PAPER IV- <u>ADVANCES IN DRUG DELIVERY SYSTEMS</u>

GOAL

To train the students in the area of novel drug delivery systems.

OBJECTIVE

Upon the completion of the course, the student shall have an understanding of the need, concept, design and evaluation of various sustained and controlled release dosage forms.

COURSE DESCRIPTION

THEORY   **50 Hours (T:2Hours/Week)**

1. CONCEPTS OF CONTROLLED RELEASE DRUG DELIVERY SYSTEMS

(Marks allotment :20)   (7 Hrs.)

Introduction, concept, advantages & disadvantages. Factors to be considered for designing controlled release dosage forms. Dissolution, Diffusion, Combination of dissolution and diffusion controlled drug delivery systems. Evaluation of CRDF.

2. POLYMER SCIENCE   (3 Hrs.)

(Marks allotment : 5)

Polymer: Introduction, classification, general synthesis and evaluation techniques. Appplication of polymers in drug delivery.

3. **APPROACHES TO CONTROLLED DRUG DELIVERY SYSTEM   (8 Hrs.)**

(Marks allotment : 20)

Classification of rate-controlled drug delivery systems. Rate-programmed release, activation-modulated and feedback regulated drug delivery systems. Effect of system parameters on controlled drug delivery. Hydrodynamically balanced systems, Osmotic pressure controlled, pH controlled, ion exchange controlled systems.

4. MUCO ADHESIVE DRUG DELIVERY SYSTEMS   (8 Hrs.)

(Marks allotment : 15)

Concepts, advantages and disadvantages, structure of oral mucosa, transmucosal permeability, theories of muco adhesion and muco adhesive polymers, mucosal membrane models, permeability enhancers. Development and evaluation of buccal, nasal, pulmonary, rectal, vaginal and ocular drug delivery systems and their applications.

5.TRANSDERMAL DRUG DELIVERY SYSTEMS (7 Hrs.)

(Marks allotment : 15)

Rationale behind transdermal drug delivery, Permeation through skin, factors affecting permeation, basic components of TDDS, formulation approaches used in development of TDDS and their evaluation, permeation enhancers. Iontophoresis, sonophoresis and magnetophoresis.

6. PARENTERAL CONTROLLED RELEASE DRUG DELIVERY SYSTEMS

(Marks allotment: 15) (5 Hrs.)

Approaches for injectable controlled release formulations. Development and evaluation of Implantable drug delivery systems, subcutaneous, intramuscular and intrauterine implants.

7. NANO DRUG DELIVERY SYSTEMS (7 Hrs.)

(Marks allotment : 25)

Formulation, development and evaluation of Nanoparticles- Polymeric nano particles, Nano crystals, Solid Lipid Nanoparticles (SLN), Metal Nanoparticles. Vesicular Systems- Liposomes, Transferosomes, Ethosomes, Niosomes, Virosomes. Carbon Nano Tubes (CNT) and Dendrimers. Safety issues related to nano drug delivery systems.

8. TARGETED DRUG DELIVERY (5 Hrs.)

(Marks allotment : 15)

Concept, advantages and disadvantages, types of targeting and applications. Monoclonal antibodies- hybridoma cell production, diagnostic and therapeutic applications – cancer and autoimmune diseases. Problems related to monoclonal antibodies.

PRACTICALS   (T:6Hours/Week)

1. Comparative evaluation of marketed sustained release tablets and data treatment.

2. Preparation and evaluation of matrix tablets using natural polymers.

3. Preparation and evaluation of matrix tablets using synthetic polymers.

4. Preparation and evaluation of microspheres by solvent evaporation.

5. Preparation and evaluation of muco- adhesive microspheres by ionic gelation method.

6. Preparation and evaluation of microspheres by temperature change method.

7. Preparation and evaluation of microcapsules by wax embedded method.

8. Preparation and evaluation of buccal patches.

9. Preparation and evaluation of buccal tablets.

10. Preparation and evaluation of transdermal films.

11. Evaluation of the effect of various permeation enhancers on transdermal drug delivery.

12. Preparation and evaluation of hydrodynamically balanced tablets.

13. Preparation and evaluation of ocular *insitu* gel.

SCHEME OF EXAMINATION

1. Synopsis   - 20 marks

2. Experiment

a) Formulation   - 35 marks

b) Evaluation   - 25 marks

3. Viva-voce   - 20 marks

   Total: **100 marks**

REFERENCES

1. Chien YW., Novel drug delivery systems, 2nd edition, revised and expanded, Marcel Decker, Inc., New York, 1992.
2. Robinson JR., Lee VHL. Controlled drug delivery systems, Marcel Decker, Inc., New York,1992.
3. John Wiley and sons, Inc, Encyclopedia of controlled delivery, Editor-Edith Mathiowitz, Published by Wiley Interscience Publication, New York/Chichester/Weinheim
4. Jain NK., Controlled and novel drug delivery, CBS Publishers & Distributors, New delhi,First edition 1997 (reprint in 2001)
5. Vyas SP., Khar RK., Controlled drug delivery-concepts and advances, Vallabh Prakashan, New Delhi, first edition 2002.
6. Indian Pharmacopoeia 2010. Volume-I, II & III, Indian Pharmacopoeia Commission. New Delhi.
7. United States Pharmacopoeia, US Publications, US
8. British pharmacopoeia
9. Howard C. Ansel, Nicholas G., Popovid loyd, Allen junior BI. Pharmaceutical dosage forms & drug delivery systems. Waverly pvt, Ltd, New Delhi, Sixth edition
10. Leon Lachman, Lieberman, Kanig JL., Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Bombay, 3rd Edition, 1987.
11. Banker and Rhodes, Modern Pharmaceutics, Marcel Decker Inc., New York, 2nd Edition, 1990.
12. Ansel HC., Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams and Wilkins, New York, 7th Edition, 2000.
13. Remington, the Science and Practice of Pharmacy, Lippincott Williams, 21st Edition, 2000.
14. Patrick J. Sinko. Lippincott Williams and Wilkins. Martin's physical pharmacy and pharmaceutical sciences. Fifth edition.
15. Wilium Alfred Martin P, Bustamante AH., Chun. Physical Pharmacy, B. I. Waverly Pvt Ltd, new Delhi, 4th edition 1995
16. S.Bharath. Pharmaceutical Technology-Concepts and Applications, Pearson Education in South Asia, First edition,2013.

JOURNALS

1. Indian Journal of Pharmaceutical Sciences (IPA)

2. Indian drugs (IDMA)

3. Journal of Pharmaceutical Education and Research

4. Dissolution Technologies
5. Journal of Controlled Release (Elsevier Sciences), desirable

6. Drug Development and Industrial Pharmacy (Francis and Taylor) desirable

7. European journal of Pharmaceutical sciences

8. European Journal of Biopharmaceutics

9. International Journal of Pharmaceutics

10. Journal of Pharmaceutical Sciences

11. DARU: Journal of Pharmaceutical Sciences

12. Asian Journal of Pharmaceutical Sciences

13. AAPS Pharma Sci Tech

14. Advances in Drug Delivery Reviews

15. Rajiv Gandhi Journal of Pharmaceutical sciences

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