ACTIVITY 1

AIM

To identify a diode, an LED, a transistor, an IC, a resistor and a capacitor from a mixed collection of such items.

APPARATUS AND MATERIAL

Apparatus. Multimeter.

Material. Above mixed collection of items.

THEORY

For identification, appearance and working of each item will have to be considered.

1. A **diode** is a two terminal device. It conducts when forward biased and does not conduct when reverse biased. It does not emit light while conducting. Hence, it does not glow.
2. A **LED (light emitting diode)** is also a two terminal device. It also conducts when forward biased and does not conduct when reverse biased. It emits light while conducting. Hence, it glow.
3. A **transistor** is a three terminal device. The terminals represent emitter (E), base (B) and collector (C).
4. An **IC (integrated circuit)** is a multi-terminal device in form of a **chip.** [See figure (UM 3482 IC Tone Generator)]
5. A **resistor** is a two terminal device. It conducts when either forward biased or reverse biased. (Infact there is no forward or reverse bias for a resistor). It conducts even when operated with A.C. voltage.
6. A **capacitor** is also a two terminal device. It does not conduct when either forward biased or reverse biased. When a capacitor is connected to a D.C. source, then multi-meter shows full scale current initially but it decay to zero quickly. It is because that initially a capacitor draw a charge.

The components to be identified are shown in figure.

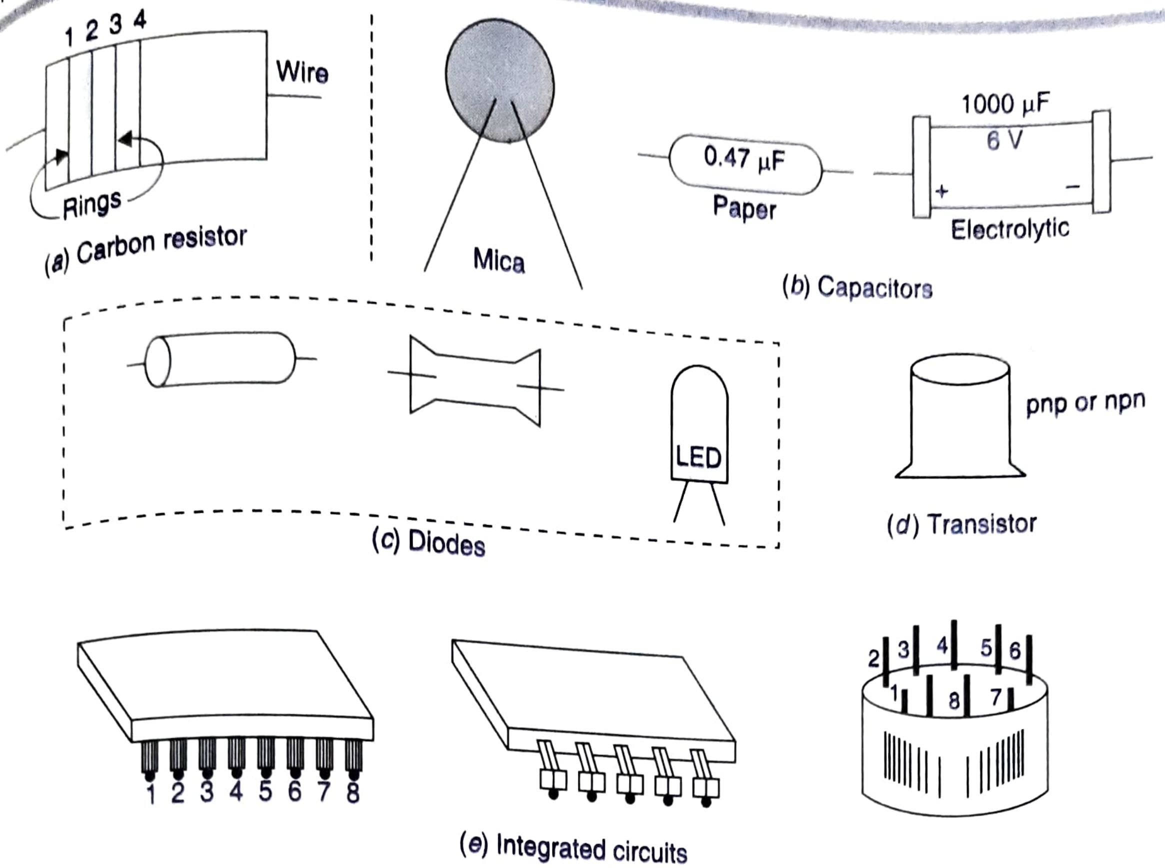


Fig. Some of the commonly available integrated circuits (ICS).

PROCEDURE

1. If the item has four or more terminals and has form of a chip, it is an IC (integrated circuit).
2. If the item has three terminals, it is a transistor.
3. If the item has two terminals, it may be diode, a LED, a resistor or a capacitor.

To differentiate proceed as ahead.

4. Put the selector on resistance R of multimeter for checking the continuity. The probe metal ends are inserted in terminal marked on the multimeter as common and P (or + ve).

If such that the black one is in common and red probe is in P (or + ve). On touching the two ends of the device to the two other metal ends of probes.

1. If pointer moves when voltage is applied in one way and does not move when reversed and there is no light emission, the item is a **diode.**
2. If pointer moves when voltage is applied in one way and does not move when reversed and there is light emission, the item is a **LED.**
3. If pointer moves when voltage is applied in one way and also when reversed, the item is a **resistor.**
4. If pointer does not move when voltage is applied in one way and also when reversed, the item is a **capacitor.**

OBSERVATIONS

No. of Obs.	*Number of legs*	*Name of device*	*No. of Obs.*	*Possible current flow*	*Name of device*
1.	More than 3	IC	4.	Unidirectional emit no light	Diode
2.	Three	Transistor	5.	Unidirectional emit light	LED
3.	Two	Capacitor, Diode, LED or resistor	6.	Both direction (steady)	Resistor
			7.	Initial high but decays to zero	Capacitor

ACTIVITY 6

AIM

To observe diffraction of light due to a thin slit.

APPARATUS

Two razor blades, adhesive tapes, a screen a source of monochromatic light (laser pencil) black paper and a glass plate.

THEORY

Diffraction is a phenomenon of bending of light around the corners or edges of a fine opening or aperture. Diffraction takes place when order of wavelength is comparable or small to the size of slit or aperture. The diffraction effect is more pronounced if the size of the aperture or the obstacle is of the order of wavelength of the waves. The diffraction pattern arises due to interference of light waves from different symmetrical point of the same wavefront. The diffraction pattern due to a single slit consists of a central bright band having alternate dark and weak bright bands of decreasing intensity on both sides.

For diffraction, $d \sin \theta = n\lambda$

Here d = size of aperture or slit

θ = angle of diffraction

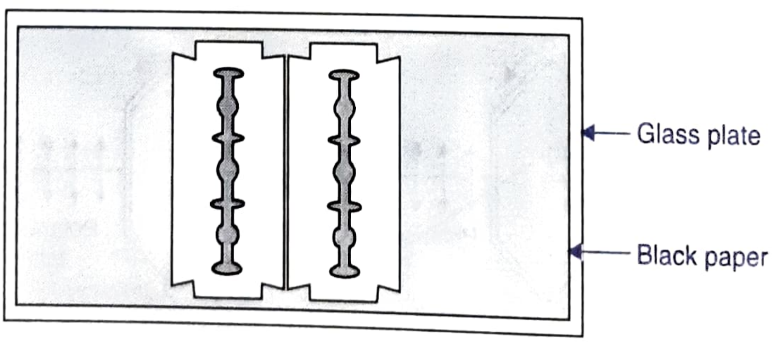
n = order of diffraction

λ = wavelength of light.

PROCEDURE

1. Fix the black paper on the glass plate by using adhesive.

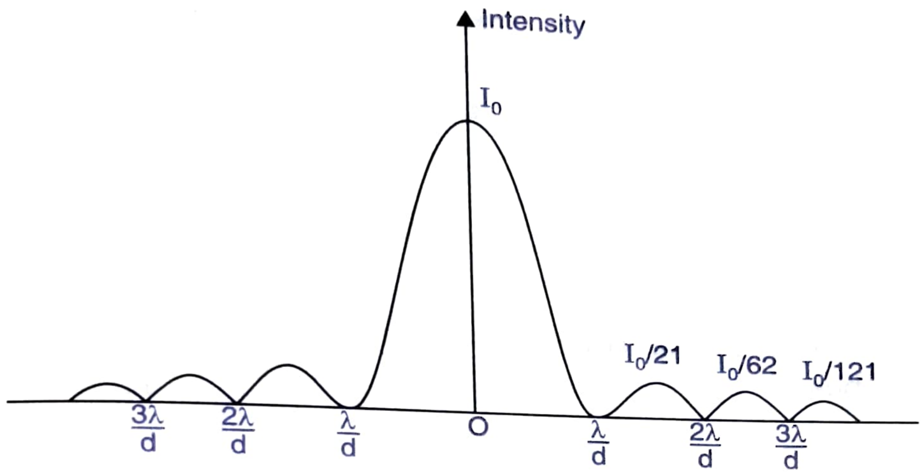
2. Place two razor blades so that their sharp edges are parallel and extremely close to each other to form a narrow slit in between.



A thin slit made by using two razor blades, black paper and a glass plate.

3. Cut the small slit in between the sharp edges of blades and place at a suitable distance from a wall or screen of a dark room.

4. Throw a beam of light on the slit by the laser pencil.
5. A diffraction pattern of alternate bright and dark bands is seen on the wall.



CONCLUSION

When light waves are incident on a slit or aperture then it bends away (spread) at the corners of slit showing the phenomena of diffraction of light.

PRECAUTION

(*i*) Air gaps should not be left between glass plates and black paper.
(*ii*) The razor blades should be placed extremely closed as possible.
(*iii*) Diffraction pattern should be seen on a wall of a dark room.
(*iv*) A point source of monochromatic light like laser torch should be used.

ACTIVITY 8

AIM

To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.

APPARATUS AND MATERIAL

Apparatus. No particular apparatus is needed.

Material. A set of thin convex lenses, one of these is of given focal length (say 15 cm), (we have to select a second lens such that the combination gives a single lens of focal length f_c = 10 cm), lens holder with stand, a white painted vertical wooden board with broad stand, half metre scale.

THEORY

1. The reciprocal of focal length in metre is called power of lens in dioptre (D).

$$P = \frac{1}{f}$$

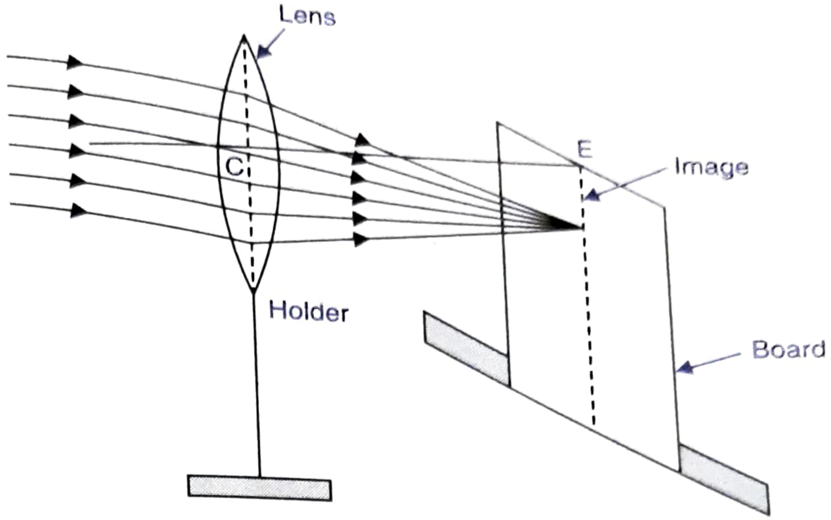
2. With a convex lens, the real image of a distant object is formed at a distance equal to its focal length.
3. If f_1 and f_2 be the focal lengths of the two lenses and F be the focal length of the combination.

Then, $$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

For lenses of power P_1 and P_2 and combination of power P.

Then, $$P = P_1 + P_2$$

DIAGRAM



Measurement of focal length of convex lenses.

PROCEDURE

1. Keep the white painted vertical wooden board to serve as a screen.
2. The convex lens (known focal length $f_1 = 15$ cm), fixed into a holder stand is put on the left of the screen. There are sunlight illuminated green trees at large distance on the left of the lens.
3. The lens is moved towards and away from the screen till a sharp, inverted image of trees is formed on the screen.
4. Distance between central lines of the screen and holder stand is measured by a half metre scale.
5. The distance gives the focal length of the convex lens about 15 cm.
6. Replace first lens by second convex lens of required power and repeat the steps from 2 to 5. This gives the focal length of second convex lens.
7. Now bring both lenses in contact and repeat the steps from 2 to 5. This gives the combined focal length.
8. Determine the focal length with other given lens.

Determine the focal length of about **six** of the convex lenses.

CALCULATIONS

Let $F = 10$ cm, so that $P = 10$ D $\quad \left(\because \; P(\text{D}) = \dfrac{100}{F\,(\text{cm})}\right)$

Following combinations will be suitable.

Power		*Focal length*	
$P_1(D)$	$P_2(D)$	f_1 (cm)	f_2 (cm)
2	8	50	12.5
4	6	25	16.7
5	5	20	20

(**Note.** The ideal values are as sample.)

VERIFICATION

The above combinations may be tried and result **verified.**

PRECAUTIONS

1. **Thin** lenses should be taken.
2. Lenses should have **same** aperture.

SOURCES OF ERROR

1. Lenses may not be **thin.**
2. Lens apertures may not be **same.**