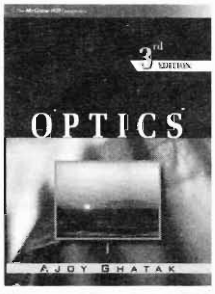
And God said, "Let there be light"

G S Ranganath



Optics
Ajoy Ghatak
3rd Edition, ISBN:0-07-058583-0
Tata McGraw-Hill, New Delhi
Price:Rs.260/-., pp.484

In a country where a majority of working scientists are trapped in the vortex of publications and conferences, an exercise of writing a book is to be highly encouraged and appreciated. Quality of our science education will not improve unless and until the scientists come out to teach and share the thrill of science by giving courses and talks, but not in their own speciality. It is not difficult to see that our text books will not improve till active scientists indulge in writing them. That Ghatak found time and energy to put together, in this book, his rich experience in research and teaching is highly commendable. Out of his labour has emerged a very useful, interesting and informative book on Optics, that will effectively meet the requirements of a devoted student. The fact that this book has run into the third edition speaks highly of it.

The subject has been spread over twenty five chapters that have been organized into eight broad themes. Every chapter ends with a list of useful references. Pedagogical presentations of certain topics is also an additional feature of this book. This is perhaps one of the very few books that has a blend of what is essential, what is interesting and what is new. Most of the books on optics confine themselves to phenomena seen in the visible part of the spectrum. The author does not suffer from such a myopic view. The book has a broad-based presentation of optics that will prepare a student better, for further studies in optics. I would like to substantiate my statements with facts from the book.

The book starts with a chapter on 'What is Light?'. It is a highly illuminating and educative presentation of the subject. The picture depicting the build-up of Young's double-slit interference pattern for electrons is very instructive. The chapter on Fermat's principle and its applications discusses the optics associated with well-known phenomena like the mirage, looming and propagation through graded index media. Interestingly this chapter also dwells upon reflections (of radio waves) from the ionosphere. The chapter on Matrix Methods in Paraxial Optics deals with many important optical situations involving thick and thin lenses. The student will be surprised to see for himself/herself the power of this method. Both these chapters are well written and are welcome additions to standard presentations of Geometrical Optics. Devoting a chapter to Group Velocity and Pulse Dispersion in the part on Vibrations and Waves exposes the student to science of

waves in all its beauty. It is educative to look at the variation of group velocity in pure silica in which one finds a maximum in group velocity at a particular wavelength. Propagation of a Gaussian packet in dispersive medium, the phenomena of Chirping and Self Phase Modulation are the highlights of this chapter. Generation of the entire visible spectrum by passing a pulse through a fiber of small cross-section is a very interesting possibility. A photo depicting this process is a distinguishing feature of this chapter. The chapter on Lasers presents the essential and interesting aspects of the subject. It discusses some relevant technical points concerning lasers. Though the last chapter has been entitled 'Some Contemporary Topics' it is mostly about Fiber Optics. Even here a student will find many useful facts and figures. In the coverage of conventional optics also, the book is very useful. The author has taken care to develop the subject in its historical context. He has included not only important and useful experimental data but has also discussed some novel situations like Fiber Bragg Gratings.

I was somewhat disappointed with the author's handling of certain topics. I will select a few of them here. The chapter on 'Aberrations' is technically sound but hardly goes beyond what we find in any standard book. It is generally not appreciated by students that we experience many beautiful illusions since our eyes suffer from chromatic aberration. The human eye has been so designed as to minimize pincushion and barrel distortions. In a similar way the retina or the back of a camera or a TV screen is curved to accommodate curvature of the field. A chapter has been devoted to Polarization Optics. A brief presentation on the Poincare Sphere would have exposed the students to one of the very useful and powerful techniques in this area. A detailed discussion on the Fourier Transforming properties of thin lenses has been presented. But one very important message has not come through effectively. Since any given lens (free from all aberrations) has still a finite aperture many high frequency spatial Fourier components cannot enter the lens and thus will not contribute to image formation. This leads to an image that will not be faithful to the object. This imposes a limit on the image resolution of the lens. This message is important since many students think that an aberration free lens should result in the image being faithful to the object. This is the essence of the Abbe's theory of image formation. I feel that such messages will greatly inspire students.

In summary I would state that the book is very useful to students. It will help a student master many of the sills required by an undergraduate and expose him or her to important and useful knowledge.

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