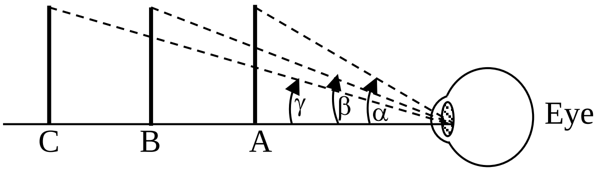
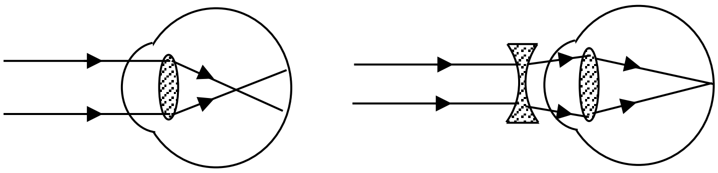
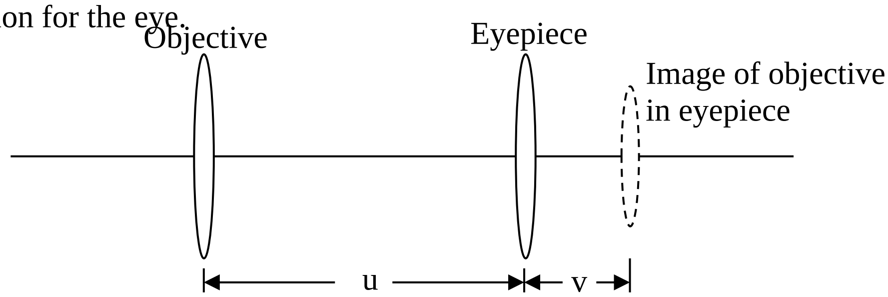
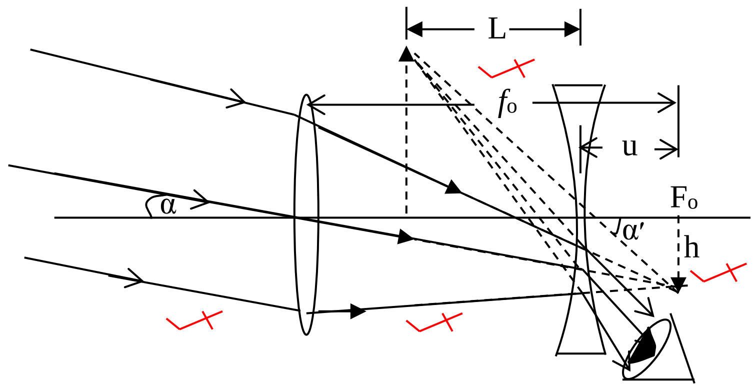
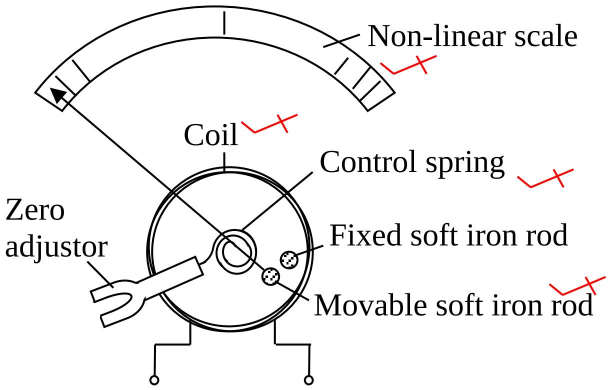
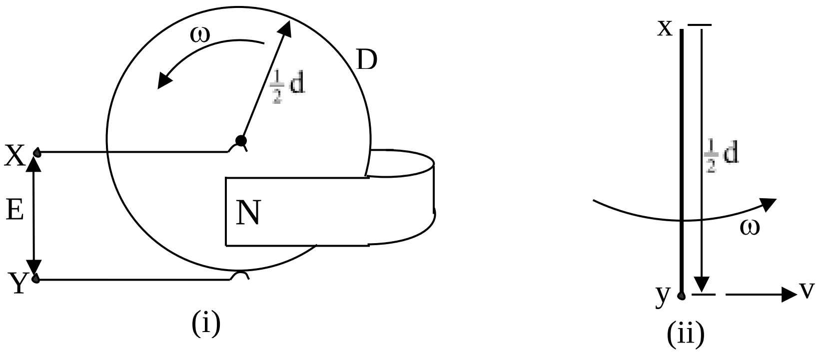
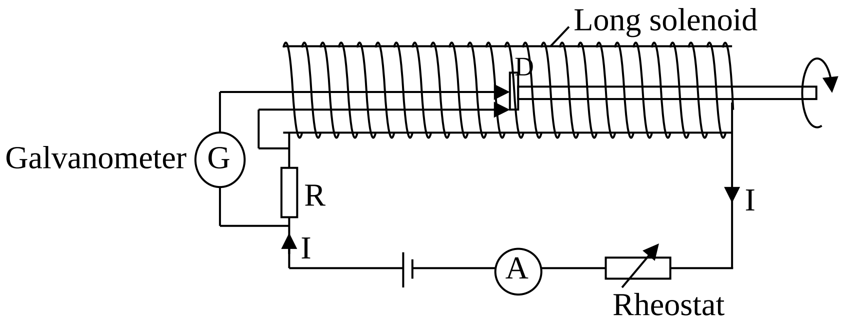
Qn	Answer	Marks
1 (a)	(i)  Take the example of poles A, B and C of equal height. They respectively subtend angles α, β and γ at the eye. The apparent size of an object depends on the visual angle it subtends at the eye. The smaller this angle is, the smaller the apparent size of the object. Now, C, which is furthest, looks smallest because its visual angle is the smallest.	1 ½ ½
	(ii) Correction of shortsightedness  (i) Defect (ii) Correction The eye ball is too long, i.e. the distance between the lens and the retina is too long. The eye can accommodate for near objects but not for very distant ones. Rays from a very distant object meet before the retina. A diverging lens is used to correct this defect as shown in figure (ii). The rays are now enabled to converge at the retina.	1 ½ ½ ½ ½
(b)	(i) This is the best position for the eye to view the image produced by the instrument.	1
	(ii) The eye-ring is the circular image of the objective in the eyepiece. At this position all rays entering the objective are received and it is therefore the best position for the eye.  Using $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, we have $\frac{1}{v}+\frac{1}{(f_o+f_e)}=\frac{1}{f_e}$	½ 1

	$\therefore \quad v = \frac{f_e}{f_o}(f_o + f_e)$ Now, $\frac{\text{Objective diameter}}{\text{Eye} - \text{ring diameter}} = \frac{u}{v} = \frac{f_o + f_e}{(f_e/f_o)(f_o + f_e)} = \frac{f_o}{f_e}$ which is the same as the angular magnification, M Thus M = $\frac{\text{Objective diameter}}{\text{Eye-ring diameter}}$	½ 1 1
(c)	(i)  	½ ½ 1
	(ii) Let f_o = focal length of the objective lens f_e = focal length of the eyepiece lens h = height of the intermediate image Then α = h/f_o and h/u Using 1/v + 1/u = 1/f we have - $1/f_e$ = 1/-L + 1/-u (eyepieces is diverging) Therefore $u = \frac{f_e L}{L - f_e}$ Now magnification, $M = \frac{\alpha'}{\alpha} = \frac{h/u}{h/f_o} = \frac{f_o}{u}$ Therefore $M = \frac{f_o}{f_e}\frac{(L - f_e)}{L} = \frac{\mathbf{f_o}}{\mathbf{f_e}}\left(\mathbf{1} - \frac{\mathbf{f_e}}{\mathbf{L}}\right)$	1 1 1
	(iii) – It is shorter - The images are brighter	1 1
(d)	In normal adjustment $f_o + f_e$ = distance between the two lenses $\therefore\ f_o + 3 = 51$ $\therefore\ f_o = 51 - 3 = 48$ cm	1 1

	Now angular magnification = $\frac{f_o}{f_e} = \frac{48}{3}$ = **16**	1
	Total = 20	
2(a)	(i) The r.m.s value of an alternating current is that value of steady current which would dissipate heat at the same rate in a given resistor as the alternating current.	1
	(ii) This is the maximum value of current in a cycle of alternating current.	1
(b)	(i) Let $I_{d.c}$ be the steady current equivalent to the alternating current, i.e. $I_{r.m.s}$ Then $I_{d.c}^2 R$ = (Mean value of I^2) x R $\therefore$ $I_{d.c} = I_{r.m.s} = \sqrt{\text{mean value of } I^2}$ If the alternating current is sinusoidal, then $I = I_o \sin \omega t$ and $I_{r.m.s} = \sqrt{\text{mean value of } I_o^2 \sin^2 \omega t}$ $= I_o\sqrt{\text{mean value of } \sin^2 \omega t}$ Now, over a full cycle, the mean value of $\sin^2 \omega t$ = ½ $\therefore$ $I_{r.m.s} = I_o\sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}} I_o = 0.707\ I_o$	1 1 1 1
(c)	 - The current to be measured flows round the coil and magnetises the two soft iron rods with like poles side by side. - Since like poles repel, the soft iron rods repel each other with the result that the movable one moves away thereby turning the pointer fixed to it. - The pointer turns until the counter torque developed in the control spring is enough to stop it. - The repulsion force, and therefore the angle turned through by the pointer, depends on the current flowing in the coil (but not linearly).	½ ½ ½ ½ 1 1 ½ ½
(d)		

	 Imagine the disc the disc to be made up of spokes parked together and each sweeping across the magnetic field – see fig. (ii). x and y are the tapping points. Taking one such spoke, Let v = velocity of the tapping point y ω = angular frequency of rotation Now, E = B*l*V, where V is the average velocity of the spoke, and $\overline{XY} = \frac{1}{2}d$ $\therefore \quad E = \frac{1}{2}Bl(v + 0)$ $= \frac{1}{2}B.\frac{1}{2}d.\frac{1}{2}d\omega$ $= \frac{1}{8}\omega Bd^2$ $= \mathbf{\frac{1}{4}\pi f B d^2}$	½ 1 ½ 1 1
(d)	 The resistance, R, to be measured is connected in series with a long solenoid. A metal disc D, placed coaxially with the solenoid is rotated at the centre of the solenoid. The emf, E, induced between the centre and the rim of D is connected across R and the frequency, f, of rotation of D is varied until the galvanometer G reads zero. Then, IR = E, where I is the current flowing in the solenoid. But, E = $\pi f r^2 B$, where r is the radius of D	1 ½ 1 1 ½ ½ ½

	∴ $IR = \pi\mu nIfr^2$, where n = number of turns per metre of the solenoid ∴ $R = \pi\mu nfr^2$	
Total = 20		