T2) by a wire. The electric circuit is completed by connecting the terminals to a batter and a switch.
(Diagram)

Working

When the push button switch is pressed, the circuit gets closed and the armature is attracted towards the electromagnet. The spring also gets detatched from the screw. This results in opening the circuit and the electromagnet gets demagnetized. The attraction disappears bringing back the spring to its original position. As soon as the spring touches the screw, the circuit gets closed and the magnet starts to work. It again attracts the armature and this process is repeated as long as the switch is turned on. As a result, the armature vibrates and hammer attached to it strikes the gong. Hence, the bell rings.

2. Telephone Receiver

Introduction

A telephone receiver is a device that converts electrical energy into sound energy.

Construction

The ear piece consists of a permanent magnet in contrast with two electromagnets. A diaphragm of magnetic alloy is positioned in front of the electromagnets.

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Working

When the message is transmitted from the other apparatus, sound energy is converted into electric current and is transported to the ear piece through the line. This electric current varies in magnitude depending upon the frequency of the sound waves. In the telephone receiver, the current passes through the electromagnet and energizes the magnet. In this way, the magnetic field strength varies as the current changes. The magnetic force that pulls the diaphragm also varies accordingly. The diaphragm therefore vibrates and gives rise to sound of the same frequency as spoken at the other end.

Fleming’s Left Hand Rule

“Place the fore finger and the second finger of the left hand at right angles. Then, if the fore finger points in the direction of the magnetic field and the second finger in the direction of the current, then the thumb will point in the direction of the motion.”

Galvanometer

Introduction

A galvanometer is a sensitive and delicate device used to measure the magnitude and direction of small currents.

Principle of Galvanometer

The principle of Galvanometer is based on the interaction of the magnetic field produced by a current forcing in a conductor and the magnetic field of permanent magnet. In this instrument, electrical energy is converted into mechanical energy.

Construction

A rectangular coil of wire is wound on a light frame with a pointer attached on the top. The coil frame is

Nuclear Physics

CHAPTER – 19

Nuclear Physics

It is the branch of Physics that deals with the structure, properties and reaction of particles found in the nuclei of atoms.

Radioactivity

The phenomenon of emission of radiation from Uranium and other substances is known as radioactivity. The substances that emit radiation are known as radioactive elements.

Experiment

A small quantity of a radioactive element such as radium is placed in a cavity of a lead block in such a way that the radiation from radium can only come out through this cavity. A photographic plate is placed at some distance above the lead block so that the radiation from radium falls upon it. The apparatus is placed in a vacuum light chamber which is evacuated by a powerful pump. This chamber is then placed between the poles of a powerful magnetic field. Under the action of magnetic field, two or three types of radiation are deflected forming three separate images on the photographic plate.

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Properties of Alpha Particles

- **Alpha particles are Helium nuclei.**
- **The charge on alpha particles is positive.**
- **The velocity of alpha particles is 1/100th of the velocity of light.**
- **Ionization power is greates.**
- **Penetration power is the least.**
- **It effects the photographic plate.**
- **It produces florescence with zinc sulphide solution.**

Properties of Beta Particles

- **Beta particles are fast moving electrons.**
- **The charge on beta particles is negative.**
- **Its velocity is slightly less than the velocity of light.**
- **Ionization power is less than alpha particles.**
- **Its penetration power is greater than alpha particles.**
- **It effects the photographic plate.**
- **It produces florescence with barium platino cyanide solution.**

Properties of Gamma Rays

- **Gamma rays are electromagnetic in nature.**
- **They are neutral rays.**
- **Its velocity is equal to the velocity of light.**
- **Ionization power is least.**
- **Its penetration power is the greatest.**
- **It effects the photographic plate.**