**The University of Jordan**

**Faculty:** Pharmacy
**Department:** Pharmaceutics and Pharmaceutical Technology
**Program:** BSc. of Pharmacy
**Academic Year/ Semester:** 2013/2014/ 1st semester
**Course Name (Course Number):** Physical Pharmacy – (Physical Pharmacy)

| | | | | | |
|---|---|---|---|---|---|
| **Credit hours** | 1 | **Level** | 3rd Year | **Pre-requisite** | Pharmaceutical Compounding (1202232) |
| **Coordinator/ Lecturer** | | **Office number** | | **Office phone** | |
| **Course website** | | **E-mail** | | **Place** | |

| **Office hours:** | | | | | |
|---|---|---|---|---|---|
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| | | | | | |

## Course Description

A practical course in physical pharmacy focusing on observing physcichemical phenomena at work in pharmaceutical dosage forms and systems

## Learning Objectives

1. To provide students with an understanding of the physico-chemical principles at work in pharmaceutical systems.

2. To provide students with the ability to utilize these principles in the design of active drugs and pharmaceutical dosage forms.

3. To provide the students with the ability to analyze the relationship between the physicochemical principles, pharmaceutical formulations and biological activity of drugs.

4. To act as a link between the basic courses (General Chemistry, Organic Chemistry, Biochemistry and Physiology) and the more applied courses (Industrial Pharmacy, Biopharmaceutics and Pharmacokinetics).

## Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

### 1. Knowledge and understanding:

1.1. To be able to explain the significance of distribution phenomena in pharmaceutical systems and in the bioavailability of drugs.

1.2. To estimate the risk and importance of drug complexation.

1.3. To discuss the different modes of drug decomposition.

1.4. To understand the contribution of diffusional processes process of drug absorption.

1.5. To understand the origin and the consequences of the interfacial phenomenon.

**2. Intellectual Skills:**

2.1. To associate the extraction process variables with the theory of distribution to achieve an efficient extraction.

2.2. To predict possible complexation related problems in pharmaceutical systems based on chemical structures.

2.3. To analyze pharmaceutical degradation data and relate it to drug stability.

2.4. To correlate permeability and diffusion properties of drug material to bioavailability.

2.5. To correlate the concepts of interfacial phenomena with the formulation and stability of colloidal preparations.

**3. Subject Specific Skills:**

3.1. To be able to develop an extraction procedure.

3.2. To be able study and analyze drug complexes.

3.3. To be able to estimate shelf lives and suitable storage conditions for a drug formulation.

3.4. To specify the factors affecting the bioavailability of drug substances.

3.5. To relate the stability of colloidal dosage forms to the interfacial properties of its components.

## 4. Transferable Skills:

4.1. To be able to meet deadlines for homework's and assignments

4.2. To be able to work effectively in a team

4.3. To be able to handle experimental data and draw scientific conclusions

**ILOs: Learning and Evaluation Methods**

| ILO/s | Learning Methods | Evaluation Methods |
|---|---|---|
| | 1. Lectures<br>2. Tutorials<br>3. Laboratory<br>4. Assignments, reports and Projects<br>5. Case studies | **1) Exams:**<br>First Exam: 5th week<br>Second Exam: 10th week<br>Final Exam 14th week<br>**2) Projects and Assignments:**<br>Are to be submitted in the lecture following the lecture they were given at unless otherwise instructed. |

**Course Contents**

| Content | Reference | Lecture # | ILO |
|---|---|---|---|
| Solubility, Miscibility, Distribution Law and its pharmaceutical relevance | | Lecture 1 | 1, 2, 3, 4 |
| Effect of ionic dissociation and molecular association on distribution | | Lecture 2 | |
| Extraction, solubility and partitioning coefficient, preservative action in oil-water systems | | Lecture 3 | |
| Definition of complexes, donor-acceptor interactions, Lewis acid-base system, types of complexes | | Lecture 4 | |
| Metal ion complexes, chelates and organic molecular complexes | | Lecture 5 | |
| Inclusion complexes, pharmaceutical applications and quantitative analysis of complexation (stoichiometric ratio determination and association constants | | Lecture 6 | |
| Methods of continuous variation, distribution method, solubility method, pH titration method and spectroscopy and charge transfer complexation. | | Lecture 7 | |
| Protein binding and its equilibria, effects on drug therapy, analysis of protein binding (equilibrium dialysis, dynamic dialysis and ultrafiltration) | | Lecture 8 | |
| First Exam | | Lecture 9 | |
| Definition or reaction rate, rate constant, order of reaction, pharmaceutical relevance, concentration dependency and determination of order. | | Lecture 10 | |
| Rate law, units of rate constants, zero order reactions and apparent zero order reactions. | | Lecture 11 | |
| First order reactions and second order reactions, integrated rate laws and half-life. | | Lecture 12 | |
| Complex reactions kinetics (reversible, parallel and series reactions). | | Lecture 13 | |
| Effect of temperature on reaction rates and Arrhenius equation. | | Lecture 15 | |
| Classical Collision theory and Transitional State Theory. | | Lecture 16 | |
| Effect of solvent, dielectric constant and ionic strength on rates | | Lecture 17 | |
| Pharmaceutical stability problems (hydrolysis, oxidation, photodegradation, …) | | Lecture 18 | |
| Solid-state kinetics and determination of shelf life. | | Lecture 19 | |

| | | | |
|---|---|---|---|
| Diffusion definition, mechanisms, pharmaceutical applications. | | Lecture 20 | |
| Ficks first law, second law and steady state diffusion. | | Lecture 21 | |
| Definition of dissolution and dissolution rate, Noyes-Whitney equation. | | Lecture 23 | |
| Dissolution rate determination, cube root law, drug release from tablets. | | Lecture 24 | |
| Diffusion controlled drug delivery (reservoir systems). | | Lecture 25 | |
| Diffusion controlled drug delivery (matrix systems) and the Higuchi equation. | | Lecture 26 | |
| Gastrointestinal absorption of drugs, percutaneous absorption of drugs. | | Lecture 27 | |
| Concepts of surfaces, interfaces, surface and interfacial tension. | | Lecture 28 | |
| Wetting of solid surfaces, spreading of liquids over liquid substrates. | | Lecture 29 | |
| Adsorption at solid surfaces, adsorption isotherms. | | Lecture 30 | |

**Learning Methodology**

1. Lectures
2. Tutorials
3. Laboratory
4. Assignments, reports and Projects
5. Case studies

**Projects and Assignments**

To be determined

**Evaluation**

**1) Exams:**

First Exam: 5th week

Second Exam: 10th week

Final Exam 14th week

**2) Projects and Assignments:**

Are to be submitted in the lecture following the lecture they were given at unless otherwise instructed.

**Main Reference/s:**


1. Physico-Chemical Principles in Pharmacy, Florence, A. T. and Attwood, D., 1985, McMillan Publishing, London.
2. Pharmaceutics: The Science of Dosage Form Design, Aulton, M. E., Ed., 1988, ELBS, London.
3. Pharmaceutical Calculations, Stoklosa, M. J. and Ansel, H. C., 1988, Lea and Febiger, USA.
4. Bently's Textbook of Pharmaceutics, Rawlins, E. A., 8th Edition, 1984, ELBS, London.
5. Ramington's Pharmaceutical Sciences.