

# Textbook of Radiology

for Residents and Technicians

provides an in-depth knowledge of latest imaging technology like interventional radiology, PAC system, elastography, radiofrequency ablation, tomosynthesis, fusion imaging, besides giving basic principles and clinical applications of CT, MRI, ultrasound, colour Doppler and digital radiography, basic anatomy, physiology, and radiological physics. It attempts to serve as an essential guide for radiological procedures, darkroom procedures and positioning, basic and surface anatomy, and radiological protection. It also provides detailed knowledge on nuclear medicine in its simplest and practical form to the residents, radiographers and radiologists.

Keeping in view the importance of the latest imaging technology, the text has been revised and essential chapters like "Artificial Intelligence", "Bone Age Estimation", "Artifacts" (ultrasound, MRI, color Doppler), "Dual Source CT", have been incorporated in concise form. It initiates the reader to imbibe good radiological practices.

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He is author of 14 books including *Clinical Sonography*, *Colour Doppler Imaging*, *Diagnostic Radiology & Imaging*, *Textbook of Radiology and Imaging*; has contributed many chapters in textbooks of paediatrics, orthopaedics, obstetrics & gynaecology; for the benefit of technologists and ultrasonologists; and has to his credit more than 325 research papers published in various national and international journals. He has been on the editorial boards of a number of national and international journals.

He has been awarded Sir JC Bose Memorial Oration Award, Distinguished Medical Teachers Award, Dr BC Roy Award, Brig SK Majumdar Oration Award, Swami Vivekanand Oration Award, Prithvinath Bhargava Memorial Oration Award, Panna Lal Oration Award, GEMS International Award, IMA AMS Dr Satya Pal Aggarwal Annual Award 2010 and CL Sahani Award 2012 by Indian Medical Association, and awarded DMA Vishisht Chikitsak Award 2015 and DNB Excellent Teachers Award 2014 by National Board of Examinations, Ministry of Health and Family Welfare, Govt. of India. He has also served as Chairman, Board of Research Studies, University of Delhi.

Prof Bhargava was instrumental in innovating and starting vocational training course at UCMS, like 10 + 2, X-ray Technician Certificate course as part of CBSE syllabus under Ministry of Health & Family Welfare and Ministry of HRD, Government of India, BSc (Medical Technology), MSc (Medical Imaging Technology), MSc (Radiography) courses under University of Delhi and Diploma in Radiography through National Open School (autonomous under Ministry of HRD, Government of India). He has served as Secretary, Indian College of Radiology and Imaging (ICRI) (1993-98), and Chairman, ICRI (1998-2002) President-Elect (2004) and then President, Indian Radiological and Imaging Association (2005).

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Sixth Edition

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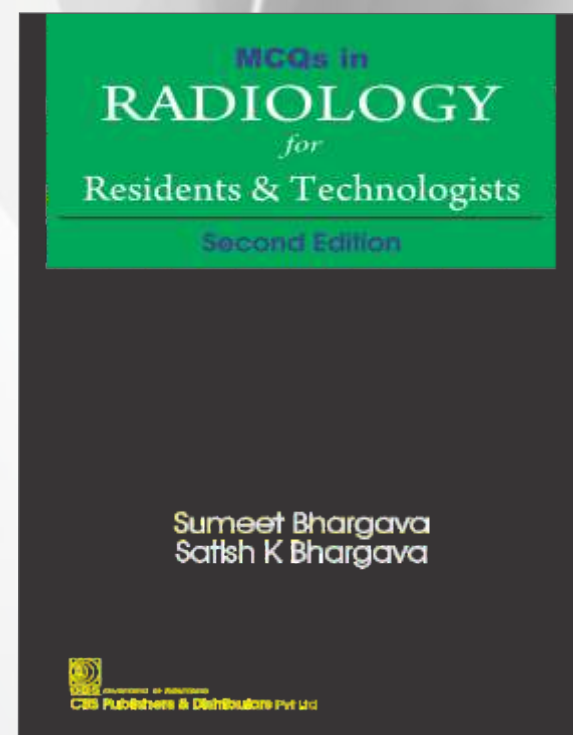
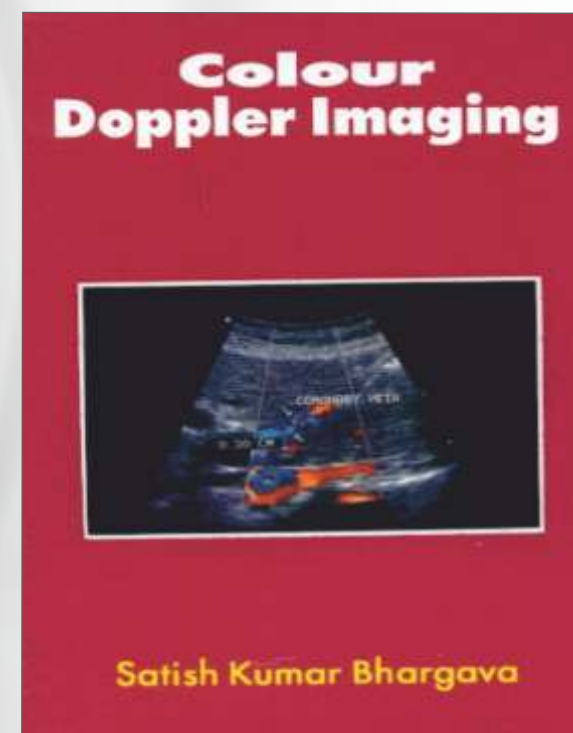
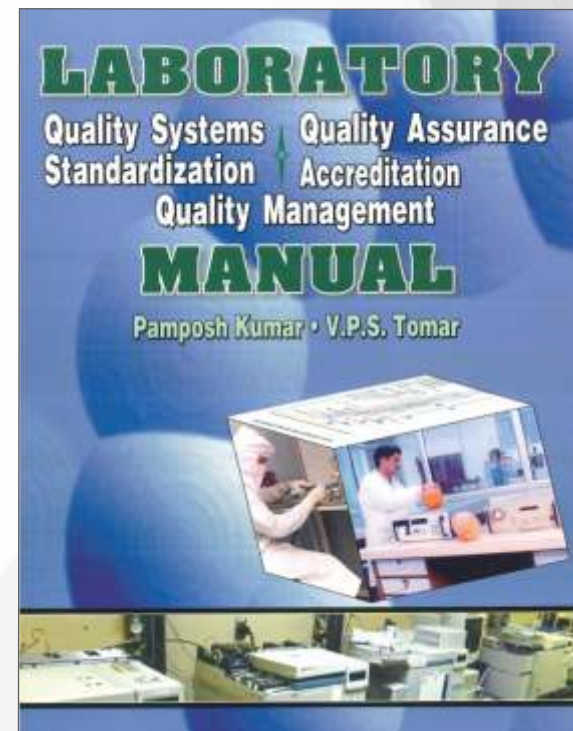
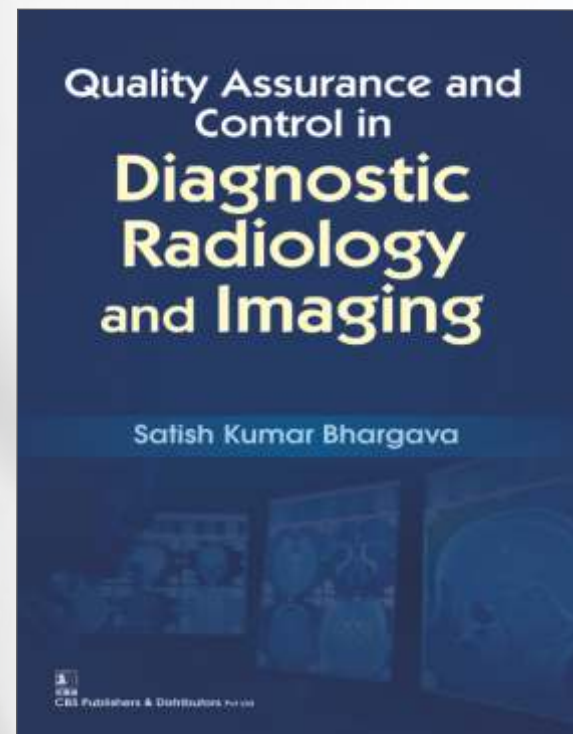
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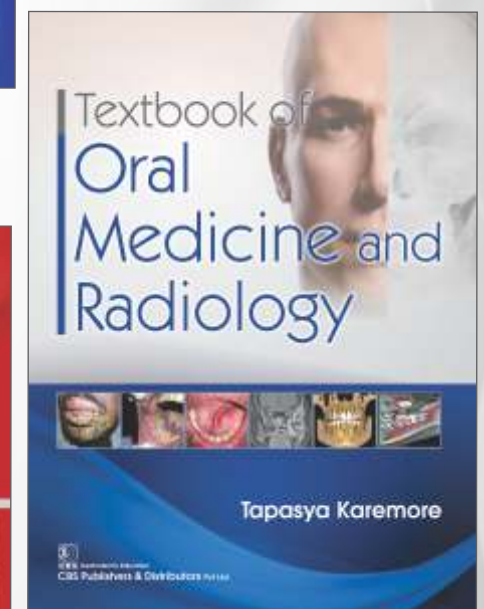
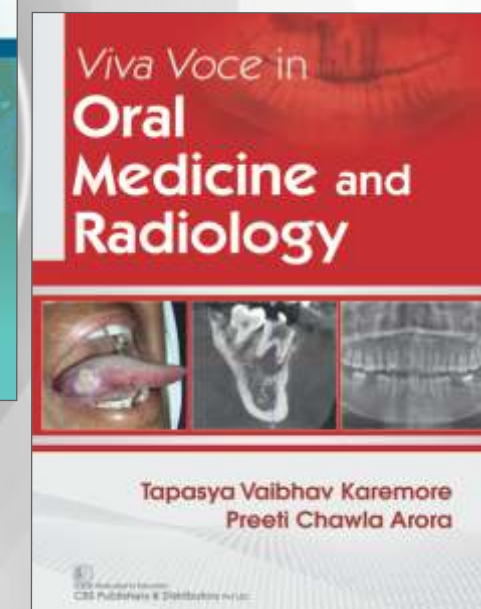
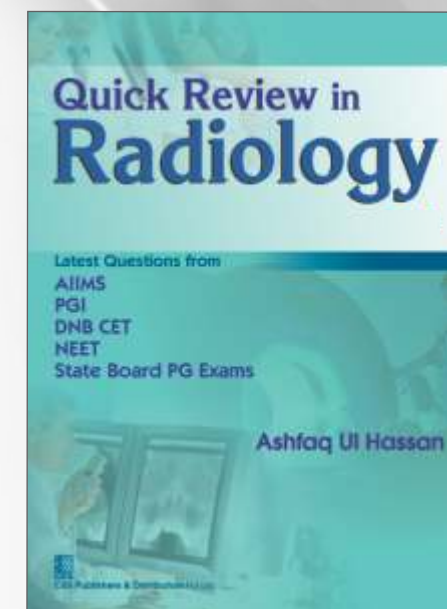
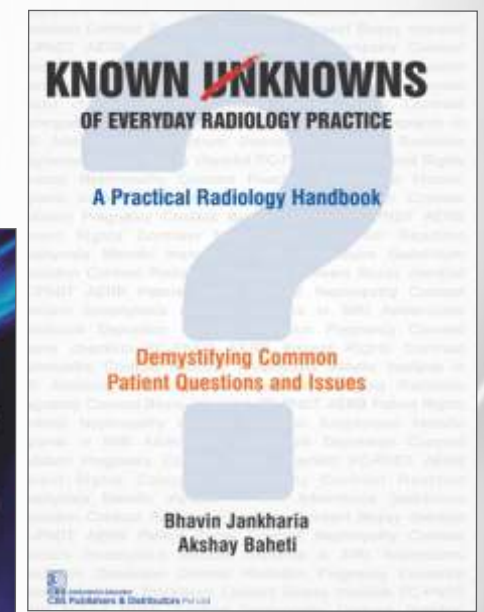
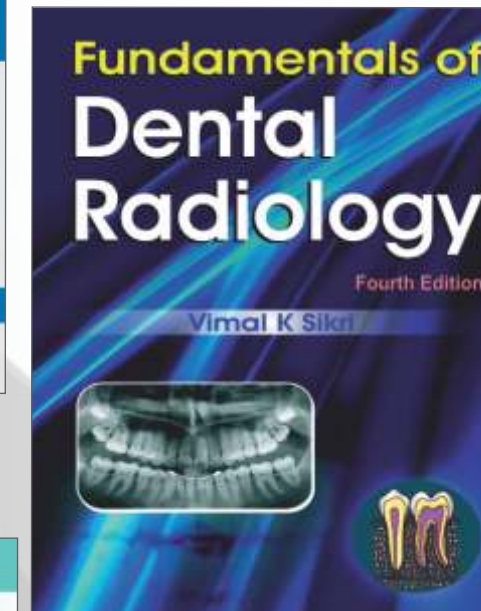
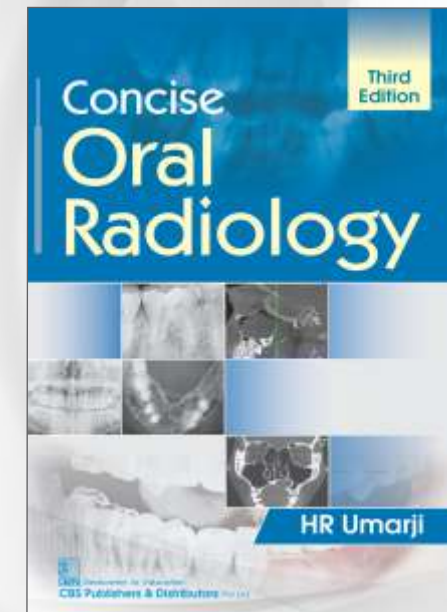
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## *for Residents and Technicians*

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to

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*My granddaughter*  
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# Preface to the Sixth Edition

**D**ue to the enormous demand by the residents, postgraduate students of MD and DNB courses, and technologists from India and abroad, and keeping in view the recent advancements in the field of radiology and imaging, the book has been completely updated with addition of a few chapters like “Artificial Intelligence”, “Artifacts”, “Bone Age Estimation”, etc. Additions have been made in some chapters with more illustrations so that the readers get benefitted.

We are sure the book in the present form will be very useful to students of MD and DNB courses, students of diploma, BSc, MSc, residents and technologists and also physiotherapy students.

We are also thankful to all the contributors for their wholehearted support and help at every stage as and when required.

**Satish K Bhargava**  
**Sumeet Bhargava**

# Preface to the First Edition

The medical science has made tremendous progress during the last decade and it has been observed that diagnosis by X-rays and other imaging modalities plays a vital role in modern era. To provide better interpretation, a good quality radiograph is essential. Hence, a more exhaustive training is required in all aspects right from basic anatomy to radiation protection and planning of the department. The present book is aimed to fulfil this need.

This book covers a broad spectrum of subjects including basic anatomy, physiology, positioning, dark room procedures, radiation protection, planning of the department and radiotherapy. The radiographers will find the book very useful for its comprehensive and authoritative information.

I acknowledge my gratitude to all my colleagues Dr MM Saha, Dr VK Bhargava, Dr KK Bishnoi, Dr I Sahai, Dr A Hasija, Dr Pratibha Gupta, Dr N Bhattacharya, Dr KTaneja, Dr VK Shiv and Dr Gopesh Mehrotra, who gave timely support and stood solidly in our joint endeavour in bringing out this book, which was inspired by Mr MS Dayal, Additional Secretary, Ministry of Health & Family Welfare, Govt. of India and Dr KK Jain, DDG (Medical), Ministry of Health & Family Welfare, Govt. of India. I am grateful to Prof KN Sharma, Principal, UCMS & GTB Hospital, who was always a great source of inspiration in completion of this book. I am thankful to Ms Sarita for her secretarial assistance and Mr Kewal Sharma, Incharge, Audiovisual Section, for assistance in making quality photographs. Thanks are also due to Mr Satish Jain and Mr VK Jain of CBS Publishers and Mr Sunil Dhir of Super Computers who took special interest in bringing out the book. I am specially thankful to them and his team for their help at all stages of technical preparation. Lastly, I am thankful to WHO to provide financial grant for its publication.

New Delhi

Satish K Bhargava  
Sumeet Bhargava



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*Satish K Bhargava* and *Poonam Narang*
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