



Dr. Rafiq Zakaria Campus

Maulana Azad Educational Trust

Y.B. Chavan College of Pharmacy

An ISO 9001:2008 Certified Institute

(B. Pharm., M. Pharm & Research Center)



COURSE MODULE

Program Title	B. Pharmacy
Department	Pharmaceutics
Course Title	Pharmaceutical Engineering

1. **NAME OF INSTITUTION** : Y. B. CHAVAN COLLEGE OF PHARMACY,
AURANGABAD
2. **AFFILIATED UNIVERSITY** : DR. BABASAHEB AMBEDKAR
MARATHWADA UNIVERSITY, AURANGABAD
3. **DEPARTMENT** : Pharmaceutics
4. **PROGRAM TITLE** : B. PHARM

4.1. Program Outcomes (PO):

PO 01: Pharmacy Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.

PO 02: Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO 03: Problem analysis: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

PO 04: Modern tool usage: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO 05: Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.

PO 06: Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g., health care professionals, promoters of health, educators, managers, employers, employees).

PO 07: Pharmaceutical Ethics: Honor personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO 08: Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO 09: The Pharmacist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO 10: Environment and sustainability: Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 11: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

5. COURSE SPECIFICATION :

5.1. Course Identification and General Information

a. Course Title:	Pharmaceutical Engineering		
b. Course Number/ Code	BP 304T		
c. Credit Hours	Theory	Practical	Total
	03	12	15
d. Study level/ semester at which this course is offered	Third Semester B. Pharm.		
e. Pre-requisite	Students should know the basics of various unit operations like Drying, distillation etc.		
f. Co-requisite	To get knowledge to perform various processes involved in pharmaceutical manufacturing process		
g. Language of teaching the course	English		
h. Prepared by	Dr. Moizul Hasan		
i. Approved by	Dr. S R Lahoti		

5.2. Course Description:

The objective of the course is to develop an understanding of basic principles and concepts of engineering in pharmaceutical processes.

5.3. Course Objectives:

1. To create awareness regarding the unit operations involved in pharmaceutical industry.
2. To provide over view of pharmaceutical machineries.
3. To enable students in selecting proper equipment for material processing in Pharmaceutical Industry.
4. To educate learners about hazards and safety aspects in industrial environment.

5.4. Course Outcomes (CO):(around 5 to 8)
(e.g., CO101.1 (CO - course code, 101 subject code as per syllabus, & .1 is first CO))

Code	Course outcome
CO 510.01	Describe and explain the principles of fluid flow and its applications
CO 510.02	Describe and define the principles and methodology of various unit operation processes and its application in pharmaceutical industry
CO 510.03	Apply academic theory and knowledge to the solution of a real-life research, plant operational or management problem
CO 510.04	Ability to develop a comprehensive process flow diagram for a pharmaceutical process
CO 510.05	Ability to apply engineering principles to address issues in various pharmaceutical processes

5.4.1 Alignment of PO to CO: (PO: Program Outcome; CO: Course Outcome)

Course code (CO)	Program Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 510.01	H	M	M	S	-	-	S	-	-	S	H
CO 510.02	H	M	S	M	-	-	S	H	S	S	H
CO 510.03	H	S	S	H	-	-	S	-	-	-	H
CO 510.04	H	H	S	-	-	-	S	-	-	-	M
CO 510.05	H	H	S	-	-	-	S	-	-	-	M

Correlation levels S, M or H as defined below:

S: Slight (Low); M: Moderate (Medium); H: Substantial (High); If there is no correlation, put ‘-’

5.4.2 Teaching and Assessment Methods for achieving learning outcome:

Teaching Strategies /methods used	Methods of Assessment
Lectures	Assignments
Group Discussions	Oral Presentations
Demonstrations	Written Examinations
Problem Solving Sessions	Laboratory Experimental
	Reports (daily assessment).

6. COURSE CONTENTS:

6.1. Theoretical Aspect:

Order	Topic list/units	Subtopics list	Number of Weeks	Contact Hours
01	1	Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitot tube and Rotameter.	01	04
02	2	Size Reduction: Objectives, Mechanisms & 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 & end runner mill	01	04
03	3	Size Separation: Objectives, applications & 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 & elutriation tank.	0.5	02
04	4	Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.	01	03
05	5	Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process.	01	03

		principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator		
06	6	Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation	01	04
07	7	Drying: Objectives, applications & mechanism of drying process, measurements & 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	01	04
08	8	Mixing: Objectives, applications & 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 & Silverson Emulsifier,	01	04
09	9	Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters	01	04

		and Seitz filter.		
10	10	Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	01	04
11	11	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 nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.	02	07

6.2. Practical Aspect:

Order	Tasks/Experiments	Number of Weeks	Contact Hours
1	I. Determination of radiation constant of brass, iron, unpainted and painted glass.	01	12
2	II. Steam distillation – To calculate the efficiency of steam distillation.		
3	III. To determine the overall heat transfer coefficient by heat exchanger.		
4	IV. Construction of drying curves (for calcium carbonate and starch).		
5	V. Determination of moisture content and loss on drying.		
6	VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.		
7	VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.		
8	VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.		
9	IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.		
10	X. Demonstration of colloid mill, planetary mixer,		

	fluidized bed dryer, freeze dryer and such other major equipment.	
11	XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity	
12	XII. To study the effect of time on the Rate of Crystallization.	
13	XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.	

6.3. Assignments/Tutorials:

Tutorials given on topics of syllabus and assignments were given as questions on the respective chapters.

7. SCHEDULE OF ASSESSMENT TASKS DURING THE SEMESTER:

Sr. No.	Assessment Method	Week due	Marks	Proportion of Final Assessment
01	Assignments, Exercises & tutorials (CAM)		10	5%
02	Sessional (Internal Theory exam)		15	10%
03	Continuous Practical Assessment (Sessional Practical exam)	Weekly during practicals	15	5%
04	Final exam (theory)	As per University at end of course	75	40%
05	Final exam(practical)		35	40%
Total			150	100%

8. STUDENT SUPPORT:

Office Hours/Week	Other Procedures
Two hours minimum	e-mail (moizulhasan@gmail.com)

9. TEACHER'S AVAILABILITY FOR STUDENT SUPPORT:

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Time	4:00 pm to 5:00 pm	4:00 pm to 5:00 pm	4:00 pm to 5:00 pm	4:00 pm to 5:00 pm	3:00 pm to 4:00 pm	4:00 pm to 5:00 pm

10. LEARNING RESOURCES:

Sr. No.	Title of Learning Material	Details
01	Text books	Remington's Pharmaceutical Sciences, Mark Publications.
02	Essential references (as per syllabus)	1. Subramanyam, Pharm. Engineering

		Unit Operations –I, Vallabh Prakashan (2002) 2. Subramanyam, Pharm. Engineering Unit Operations –II, Vallabh Prakashan (2002) 3. Sambamurthy, Pharmaceutical Engineering, Ist Edition (1998) 4. A.R. Paradkar. Introduction to Pharmaceutical Engineering, Nirali Prakashan
03	Reference material	1. Badger W.L.& Banchero J.T., Introduction to Chemical Engineering, Mc Graw Hill, NY 2. Brown George G., Unit Operations, CBS Publication 3. Cooper & Gunn, Tutorial Pharmacy, CBS Publication 4. Perry R.H., Perry's Chemical Engineers Hand Book, Tata Mc Graw Hill 5. Richardson J.F.& Coulson J. M., Chemical Engineering, Asian Books Delhi
04	E-materials and websites	1. Soft copies pharmaceutical engineering books are available on http://www.pharmatext.org 2. Latest information regarding to pharmaceutical engineering are available on http://www.pharmainfo.net 3. Soft copies of pharmaceutical engineering subjects' presentation and material are available on http://www.authorstream.com .
05	Other learning material	PPT

11. FACILITIES REQUIRED:

Sr. No.	Particular of Facility Required
01	Lecture Rooms (capacity for 60 students)
02	Laboratory (capacity for 20 students)
03	Computing resources: P-IV-PCs with recent hardware/ utilization of open source and licensed application software
04	Other resources: Appropriate laboratory tools, Chemicals, Glass ware, Apparatus, Instrumentation

12. COURSE IMPROVEMENT PROCESSES:

12.1. Strategies for obtaining student feedback on effectiveness of teaching:

Course delivery evaluation by students using: Questionnaire forms and online questionnaires

12.2. Other strategies for evaluation of teaching by the instructor or by the department:

Periodic review by Academic Planning & Monitoring Committee and departmental review committee, Observations and assistance of colleagues, External assessments by advisors/ examiners and auditors.

12.3. Process for improvement of teaching:

Use of ICT tools, teaching aids, Simultaneous practical orientation and theory classes (SPOT), Adoption of reflective teaching.

12.4. Describe the planning procedures for periodically reviewing of course effectiveness and planning for improvement:

Periodic review by departmental review committee, Review of course delivery and outcome through assessment and feedback from all stake holders.

12.5. Course development plans:

Provide inputs for course improvement and update to University Course development Committees (Board of Studies)

13. INFORMATION ABOUT FACULTY MEMBER RESPONSIBLE FOR THE COURSE:

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Location	Department of Pharmaceutics
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