SHORT QUESTIONS

Q 10.1 : **Linear magnification** is the ratio of the size of the image to the size of the object. **Angular magnification** is the ratio of the angle subtended by the image as seen through the optical device to that subtended by the object at the unaided eye placed at least distance of distinct vision.

A **convex lens** of shorter focal length can be used as a magnifier when the object is placed very close to it i.e; when it lies between the lens and its focus. The image then formed is virtual, erect and magnified.

Q 10.2 : Angular magnification or magnifying power of an optical instrument means how large or magnified is the image formed by the instrument. But the magnification alone is of no use unless we can see the details of the object distinctly. The resolving power of an instrument is its ability to reveal the minor details of an object under examination.

The magnification of the optical instrument is **limited** due to defects of the lenses such as chromatic and spherical aberrations. The image does not remain well defined and details of the object are not seen distinctly.

Q 10.3 : If blue light is used to see the object in the compound microscope, it increases its resolving power and more detail of the object can be studied

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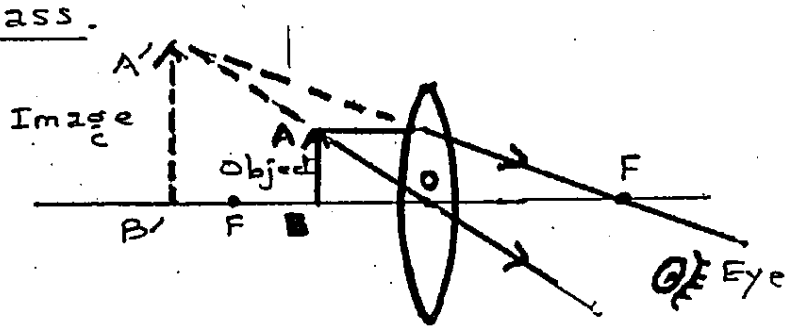
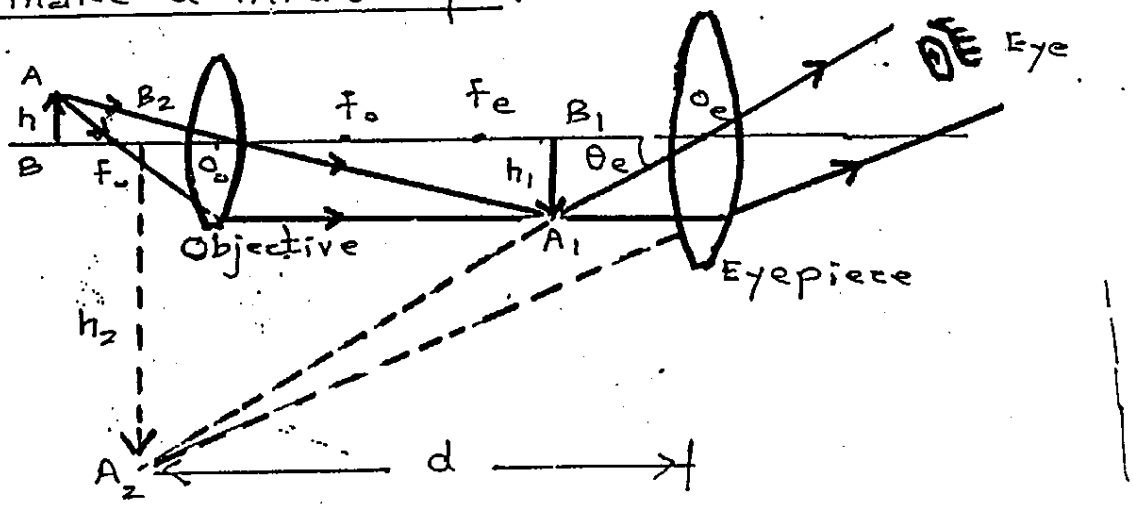
Q 10.4 : The image seen in the cheap microscope have coloured edges due to defect of lenses known as chromatic aberration. This is because of the prism like formation of the lens, which causes dispersion of the white light and makes the image coloured.

Q 10.5 :

(a) Ray diagram of a biconvex lens used as a magnifying glass.



(b) Ray diagram of two biconvex lenses arranged to make a microscope.

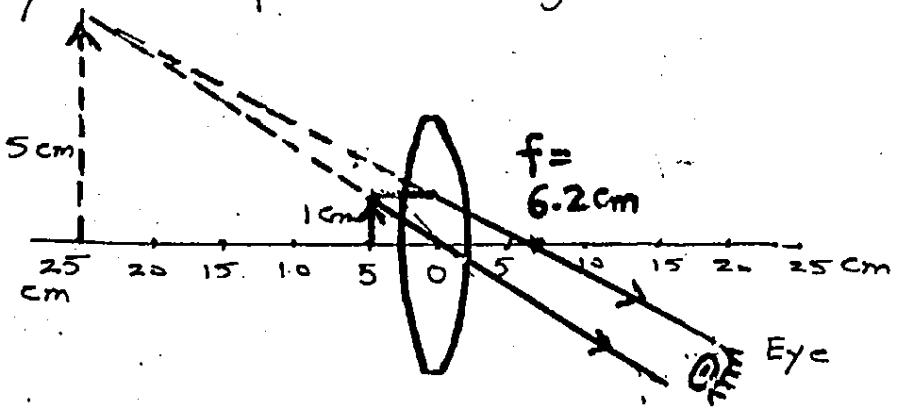


Q 10.6 : Still he will see the full image of the moon but its brightness is reduced as less light is transmitted by the half covered objective lens.

Q 10.7 :

Ray diagram;

f = 6.2cm



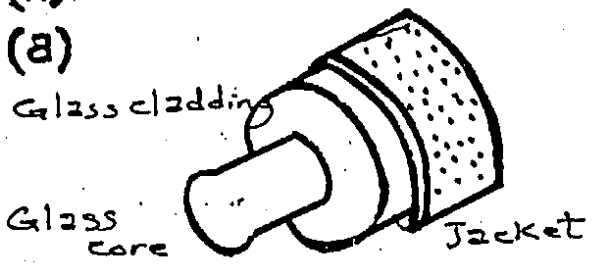
Q 10.8 :(i) The resolving power of compound microscope, lens of diameter 'D' is given by;

$$\alpha_{min} = 1.22 \times \frac{\lambda}{D}$$

Hence, the correct answer is statement 'b'.

(ii) The correct answer is statement 'd'.

Q 10.9 :(a)



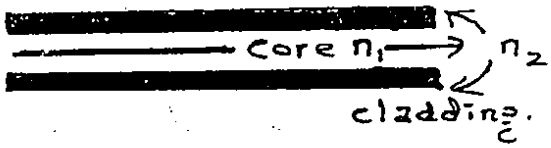


fig (a) Light path through a single mode fibre

It has a very thin core of about 5 μm diameter and has a relatively larger cladding (of glass or plastic). Since it has a very thin core, a strong monochromatic light source i.e; Laser source has to be used to send light signals through it. Transmission is free from dispersion defects and can carry more than 14 TV channels or 14000 phone calls simultaneously.

(b)

fig (b) Light propagation through Multi-mode step-index fibre.

Q 10.10. An optical fibre communication system consists of three major components :-

1. a transmitter that converts electrical signals into light signals.
2. an optical fibre for guiding the signals by total internal reflection and continuous refraction.
3. a receiver at the other end, which converts light signals to electrical signal.

To convert audio or video information by light signals, the waves are modulated. The most common method is

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digital modulation in which a laser is flased on and off at an extremely fast rate. A pulse of light represents number 1 and the absence of light represent 0. Any information can be represented by a particular pattern or code of these 1s and 0s and at the receiving end these are decoded to reconstruct the original information.

Q 10.11: If the source of light signals is not monochromatic, then the light will disperse while propagating through the core of the optical fibre into different wavelengths λ_1, λ_2 and λ_3 etc as shown in fig.

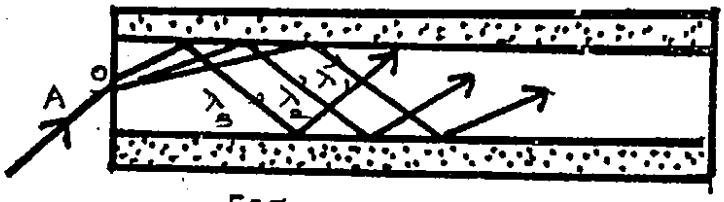

fig.

As shown, λ_1 meets the core and cladding at the critical angle and λ_2 and λ_3 are at slightly greater angles. The light paths have thus different lengths. So, the light of different wavelengths reaches the other end of the fibre at different times and the signal received is distorted.

NUMERICAL PROBLEMS.

P. 10.1:

DATA. Focal length = $f = 5$ cm

Distance of the image from the lens = $q = -25$ cm

(a) Distance of the object from the lens = $p = ?$

(b) Angular magnification = $M = ?$

(c) Angular magnification = $M = ?$ (When image is at infinity)

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