Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2023-2024
Course Handout Part II

Date: 28-12-2023

In-addition to Part – I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No : **PHA G617**
Course Title : Advanced Drug Delivery Systems
Instructor-in-charge : Prof. Swati Biswas

1. **Course Description:** ADDS is an advanced-level course designed to give students an overview of various novel drug delivery systems and their developmental strategies. The focus will be mainly on the designing strategies, formulation approaches, and physicochemical characterization procedures of various nanomedicines.

2. **Scope and objective of the course:** The scope of the course is to provide an understanding of various advanced drug delivery systems (ADDS), the process of development, techniques for their characterizations, and the utility of the ADDS in biological systems.
   The prime objective of this course is to impart knowledge of the design, development, and evaluation of novel drug delivery systems (NDDS). The primary focus would be to understand the biopharmaceutical, physicochemical and physiological parameters affecting the design and development of NDDS. The nano-therapeutic intervention of various diseases and the design and development of targeted and stimuli-sensitive nanocarriers will be discussed.

3. **Learning outcome:**
   - Students will learn how to prepare various nanomedicines, including liposomes, polymeric micelles, solid lipid nanoparticles, neosomes, transferosomes, polymeric nanoparticles, protein nanoparticles, and inorganic nanoparticles.
   - Students will learn various strategies for targeting drugs to the disease site via various nanomedicines
   - Students will learn how the disease site-associated stimuli are utilized to prepare ‘smart’ drug delivery systems for targeted delivery and payload release.
   - Students will learn the procedures to characterize the nanoparticles physicochemically.

4. **Text Book:**

Tyle, P. Specialized Drug Delivery Systems- Manufacturing and Production Technology, Marcel Dekker, New York, 1990

5. Reference Books:

i. Prescott, L.F., and Nimmo, W.S. Novel Drug Delivery, John Wiley & Sons, Chichester, 1989.
ii. McNally, E. J. Protein Formulation and Delivery, Marcel Dekker, New York, 2000.
iii. Frokjaer, S., and Hovgaard, L. Pharmaceutical Formulation Development of Peptides and Proteins, Taylor and Francis, London, 2000.

6. Course Plan:

A. Theory:

Lect. No.	Learning Objectives	Topics to Covered	Ref. Chap/Sc # (Book)
1-2	Overview of NDDS, Opportunities and challenges	General Introduction	T.1 CH.1
3-8	Various aspects affecting design, development, and selection of NDDS	Physicochemical, Biopharmaceutical, and Physiological factors important for design of NDDS	R.3 CH. 2 &7
9-14	Techniques used for the development of NDDS (in general) and their characterization	Various Techniques involved in development of NDDS, and characterization techniques, including particle size distribution, zeta potential, IR, XRD, DSC, etc.	R.3 CH. 2 &7
15-20	Targeted Drug delivery	Various drug delivery systems for site-specific targeting	R.3 CH.9,25,&32
21-26	Stimuli-sensitive drug delivery	Micro-environment sensitive, thermo, light, and ultra-sound sensitive systems	Class-notes
27-30	Drug delivery of proteins and peptides	Fundamental considerations in the design of Protein/Peptide-based delivery systems	T.1 CH.6, R.1 CH.29, R.2 CH.5
31-33	Advanced drug delivery systems for GIT-related diseases	Drug delivery to stomach, small, and large intestines	These are advanced topics and will be covered using journal articles. Federal guidelines keep on changing, so the latest guidelines would be covered.
34-36	Advanced drug delivery systems for ocular diseases	Drug delivery for various disease conditions, including infections, glaucoma, choroidal neovascularization	
37-42	Lipid-Based Drug Delivery Systems, including liposomes, neosomes, transferosomes, solid lipid nanoparticles, nanostructured lipid carriers, and carbon-based nanomaterials	Design of lipid drug delivery systems. Characterization and evaluation	

Lab plan:

Practical No.	Experiment Title
1	Preparation and characterization of curcumin-loaded solid lipid nanoparticles by the solvent evaporation method.
2	Preparation and evaluation of curcumin-loaded liposomes by thin-film hydration method.
3	Preparation and evaluation of ciprofloxacin-loaded transdermal patch.
4	Preparation and characterization of Curcumin-loaded polymeric microsphere.
5	Preparation and characterization of gelatin microsphere.
6	Preparation and characterization of ciprofloxacin-loaded polymeric nanoparticles.
7	Preparation and characterization of niosomes containing curcumin as a model drug.
8	Preparation and characterization of Calcium alginate beads containing Diclofenac sodium as a model drug.
9	Polymeric micellar nanoformulation for theragnostic and photothermal application
10	Formulation and characterization of poloxamer/pNIPAAm-based thermo-sensitive hydrogel containing Diclofenac sodium as a model drug.
11	Preparation and characterization of antibacterial drug-eluting contact lenses
12	Preparation and characterization of manganese dioxide nanoparticles
13	Xanthan gum-stabilized gold nanoparticles for curcumin delivery: Preparation and characterization

7. Evaluation Scheme:

Components	Duration	Weightage	Date and Time	Nature of component
Mid-semester test	90 minutes	30 %		closed Book
Lab work	Continuous	20 %	continuous	Open book (20 %)
Quiz (in class)	20 min	5 %	To be announced	Open book (5 %)
Seminar/assignment	15-20 min	5 %	Post-mid sem	Open book (5 %)
Comprehensive Examination	180 minutes	40%		Closed book (30 %) Open book (10 %)

8. **Mid-Semester Evaluation:** This Will be announced after the mid-semester test.

9. **Make-up:** Prior approval or intimation to take a make-up is a must. It is solely the discretion of the instructor-in-charge dependent upon the genuineness of the circumstances to allow a student to appear for a make-up evaluation component.

10. **Grading policy:** As specified in Handout–Part I, appended to the timetable, the instructor in-charge reserves the right to award a NC report in case the student does not make himself/ herself available for any of the evaluation component mentioned above. Also, it is not imperative on part of the instructor in-charge to award all the grades. Borderline cases during grading will be judged based on regularity to classes and consistency or progress in the performance in evaluation components. The maximum pull-up to be exercised by the instructor in-charge will be announced in the class and shall be based on the subjective judgment of the evaluator.

11. **Chamber Consultation Hours:** To be announced in the class.

12. **Notices**: Notices concerning the course will be displayed in the CMS course page only.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester, and no type of academic dishonesty is acceptable.

Swati Biswas
Instructor-in-charge
PHA G617