AS PER PCI REGULATIONS
SECOND YEAR B. PHARM. | SEMESTER-III

PHARMACEUTICAL ENGINEERING

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Dr. VAIBHAVKUMAR A. JAGTAP
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KEERTHY H. S.

NIRALI PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

A Text Book of

PHARMACEUTICAL ENGINEERING

As Per PCI Regulations

SECOND YEAR B. PHARM.

Semester III

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We are grateful to the almighty, the most beneficent and merciful, the owing on the gift of forbearance, self control and patience that carried us through our endeavour and finally made this book a grand success.

The satisfactions, which accomplish a successful completion of any task, are incomplete without the mentioning of the names of those people who make it possible.

We are pleased to express our deep sense of gratitude towards our parents for their creative suggestions, unfailing advice, and constant encouragement to transform teaching in the form of a user friendly book for the students.

We thank our colleagues for their helpful comments and suggestions.

We hope this book will leave the desired impression and look forward to receive the comments from the readers.

We are thankful to the publishers and extend our thanks to supportive friends, colleagues for bringing out this nicely printed book.

Authors

Preface

This book having title "Text Book of Pharmaceutical Engineering" (As Per PCI Regulations).

This book is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Pharmaceutical Engineering is concerned with the study of industrial process required to convert raw material into value added Pharmaceutical such as drugs and excipients. It is a subject of importance both to the industrial pharmacist and the undergraduate students.

Upon the completion of the course student shall be able to:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

This book consists of Chapters: Flow of Fluids, Size Reduction, Size Separation, Heat Transfer, Evaporation, Distillation, Drying, Mixing, Filtration, Centrifugation and Materials of Pharmaceutical Plant Construction, Corrosion and its Prevention.

Special emphasis is laid on Example, Diagram and Tables, Model Calculations and Long Type Question, Short Type Question and Multiple Choice Question (MCQ's) with Answers.

This book is designed according to the curriculum of undergraduate courses in Pharmacy by Pharmacy Council of India New Syllabus useful All over India.

We sincerely request reader to send their valuable suggestions and constructive comments for making improvement in the text edition of the book.

We extend our good wishes to the students and professor and sincerely hope to have continued support from them and to our other books in future.

Authors

Syllabus

BP304T. PHARMACEUTICAL ENGINEERING (Theory)

UNIT-I

Flow of Fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Size Reduction: Objectives, Mechanisms and Laws governing size reduction, Factors affecting size reduction, Principles, Construction, Working, Uses, Merits and demerits of Hammer mill, Ball mill, Fluid energy mill, Edge runner mill and End runner mill.

Size Separation: Objectives, Applications and mechanism of size separation, Official standards of powders, Sieves, Size separation Principles, Construction, Working, Uses, Merits and demerits of Sieve shaker, Cyclone separator, Air separator, Bag filter and Illustriation tank.

UNIT-II

Heat Transfer: Objectives, Applications and Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, Convection and radiation. Heat interchangers and heat exchangers.

Evaporation: Objectives, Applications and factors influencing evaporation, Differences between evaporation and other heat process. Principles, Construction, Working, Uses, Merits and demerits of Steam jacketed kettle, Horizontal tube evaporator, Climbing film evaporator, Forced circulation evaporator, Multiple effect evaporator and Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation, Flash distillation, Fractional distillation, Distillation under reduced pressure, Steam distillation and molecular distillation

UNIT- III

Drying: Objectives, Applications and mechanism of drying process, Measurements and applications of Equilibrium Moisture content, Rate of drying curve. Principles, construction, Working, Uses, Merits and Demerits of Tray dryer, Drum dryer spray dryer, Fluidized bed dryer, Vacuum dryer, Freeze dryer.

Mixing: Objectives, Applications and factors affecting mixing, Difference between solid and liquid mixing, Mechanism of solid mixing, Liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, Twin shell blender, Ribbon blender, Sigma blade mixer, Planetary mixers, Propellers, Turbines, Paddles and Silverson Emulsifier,

UNIT-IV

Filtration: Objectives, Applications, Theories and Factors influencing filtration, Filter aids, Filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate and frame filter, Filter leaf, Rotary drum filter, Meta filter and Cartridge filter, Membrane filters and Seidtz filter.

Centrifugation: Objectives, Principle and applications of Centrifugation, Principles, Construction, Working, Uses, Merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, Semi-continuous centrifuge and super centrifuge.

UNIT- V

Materials of Pharmaceutical Plant Construction, Corrosion and its Prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, Types of corrosion and their prevention.

Ferrous and non-ferrous metals, Inorganic and Organic non-metals, Basic of material handling systems.

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SCHEMES FOR INTERNAL AND END EXAMINATION

Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP304T	Pharmaceutical Engineering (Theory)	10	15	1 Hr.	25	75	3 Hrs	100

SCHEMES FOR CONTINUOUS MODE

Title	Marks
Attendance	**4**
Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	4
Student - Teacher interaction	3
Total	**10**

GUIDELINES FOR ATTENDANCE MARKS

Percentage of Attendance	Theory
95 – 100	4
90 – 94	3
85 – 89	2
80 – 84	1
Less than 80	0

QUESTION PAPER PATTERN FOR SESSIONAL EXAMINATIONS

Q. No.	Title		Marks
I	Multiple Choice Questions (MCQs)	10×1	10
	OR		
	Objective Type Questions	5×1	
II	Long Answers (Answer 1 out of 2)	1×10	10
	Short Answers (Answer 2 out of 3)	2×5	10
	Total		**30**

Note: Two Sessional exams shall be conducted for each theory and average marks of two Sessional exams shall be computed for internal assessment. Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks.

QUESTION PAPER PATTERN FOR END EXAMINATIONS

Q. No.	Title		Marks
I	Multiple Choice Questions MCQs) OR Objective Type Questions	20×1 10×2	20
II	Long Answers (Answer 2 out of 3)	2×10	20
III	Short Answers (Answer 7 out of 9)	7×5	35
	Total		**75**

GRADE POINT EQUIVALENT TO % OF MARK and PERFORMANCES

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

DECLARATION OF CLASS

Class	CGPA
First Class with Distinction	7.50 and above
First Class	6.00 to 7.49
Second Class	5.00 to 5.99

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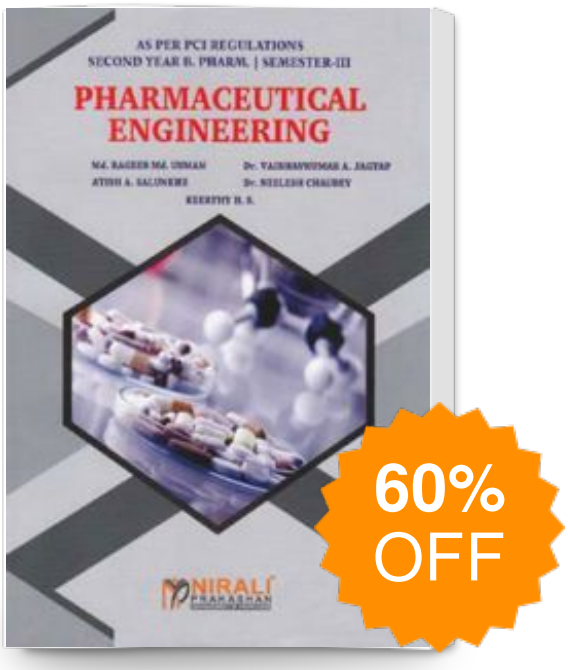
Contents

Unit I

Pharmaceutical Engineering



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