

Textbook of **Pharmacognosy and Phytochemistry I** Theory and Practical Course Codes BP405T and BP409P for **Fourth Semester Bachelor in Pharmacy**

is aimed to serve as a complete textbook for the fourth semester students of Bachelor in Pharmacy covering both theoretical and practical parts as per the latest syllabus prescribed by the Pharmacy Council of India (Course Codes BP405T and BP409P). This book will also help the BPharm students who are preparing for the GPAT.

The main objective of this book is to provide the students knowledge of basic understanding of the plant tissue culture techniques, cultivation, collection, processing and storage of crude drugs and the role of pharmacognosy in various systems of medicine. This book also gives the information on oral vaccines, hallucinogens, teratogens, natural allergens, and fibers. Upon completion of the study of this book, the students will be able to know the organoleptic, microscopic, physical, and chemical evaluation of crude drugs. The students will also be able to understand the importance of novel medicinal agents from marine sources as well as plant tissue culture.

This book gives a comprehensive treatment of basic concepts of historical development and scope of pharmacognosy, classification of crude drugs and primary and secondary plants metabolites. This book strikes a balance between essential and advanced areas of knowledge apart from general topics. The subject matter is comprehensive and written in an easy to follow language, is suitably illustrated with well-labelled diagrams and contains valuable tables in both the theoretical and practical parts.

Md Rafiul Haque MPharm PhD

is a member of faculty at School of Pharmacy, Al-Karim University, Katihar, Bihar. He obtained his PhD (Pharmacognosy and Phytochemistry), BPharm (2006) and MPharm (2009) from School of Pharmaceutical Education and Research (SPER), Hamdard University, New Delhi. He obtained AICTE Fellowship during his tenure in MPharm. He worked as a Senior Research Fellow in the CCRUM Project, Department of AYUSH, New Delhi, and in various unit operations of Hamdard Lab (India), Manesar, Gurugram (Haryana). He has great work experience in the field of teaching, industry, and research. He has published various research articles in international reputed journals and a few papers in national journals of repute, and also presented papers at many national and international conferences. He is GATE qualified and has been honored by the institute for his dynamic contribution to the growth of the organization. He is an active member of the IPA. He is a reviewer of various journals like *Pharmaceutical Biology*, *Toxicology Mechanisms and Methods*.



CBS Publishers & Distributors Pvt Ltd
4819/XI, Prahlad Street, 24 Ansari Road, Daryaganj, New Delhi 110 002, India
E-mail: delhi@cbspd.com, customercare@cbspd.com; Website: www.cbspd.com
New Delhi | Bengaluru | Chennai | Kochi | Kolkata | Lucknow | Mumbai
Hyderabad | Jharkhand | Nagpur | Patna | Pune | Uttarakhand



Scan for the price of this book and catalogue

ISBN: 978-93-5466-448-9



Textbook of **Pharmacognosy and Phytochemistry I**

Haque

Textbook of **Pharmacognosy and Phytochemistry I** Theory and Practical Course Codes BP405T and BP409P

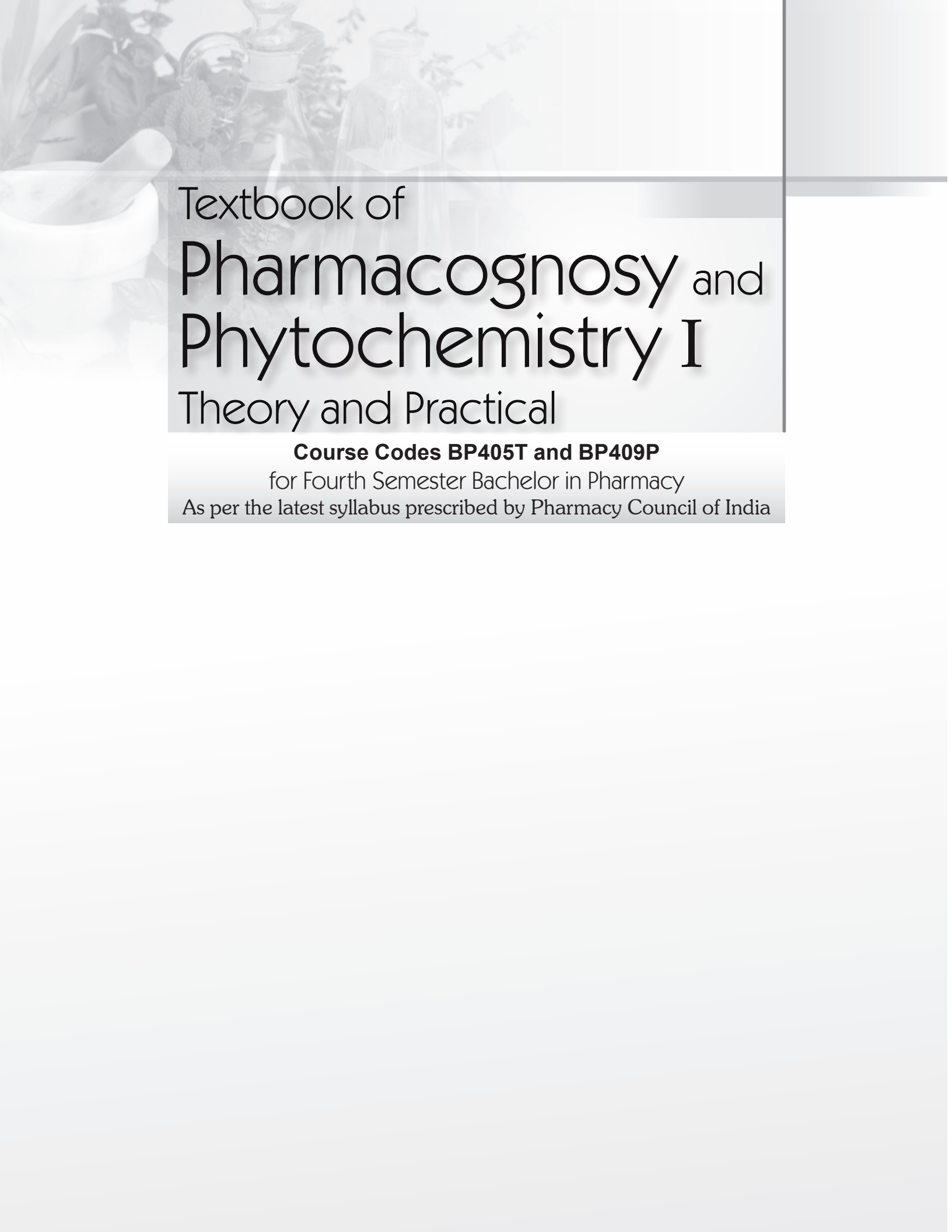
for **Fourth Semester Bachelor in Pharmacy**

As per the latest syllabus prescribed by Pharmacy Council of India

Md Rafiul Haque



Dedicated to Education
CBS Publishers & Distributors Pvt Ltd

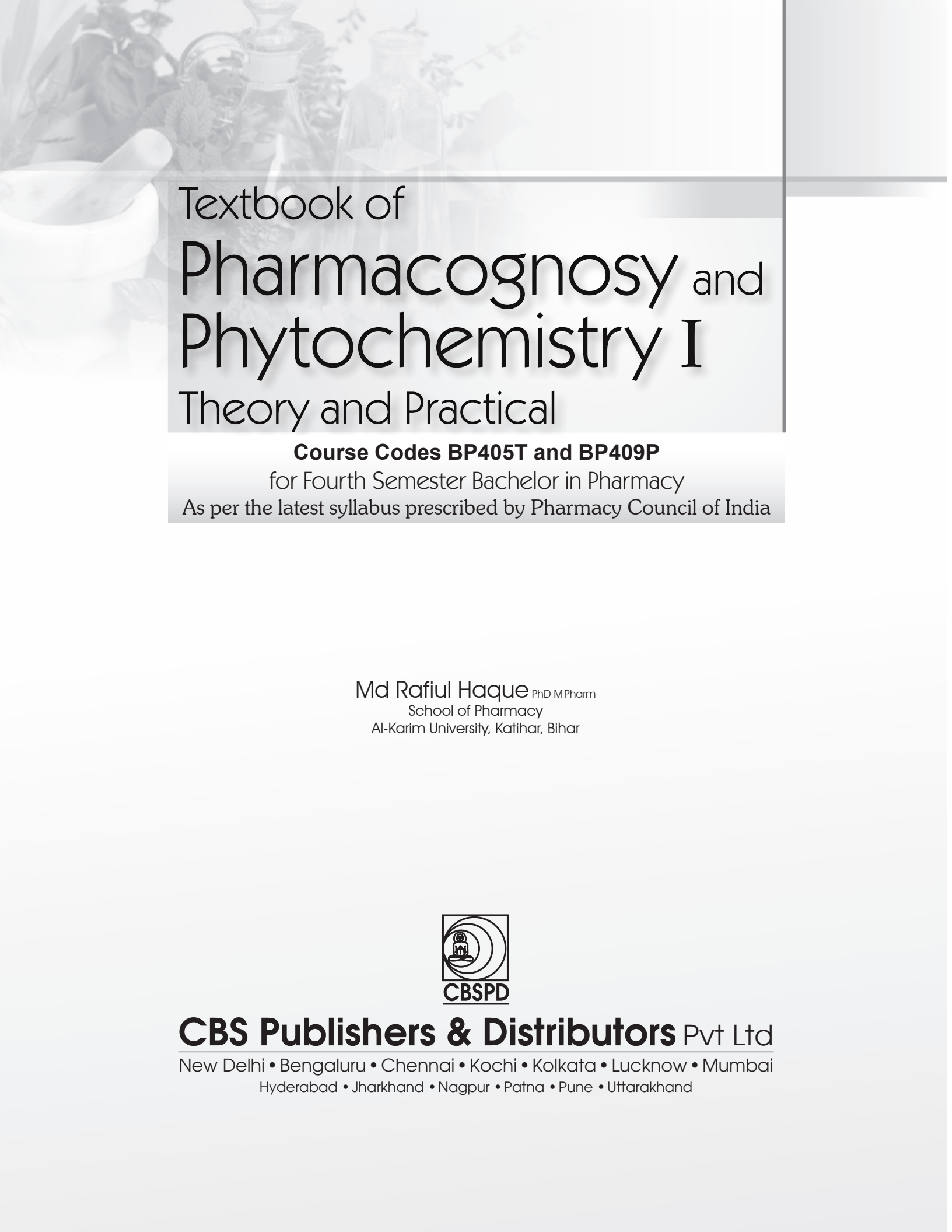


Textbook of
Pharmacognosy and
Phytochemistry I
Theory and Practical

Course Codes BP405T and BP409P

for Fourth Semester Bachelor in Pharmacy

As per the latest syllabus prescribed by Pharmacy Council of India



Textbook of
**Pharmacognosy and
Phytochemistry I**
Theory and Practical

Course Codes BP405T and BP409P

for Fourth Semester Bachelor in Pharmacy

As per the latest syllabus prescribed by Pharmacy Council of India

Md Rafiul Haque ^{PhD MPharm}
School of Pharmacy
Al-Karim University, Katihar, Bihar

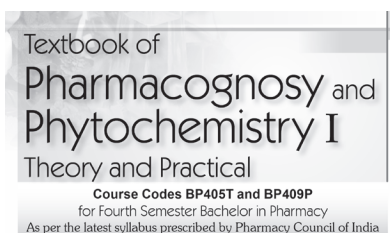


CBS Publishers & Distributors Pvt Ltd

New Delhi • Bengaluru • Chennai • Kochi • Kolkata • Lucknow • Mumbai
Hyderabad • Jharkhand • Nagpur • Patna • Pune • Uttarakhand

Disclaimer

Science and technology are constantly changing fields. New research and experience broaden the scope of information and knowledge. The author has tried his best in giving information available to him while preparing the material for this book. Although all efforts have been made to ensure optimum accuracy of the material, yet it is quite possible some errors might have been left uncorrected. The publisher, the printer and the author will not be held responsible for any inadvertent errors or inaccuracies.



ISBN: 978-93-5466-448-9

Copyright © Author and Publisher

First Edition: 2023

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system without permission, in written, from the author and the publisher.

Published by Satish Kumar Jain and produced by Varun Jain for

CBS Publishers & Distributors Pvt Ltd

4819/XI Prahlad Street, 24 Ansari Road, Daryaganj, New Delhi 110 002, India

Ph: 011-23289259, 23266861, 23266867

Fax: 011-23243014

Website: www.cbspd.com

e-mail: delhi@cbspd.com; cbspubs@airtelmail.in

Corporate Office: 204 FIE, Industrial Area, Patparganj, Delhi 110 092, India

Ph: 011-49344934

Fax: 011-49344935

e-mail: publishing@cbspd.com; publicity@cbspd.com

Branches

- **Bengaluru:** Seema House 2975, 17th Cross, K.R. Road, Banasankari 2nd Stage, Bengaluru 560 070, Karnataka, India
Ph: +91-80-26771678/79 Fax: +91-80-26771680 e-mail: bangalore@cbspd.com
- **Chennai:** 7, Subbaraya Street, Shenoy Nagar, Chennai 600 030, Tamil Nadu, India
Ph: +91-44-26680620, 26681266 Fax: +91-44-42032115 e-mail: chennai@cbspd.com
- **Kochi:** 42/1325, 1326, Power House Road, Opposite KSEB, Power House, Ernakulum 682018, Kochi, Kerala, India
Ph: +91-484-4059061-67 Fax: +91-484-4059065 e-mail: kochi@cbspd.com
- **Kolkata:** 147, Hind Ceramics Compound, 1st Floor, Nilgunj Road, Belghoria, Kolkata 700056, West Bengal, India
Ph: +91-33-25330055/56 e-mail: kolkata@cbspd.com
- **Lucknow:** Basement, Khushuma Complex, 7 Meerabai Marg (behind Jawahar Bhawan), Lucknow 226001, UP, India
Ph: +91-522-4000032 e-mail: tiwari.lucknow@cbspd.com
- **Mumbai:** PWD Shed, Gala No. 25/26, Ramchandra Bhatt Marg, Next JJ Hospital Gate No. 2, Opp. Union Bank of India, Noorbaug, Mumbai 400009, Maharashtra, India
Ph: +91-22-66661880/89 e-mail: mumbai@cbspd.com

Representatives

- | | | | | | |
|--------------------|--------------|--------------------|--------------|----------------------|--------------|
| • Hyderabad | 0-9885175004 | • Jharkhand | 0-9811541605 | • Nagpur | 0-9421945513 |
| • Patna | 0-9334159340 | • Pune | 0-9923910676 | • Uttarakhand | 0-9716462459 |

Printed at: Glorious Printers, Dayaganj, Delhi, India.

Preface

It is a pleasure for the students of the 4th semester (2nd year) of B Pharm to get acquainted with the first edition of **Textbook of Pharmacognosy and Phytochemistry I** as per the new PCI regulation. This book has both theoretical and practical parts for the convenience of students and teachers.

The theoretical part of this book is designed to provide basic knowledge on the historical development and scope of pharmacognosy, the sources, and classification of crude drugs and their quality control studies such as organoleptic, microscopic, physical, and chemical method, etc. This book will help in understanding the basic concepts of primary and secondary plants metabolites, cultivation, collection, processing and storage, plant tissue culture, and edible vaccines. In the theoretical part of this book, basic bits of knowledge of plant products such as hallucinogens, teratogens, natural allergens, and fibers are discussed. The role of pharmacognosy in various systems of medicine such as modern medicine and traditional systems of medicine, namely Ayurveda, Unani, Siddha, Homeopathy, and Chinese systems of medicine are also discussed in this book.

The experimental part of this book is designed to provide basic practical knowledge on the determination of leaf constant parameters such as stomatal number and index, vein islet number, vein islet termination, and palisade ratio. Using this book will also help in understanding basic practical knowledge on the determination of the size of starch grains, calcium oxalate crystals, fiber length and width, and starch grains by the Lycopodium spore method. The determination of ash value, extractive value, foreign matters, moisture contents, swelling index, and foaming index are also discussed in the practical part of this book.

The subject matter is illustrated with well-designed diagrams and tables. This book will be beneficial for the students as well as the professors.

Suggestions and criticisms are welcome.

Md Rafiul Haque

Contents

<i>Preface</i>	v
<i>Syllabus</i>	ix

Theory

1. Sources, Classification and Quality Control of Crude Drugs	3
Introduction of pharmacognosy 3	Quality control of crude drugs 21
Introduction 3	Introduction 21
Historical development of pharmacognosy 3	Drug evaluation 23
Developmental events 5	Camera lucida 32
Scope of pharmacognosy 6	Short questions 34
Sources of drugs 8	Long questions 35
Introduction 8	
Classification of crude drugs 15	
Introduction 15	
2. Cultivation and Conservation of Medicinal Plants	36
Cultivation, collection, and preparation of crude drugs 36	Hybridization 51
Introduction 36	Conservation of medicinal plants 51
Plant hormones and their applications 46	Introduction 51
Auxin 46	Conservation strategies 54
Cytokinin 47	<i>In situ</i> conservation 55
Abscisic acid 49	<i>Ex situ</i> conservation 56
Polyploidy, mutation, and hybridization concerning medicinal plants 50	WHO/IUCN/WWF international consultation on the conservation of medicinal plants 58
Polyploidy 50	Short questions 60
Mutation 50	Long questions 60
3. Plant Tissue Culture and Edible Vaccine	61
Plant tissue culture 61	Introduction 84
Introduction 61	Short questions 87
Types of cultures 67	Long questions 87
Edible Vaccine 84	

4. Role of Pharmacognosy and Plant Secondary Metabolite 88

Pharmacognosy in various systems of medicine 88	Tannin 108
Introduction 88	Glycosides 110
Secondary metabolites 103	Flavonoids 114
Introduction 103	Resins 116
Alkaloids 104	Short questions 117
Volatile oils 106	Long questions 118

5. Primary Metabolites and Plant Products 119

Primary metabolites 119	Novel medicinal agents from marine sources 139
Introduction 119	Introduction 139
Carbohydrates 120	Drug discovery from marine microorganisms 140
Proteins and enzyme 124	Short questions 141
Lipid 127	Long questions 142
Plant products 130	
Plant fiber 130	

Practical

Experiment 1 145

Pharmaceutical aids 145	Gelatin 150
Introduction 145	Starch 151
Tragacanth 147	Honey 152
Acacia 147	Castor oil 153
Agar 149	

Experiment 2 154

Leaf constant 154	Determination of calcium oxalate crystals 165
Introduction 154	Determination of fiber length and width 167
Stomata 155	Determination of lycopodium spore method 169
Determination of size of starch grains 162	

Experiment 3 171

Introduction 171	Determination of moisture content (loss on drying) 174
Determination of foreign matter 171	Determination of swelling index 174
Determination of ash 172	Determination of foaming index 175
Determination of extractable matter (extractive value) 173	

<i>Important reagents used in pharmacognosy and phytochemistry</i>	176
<i>Important terms used in pharmacognosy and phytochemistry</i>	180
<i>Index</i>	185

Syllabus

PHARMACOGNOSY AND PHYTOCHEMISTRY I

Theory Course Code: BP 405T

45 Hours

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

1. to know the techniques in the cultivation and production of crude drugs
2. to know the crude drugs, their uses and chemical nature
3. know the evaluation techniques for the herbal drugs
4. to carry out the microscopic and morphological evaluation of crude drugs

COURSE CONTENTS

UNIT I

10 Hours

- **Introduction to pharmacognosy:**
 - a. Definition, history, scope and development of pharmacognosy
 - b. Sources of drugs: Plants, animals, marine and tissue culture
 - c. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo-gum-resins).
- **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo- and sero-taxonomical classification of drugs
- **Quality control of drugs of natural origin:**
 - Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.
 - Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT II**10 Hours**

- **Cultivation, collection, processing and storage of drugs of natural origin:**
 - Cultivation and collection of drugs of natural origin
 - Factors influencing cultivation of medicinal plants.
 - Plant hormones and their applications.
 - Polyploidy, mutation and hybridization with reference to medicinal plants
- **Conservation of medicinal plants**

UNIT III**07 Hours**

- **Plant tissue culture**
 - Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance.
 - Applications of plant tissue culture in pharmacognosy.
 - Edible vaccines

UNIT IV**10 Hours**

- **Pharmacognosy in various systems of medicine:** Role of pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.
- **Introduction to secondary metabolites:** Definition, classification, properties and test for identification of alkaloids, glycosides, flavonoids, tannins, volatile oil and resins

UNIT V**08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

- **Plant products:**
 - Fibers: Cotton, jute, hemp
 - Hallucinogens, teratogens, natural allergens
- **Primary metabolites:** General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as pharmaceutical aids and/or medicines for the following primary metabolites:
 - *Carbohydrates:* Acacia, agar, tragacanth, honey
 - *Proteins and enzymes:* Gelatin, casein, proteolytic enzymes (papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).
 - *Lipids (waxes, fats, fixed oils):* Castor oil, chaulmoogra oil, wool fat, bees wax
 - *Marine drugs:* Novel medicinal agents from marine sources

Practical Course Code: BP409P**4 Hours/Week**

1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of ash value
8. Determination of extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

