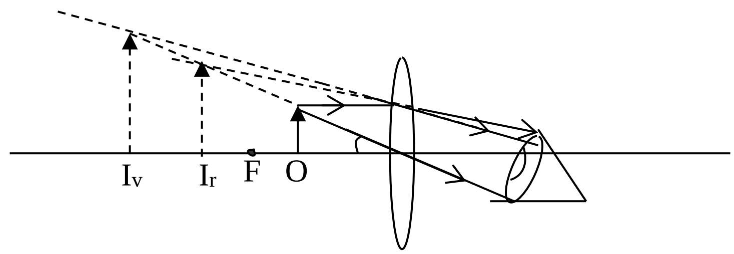
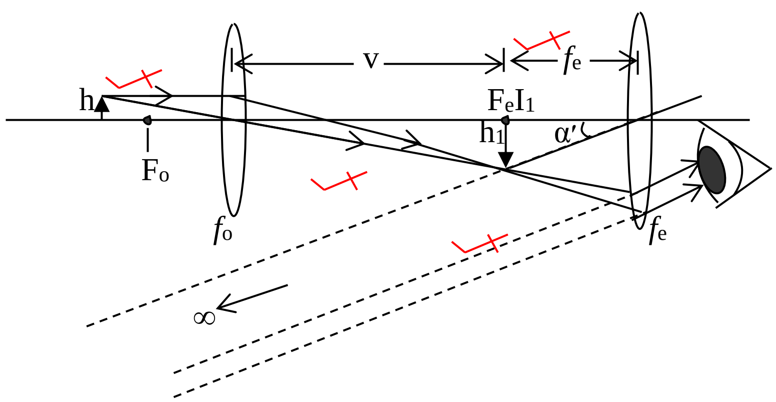
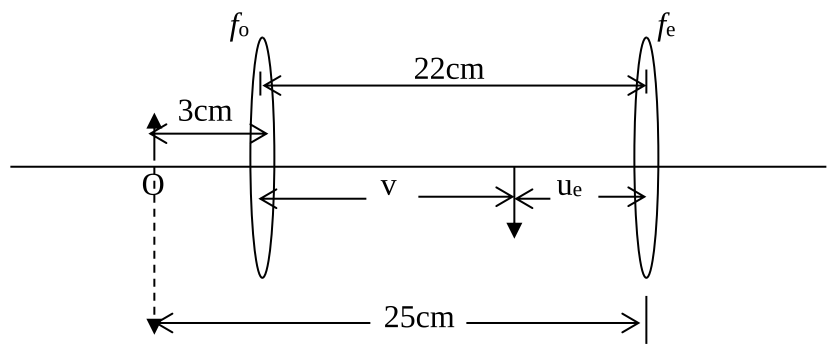
Qn	Answer	Marks
1 (a)	(i) - Spherical aberration is minimised by shielding off the marginal rays. - Chromatic aberration is minimised by combining two lenses of different materials in contact, one converging and the other diverging, such that the ratio of their focal lengths is numerically equal to the ratio of the corresponding dispersive powers.	1 1
	(ii) 	1
	The object gives rise to various coloured images according to the colours of the spectrum $I_v, \ldots . I_r$. However, since the eye is close to the lens the various coloured images subtend the same angle at the eye. So the images practically overlap.	½ ½
(b)	(i) 1. Minimal chromatic aberration 2. Image is brighter than for refractor type 3. Only one surface of the objective has to be ground 4. Greater resolving power	½ ½ ½ ½
	(ii) Resolving power can be increased by using a larger diameter of the objective.	1
(c)	(i) 	½ ½ ½ ½
	- The object is positioned a little further from the objective lens than the principal focus.	1

	- This gives rise to a real inverted image, which must be arranged to lie in the focal plane of the eyepiece. - So the arrangement allows the eyepiece to form the final image at infinity.	½ ½
	(ii) Let the size of the object be h Then the angle subtended by the object at the unaided eye is $\alpha = h/D$, If h_1 is the size of the intermediate imge, from the diagram, the angle subtended by the final image will be equal to $\alpha^1 = h_1/f_e$ The magnifying power, $M = \frac{\alpha^1}{\alpha} = \frac{h_1/f_e}{h/D} = \frac{h_1}{h}.\frac{D}{f_e}$ But $\frac{h_1}{h} = \frac{v}{f_o} - 1$ $\therefore \quad \mathbf{M} = \left(\frac{\mathbf{v}}{\mathbf{f_o}} - \mathbf{1}\right)\frac{\mathbf{D}}{\mathbf{f_e}}$	½ ½ 1 1
	(iii)  Angular magnification, $M = \frac{h_2}{h_1}.\frac{h_1}{h} = {}^{-}15$ But $\frac{h_2}{h_1} = \frac{{}^{-}25}{f_e}$ and $\frac{h_1}{h} = \frac{v}{3}$. Also $u_e = 22 - v$ $\therefore \quad \frac{{}^{-}25}{22 - v}.\frac{v}{3} = {}^{-}15$ $\therefore \quad 25v = 990 - 45v \qquad \therefore v = 14.1$ cm Using $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ for the objective lens. we have $\frac{1}{14.1} + \frac{1}{3} = \frac{1}{f_o}$ $\therefore \quad f_o = \frac{3 \text{ x } 14.1}{3 + 14.1} = \underline{\mathbf{2.47\ cm}}$	1 1 1 1 1

	And for the eyepiece $\frac{1}{^-25} + \frac{1}{7.9} = \frac{1}{f_e}$ $\therefore f_e = \frac{^-25 \times 7.9}{^-25 + 7.9} = \mathbf{11.55\ cm}$	1
	Total = 20	
2 (a)	(i) – Some power is lost in the ohmic resistance of the coil as the generator drives current in a load. - Some power is spent in running the coil against mechanical friction - Some eddy current may circulate in the core of the coil so that energy is spent in overcoming the opposing effect brought about by this current.	1 1 Any 2
	(ii) The ohmic loss is minimised by using copper for the coil. Loss against friction is minimised by using bearings and suitable lubrication. Loss due to eddy currents is minimised by laminating the core. Loss due to insufficient concentration of the magnetic field in the space bound by the coil is minimised by use of soft iron for the core	1 1 1 1
(b)	(i) $X_c = \frac{1}{2\pi fC}$ and $X_L = 2\pi fL$	2
	(ii) According to the expressions in (i), the capacitive reactance is inversely proportional to the frequency of the supply. On the other hand, the inductive reactance is directly proportional to the frequency of the supply. So at higher frequencies a greater a.c. current flows through the capacitor branch and lower current through the inductor branch. This means the p.d across the resistor in the capacitor branch will rise as that across the resistor in the inductor branch falls when the frequency is increased.	1 1 1 1
(c)	(i) $X_L = 2\pi fL = 2\pi \times 60 \times \frac{1}{\pi} = 120\ \Omega$ Impedence, $Z = \sqrt{R^2 + X^2_L}$ $= \sqrt{160^2 + 120^2} = \mathbf{200\ \Omega}$	1 1 1
	(ii) $I = \frac{V}{Z} = \frac{40}{200} = \mathbf{0.2\ A}$	2
	(iii) On average, power is consumed only in the pure resistance Thus, power $= I^2R = 0.2^2 \times 160$ $= \mathbf{6.4\ W}$	1 1 1
	Total = 20	