



Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021
Course Handout Part II

Date: 11-08-2020

In-addition to Part – I (General Handout for all courses appended to the time table) 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
Instructors : Swati Biswas, Milan Paul, Asif Itoo
Google meet link: meet.google.com/nwp-jigp-irm

Description : A study of physicochemical and biopharmaceutical factors involved in the design of novel drug delivery systems like mucosal, particulate systems for systemic delivery of bioactive molecules. Special considerations for delivery of protein, peptide and other biological products. In vitro and in vivo evaluation of novel drug delivery systems.

1. Scope and objectives of the course:

Study on understanding the strategies to develop nano-formulations. Various delivery routes of advanced drug delivery systems, including oral, mucosal, nasal, buccal, ocular will be discussed. Understand the challenges and strategies for the delivery of protein, peptide and other biological products. Intervention of various diseases, including cancer, ocular diseases, diabetes, and infectious diseases by nano-formulations will be discussed. Targeted, and stimuli-sensitive drug delivery systems will be discussed. The scope of the course is to provide understanding on various advanced drug delivery systems (ADDS), the process of development, techniques for their characterizations and the utility of the ADDS in the biological systems.

The prime objective of this course is to impart knowledge of 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. Nano-therapeutic intervention of various diseases, and design and development of targeted and stimuli-sensitive nanocarriers will be discussed.

2. Learning Outcome:

- Knowledge of advanced drug delivery systems, including solid lipid nanoparticles, liposomes, micelles, inorganic nanoparticles, dendrimer, and other nano/microparticles.
- Ability to design and develop nano-formulations of any conventional therapy suitable for certain disease conditions.
- Ability to perform physico-chemical characterization of nano-formulations

- Thorough idea about the polymers, surfactants used to develop advanced drug delivery systems.

3. Text Book:

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

4. Reference Books:

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

5. A. Course Plan:

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 the design of NDDS	R.3 CH. 2 &7
9-14	Techniques used for development of NDDS (in general) and their characterization	Various Techniques involved in development of NDDS, characterization technique, 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	Basic 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.
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	Design of lipid drug delivery systems. Characterization and evaluation	Federal guidelines keep on changing so latest guidelines would be covered.
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B. Lab component:

Practical No.	Experiment Title
1	Preparation and characterization of Curcumin loaded solid lipid nanoparticles by a 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	Development and characterization of Curcumin loaded microsphere.
5	Development 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	Synthesis and characterization of PEG PLA micelles to load a hydrophobic drug.
10	Formulation and characterization of thermos-sensitive hydrogel containing Diclofenac sodium as a model drug.
11	Formulation and characterization of Curcumin loaded solid lipid nanoparticles by ultra-probe sonication method.
12	Preparation and evaluation of Curcumin loaded liposomes by ether injection method.

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Remarks
Test I	30 min	15	September 10-September 20 (during scheduled class hour)	Open book
Test II	30 min	15	October 09-October 20 (during scheduled class hour)	Open book
Test-III	30 min	15	November 10-November 20 (during scheduled class hour)	Open book
Surprise quizzes	15 min	15	during class hours	Open book

(3 in total)				
Lab component (viva + submission of reports and day- to-day activity)	Weekly	15	Continuous	Open book
Comprehensive Exam	120 min	25	01/12 FN	Open book

7. **Mid-semester grading:** will be announced after test-II.
8. **Chamber consultation hours:** To be announced in the class.
9. **Notices:** Notices pertaining to this course will be displayed **on CMS or by email**.
10. **Make-up Policy:** Make-up will be given only for **genuine** reasons.
11. **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.

Instructor-in-charge