Maulana Azad Educational Trust's
Y. B. Chavan College of Pharmacy
(B. Pharm., M. Pharm. & Research Centre)
ISO 21001:2018 & 14001:2015 | NIRF 2023 AIR 80th
NAAC ACCREDITATION "A" GRADE (CGPA SCORE 3.23)
Dr. Rafiq Zakaria Campus, Dr. Rafiq Zakaria Marg, Rauza Bagh, Aurangabad-431001 | www.ybccpa.ac.in

COURSE MODULE

Program Title	M. Pharmacy SEM-I
Department	Pharmaceutics
Course Title	Drug Delivery System

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** : M. PHARM.

4.1. Program Specific Outcome:

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PSO-1: Independently carry out research and development work by utilizing modern tools like Artificial Intelligence (AI), Computer based Informatics and Simulations Models.

PSO-2: Highlight advancement in knowledge associated with novel as well as conventional drug delivery systems

PSO-3: Build professional, Statistical, computational, analytical, critical thinking and Problem-solving skills.

PSO-4: Apply Good manufacturing Practices and Regulations to Drugs and Cosmetics.

PSO-5: Explain and apply the concepts of Biopharmaceutical, Molecular and Biological aspects in formulation development and drug targeting

5.1.Course Description:

This course is designed to impart knowledge on the area of advances in noveldrug delivery systems.

5.2.Course Objectives:

Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug deliverysystems.
- The criteria for selection of drugs and polymers for the development ofdelivering system
- The formulation and evaluation of Novel drug delivery systems.

5. COURSE SPECIFICATION :

a. Course Title:	DRUG DELIVERY SYSTEMS	
b. Course Number/Code	(MPH 102T)	
c. Credit Hours	Theory	Practical

	60 hr	72 hr
d. Study level/semester at which this course is offered	M.Pharm SEM-I	
e. Pre-requisite	Basic of Pharmaceutics	
f. Co-requisite	Pharmaceutics	
g. Program in which the course is offered	M Pharm	
h. Language of teaching the course	English	
i. Prepared by	Dr. Mohammad Ismail M	
j. Approved by HOD	Dr S.R.Lahoti	

6.0.Course Outcomes (COs) : (Min. 4 and Max. 6)

(Use Bloom's Taxonomy words)

CO Code	Course outcome
CO 202.01	Apply the knowledge for pre-formulation studies of various formulations.
CO 202.02	Understand and apply the optimization techniques and statistics in formulation research.
CO 202.03	Ability to professionally manage various activities in industry
CO 202.04	To understand various concepts and principal in dosage form design
CO 202.05	Ability to validate various processes in pharmaceutical industry

6.1. Knowledge and Understanding

(Alignment of PSOs to COs)

Course Code	**Program Specific Outcome**				
	PSO-1	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO 202.01	**H**	**H**	**M**	**M**	**H**
CO 202.02	**H**	**H**	**H**	**H**	**M**

CO 202.03	**M**	**M**	**H**	**M**	**S**
CO 202.04	**H**	**H**	**H**	**M**	**H**
CO 202.05	**M**	**M**	**M**	**M**	**S**

Correlation levels 1, 2 or 3 as defined below:

1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High); If there is no correlation, put '-'

6.2.Tools for the Teaching and learning

Theory subjects	Practical Subjects
• **PowerPoints presentation** • **Videos** • **Flash Card** • **Models** • **Software** • **Charts** • **Smart Boards** • **White boards** • **Online Platform**	• **White boards** • **Glassware** • **Chemicals** • **Instruments** • **Equipment** • **Software** • **Models** • **Plants/Crude Drugs** • **Animal**

6.3.COURSE CONTENT

6.1. Theoretical Aspect:

Order	Topic list/units	Subtopics list	Number of Weeks	Contact Hours
1	Unit I	Sustained Release(SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing,	2	10

		Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.		
2	Unit II	Rate Controlled Drug Delivery Systems: Principles &Fundamentals, Types, Activation; Modulated Drug DeliverySystems;Mechanically activated, pH activated, Enzyme activated,and Osmotic activated Drug Delivery Systems Feedbackregulated Drug Delivery Systems; Principles & Fundamentals.	2	10
3	Unit III	Gastro-Retentive Drug Delivery Systems: Principle, conceptsadvantages and disadvantages, Modulation of GI transit timeapproaches to extend GI transit. Buccal Drug Delivery Systems:Principle of muco adhesion, advantages anddisadvantages, Mechanism of drug permeation, Methods offormulation and its evaluations.	2	10
4	Unit IV	Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	2	6
5	Unit V	Transdermal Drug Delivery Systems: Structure of skin andbarriers, Penetration enhancers, Transdermal Drug DeliverySystems, Formulation and evaluation.	3	10

6	Unit VI	Protein and Peptide Delivery: Barriers for protein delivery.Formulation and Evaluation of delivery systems of proteins andother macromolecules.	2	8
7	Unit VII	Vaccine delivery systems: Vaccines, uptake of antigens, singleshot vaccines, mucosal and transdermal delivery of vaccines.	2	6
	TOTAL		15 weeks	60

6.2.Practical Aspects

C105.1	**To recall the basic principles of analytical techniques and theirinstrumentation used for drug analysis.**
C105.2	**To summarize the preformulation studies and basic excipients used for various controlled/sustained drug delivery systems**
C105.3	**To make use of various analytical instruments for estimation of drugs in various formulations.**
C105.4	**To simplify the formulation techniques, prepare matrix tablets, floating tablets**
C105.5	**To assess the drug release from sustained and controlled drug delivery systems.**
C105.6	**To evaluate the dosage forms, construct kinetic plots and determine similarity factor.**

List of Experiments

Order	Name of Experiment	Number of Weeks

1	Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer	**1**
2	Simultaneous estimation of multi component containing formulations by UV Spectrophotometry	**1**
3	Experiments based on HPLC	**1**
4	Experiments based on Gas Chromatography	**-**
5	Estimation of riboflavin/quinine sulphate by fluorimetry	**-**
6	Estimation of sodium/potassium by flame photometry	**-**
7	To perform In-vitro dissolution profile of CR/ SR marketed formulation	**1**
8	Formulation and evaluation of sustained release matrix tablets	**1**
9	Formulation and evaluation osmotically controlled DDS	**1**
10	Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS	**1**
11	Formulation and evaluation of Muco adhesive tablets.	**1**
12	Formulation and evaluation of trans dermal patches.	**1**
13	To carry out preformulation studies of tablets	**1**
14	To study the effect of compressional force on tablets disintegration time	**1**
15	To study Micromeritic properties of powders and granulation	**1**
16	To study the effect of particle size on dissolution of a tablet	**1**
17	To study the effect of binders on dissolution of a tablet	**1**
18	To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.	**1**

7.0. ASSESSMENT MECHANISM:

Sr. No.	Assessment Mechanism	Week due	Marks	Proportion of Final Assessment
1	Continuous Assessment (Theory)	2nd week of every month	10	4%
2	Sessional (Internal Theory exam)	As per schedule of examination	15	6%
3	Continuous Practical Assessment	Weekly during	20	8%

	(Sessional Practical exam)	practical		
4	Sessional (Internal Practical exam)	As per schedule of examination	30	12%
5	Final exam (theory)	As per University at end of course	75	30%
6	Final exam(practical)		100	40%
Total			150	**100%**

8.0.STUDENT SUPPORT:

Office hours/week	Other procedures
Two hours minimum	**Sharing of Study materials/ Question Bank**

9.0.TEACHER'S AVAILABILITY FOR STUDENT SUPPORT:

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Time	**12:00-1:00**	**12:00-1:00**	**12:00-1:00**	**12:00-1:00**	**12:00-1:00**	**12:00-1:00**

10.0. LEARNING RESOURCES:

Sr. No.	Title of Learning Material	Details
1	Text books	1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised andexpanded,Marcel Dekker, Inc., New York, 1992. 2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, MarcelDekker,Inc., New York, 1992. 3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published byWileyInterscience Publication, John Wiley and Sons, Inc, New YorkChichester/Weinheim 4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors,New Delhi, First edition 1997 (reprint in 2001). 5. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances,Vallabh Prakashan, New Delhi, First edition 2002
2	Reference material	Encyclopedia of Pharmaceutical Technology by James swarbick

3	E-materials and websites	1. Indian Journal of Pharmaceutical Sciences (IPA) 2. Indian drugs (IDMA) 3. Journal of controlled release (Elsevier Sciences) desirable 4. Drug Development and Industrial Pharmacy (Marcel & Decker) desirable
4	Other learning material	New publications, GOI notification & US FDA updates

11.0. FACILITIES REQUIRED:

Sr. No.	Particular of Facility Required
1	Lecture Rooms (capacity for 60 students)
2	Laboratory (capacity for 20 students)
3	Computing resources: PC with latest version and hardware/software and utilization of open source and licensed application software
4	Other resources: Appropriate laboratory tools, Chemicals, Glass ware, Apparatus, Instrumentation

12.0. 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 meeting , 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)

13.0. INFORMATION ABOUT FACULTY MEMBER RESPONSIBLE FOR THE COURSE:

Name	Dr. Mohammad Ismail M
Location	Respective Cabin (beside Stores, IInd floor)
Contact Detail (e-mail &cell no.)	9834368366, mdismail23456@gmail.com
Office Hours	10:00 AM to 5:00 PM