BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-2021
COURSE HANDOUT

Date: 16.01.2021

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 F244**
Course Title : **Physical Pharmacy**
Instructor-in-Charge : **ANUPAMA MITTAL**
Instructor(s) : **None**
Practical Instructors: Sudeep Phukale, Arihant K Singh, Moumita Basak, and Nikita Hinge

1. Course Description: The course describes the relevance of various physiological, physico-chemical and biopharmaceutical properties of drug with respect to drug absorption, dosage form design, pre-formulation studies and therapeutic efficacy. It also discusses the various underlying principles involved in designing of particular dosage form.

2. Scope and Objective of the Course: This course deals with the applications of physiochemical principles like solubility, pKa, crystal structure, polymorphism etc. to formulation and stability of the API in different drug delivery systems. It also includes discussion on the surface properties, kinetics and rheology.

3. Text Books: Patrick J Sinko and Yashveer Singh. "Martin's Physical Pharmacy and Pharmaceutical Sciences". Lippincott Williams & Wilkins, 6th Edition, 2009.

4. Reference Books:

(i) David B. Troy and Paul Beringer, " Remington: The Science and Practice of Pharmacy, Lippincott Williams and Wilkins; 21st Edition, 2005.
(ii) Liberman, H and Lachmnan, L, Theory and Practice of Industrial Pharmacy". CBS; 4th Edition, 2013.
(iii) Liberman, H and Lachman, L, "Pharmaceutical dosage forms": Tablets Vol.2, Marcel Dekker, New York, 1980.
(iv) Liberman, H and Lachman, L, "Pharmaceutical dosage forms": Disperse systems Vol.1, Marcel Dekker, New York, 1987.

5. Course Plan:

Module No./Topics	Lecture session	Reference Chap/Sec	Learning outcomes
1. Introduction to Physical Pharmacy	Physical Pharmacy: Introduction and Application.	2(a) ch 14	Significance of physicochemical properties in dosage form designing
2-6. Polymorphs, solubility, pH, pKa, Log P etc.	Preformulation studies, Molecular optimization, pKa determination, Crystallinity and polymorphism, hygroscopicity, partition coefficient.	Ref (ii)	Understanding of each of the mentioned properties in depth, their determination and their role in designing the dosage form for a particular API.
7-10. Micrometrics	Powder characterization (Particle size, measurement & analysis), Types of powder	2(a) ch 16	Measurement of particle size and size distribution, significance of density, porosity and flow of powders in

	densities and quantitative estimation, flow properties of powders.		dosage form designing and packaging.
11-15. Rheology - Introduction	Concept of viscosity, Newtonian and Non-Newtonian systems, Thixotropy, Rheopexy, Temperature dependence of viscosity, single-point and multi-point viscometers and viscoelasticity, application of viscosity in delivery systems.	2(a) ch 17	Significance of rheological behavior in dosage form designing, measurement of viscosity for both Newtonian and Non-Newtonian systems. Selection of appropriate viscometer for a given fluid.
16-18. Determination of surface tension	Surface and interfacial tension, surface energy, determination of surface tension	2(a) ch 14	Significance of surface tension in dosage form designing and knowledge of various methods for determining surface tension
19-21. Adsorption at interfaces	Adsorption isotherms, types of adsorption, surface-active agents and classification, Hydrophilic-hydrophobic balance (HLB), Electrical properties at interface.	2(a) ch 14	Applications of adsorption at solid/liquid interfaces in pharmacy, how to reduce surface tension if required and selection of proper surfactant for a given application.
21-24 Diffusion & Dissolution	Principles of diffusion & dissolution, different dissolution apparatuses, Mathematical models & applications to drug release	2(a) ch 13	Significance of diffusion & dissolution in release of drug from the dosage form, selection of dissolution apparatus depending upon the type of dosage form, modeling of release kinetics.
25-28 Kinetics	Order of reactions & its determination & factors affecting the order of reaction	2(a) ch 12	Projecting shelf life of an API and how to control factors responsible for degradation of formulations during storage.
29. Stability testing	Different types of stability testing and recommended conditions for stable formulations	2(a) ch 12	Significance of different types of stability testing in dosage form.
30-32 Colloids	Types and applications of colloids in pharmacy & molecular weight determination	2(a) ch 15	Properties of colloids and their importance and their applications in pharmacy
33-34. Suspensions	Evaluation of physical stability, electrical properties and formulation of suspensions	2(a) ch 18	Application of the above discussed physicochemical properties in formulation of suspensions.
35. Emulsions	Types, properties, evaluation of stability and formulation of emulsions.	2(a) ch 18	Application of the above discussed physicochemical properties in formulation of emulsions.

36-38. Complexation	Classification of complexes and method of analysis	2(a) ch 11	Applications of complexes in dosage form designing

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Remarks
Mid Term Test	90 min	25	As in timetable	CB/OB or both
Assignment/Surprise Quiz #/Seminar	--	15	During the lecture hours	Multiple Quizzes will be conducted and average will be taken for final total
Comprehensive Exam	3 hrs	35	12/05/19	CB/OB or both
Laboratory component	2h/week	25	Tuesday (H1-2)/ Thursday (H10-11)	Laboratory attendance is must and no make-up will be given

[$]Students are strongly advised to prepare their own notes based on class lectures and relevant information from textbook and reference material, as only these notes would only be allowed for consultation during assessments of open book evaluation components. Photocopies of any material, written or printed will not be permitted. Stapled sheets , loose sheets of information written or printed will not be allowed.

*Slides used during class hours provide key information for which additional supportive information is expected to be collected from sources aforementioned. Recent developments in the area/topic will be discussed in class based on their significance to healthcare delivery and hence some information on therapeutic benefits and toxicity effects, besides others, may differ from the information in text, reference material and hence students are expected to take note of such key discussions during contact hours. Such discussions held in class will be considered as primary source of information in assessments.

[#] Quiz(zes) may/will be conducted as a part of evaluation component, at random, during contact hours including lecture, tutorial hours, as convenient, with/without prior intimation and sometimes outside class contact hours (for both theory and practical) and hence it is expected that the students come prepared to every class on topics covered in earlier contact hours. Regular classes will be held in designated tutorial hour to maintain continuity.

7. Mid-Sem. Grading would be done once at least 30-40 % evaluation components are completed.

8. All evaluation components are equally important, irrespective of weightage. Hence, students failing to attend scheduled classes, or absenting themselves in one or many of the evaluation components, may become ineligible for obtaining a valid grade at the end of the semester. Attendance in lectures, tutorials and practicals are all equally important as they are all integral components of learning, irrespective of weightage and may be taken into consideration, during grading.

Hence, students are strongly advised to keep away from absenting themselves from all aforementioned contact sessions. Clearing the course would require adequate performance in written quizzes, tests**, examinations**, and in practical (laboratory) components, separately (i.e. procuring low marks in evaluation components, aforementioned**, other than laboratory practicals, would not suffice, to clear the course).**

9. Any other adaptive changes in the handout, will be announced in class, if any.

10. Reading Assignments: Students are advised to read, collect additional information on the above mentioned topics as per given schedule.

11. Chamber consultation hours: Wednesday 03:00-04:00 pm.

12. Notices: Notices concerning the course will be displayed on NALANDA only.

13. Make-Ups: Make-Ups are not given as a routine. It is solely dependent upon the GENUINENESS OF THE CIRCUMSTANCES under which a student fails to appear in a scheduled evaluation component. In such circumstances, prior permission should be obtained from the Instructor-in-Charge. In no case the make-up letter be slipped inside the chamber of the Instructor-In-Charge. The decision of the Instructor-in-Charge will be final.

Instructor-in-charge
PHA F244