# PHC 213
# Course Specification

*Internal Quality Assurance Arrangements*

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| Institution: King Saud University |
| College/Department: College of Pharmacy/Department of Pharmaceutical Chemistry |

## A Course Identification and General Information

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| 1. Course title and code: Pharmaceutical Analytical Chemistry / **PHC 213** |
| 2. Credit hours: 3 (2 +1) |
| 3. Program(s) in which the course is offered: B.Sc. and Pharm. D |
| 4. Name of faculty member responsible for the course: To be announced |
| 5. Level/year at which this course is offered: Level 3 |
| 6. Pre-requisites for this course: CHEM105 |
| 7. Co-requisites for this course: NA |
| 8. Location if not on main campus: |

## B Objectives

By the end of the course the student will have mastered the following knowledge and skills:

- The student will be able to check the feasibility of the titrimetric reactions.
- The student shall be able to derive the titration curve and choose the suitable indicator.
- The student will be able to calculate the percentage purity of solid (powdered) samples and the concentration of liquid samples.

- The student will be able to obtain the absorption spectrum of the light-absorbing compound, calculate its molar absorptivity, defined its $\lambda_{max}$ and apply Beer's law for calculation of its concentration.
- The student will have knowledge on the principles of chromatographic separation of pharmaceutical compounds in a mixture.

## C. Course Description

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| يختص هذا المقرر بالتقديم للكيمياء التحليلية الصيدلية وينقسم المقرر إلى قسمين : التحليل الحجمي والتحليل الآلي ، وكلا القسمين يشمل موضوعات متعددة من طرق التحليل الكمي . تقدم كل طريقة من طرق التحليل الأسس النظرية والمعاملات الرياضية واستنباط القوانين اللازمة للحسابات النهائية والتطبيقات الخاصة بكل طريقة في مجال التحليل الصيدلي. |
| Pharmaceutical analytical chemistry is the science and art of determining the composition of materials in terms of the elements or compounds contained in them. The course will include introduction to both volumetric and instrumental methods of analysis. The course will cover the basic principles of each method, mathematical treatment, laws, calculation, advantages and limitations and finally, the applications of each method. More attention will be given to its application in the field of pharmaceutical analysis. |

**PHC 213 (Pharmaceutical Analytical Chemistry) LECTURES' OUTLINE**

| Week | Lecture number | Date | Topic |
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| 1 | 1 | | **Acid-Base Titrations**<br>Theories of acids and bases |
| | 2 | | pH of strong acids and bases, weak acids and bases and salts. |
| 2 | 3 | | Buffer solutions. |
| | 4 | | Titration curves and acid-base indicators. |
| 3 | 5 | | Acid-base titrations in non-aqueous medium. |
| | 6 | | **Precipitation and Complex-formation Titrations**<br>Principles of precipitimetric titrations |
| 4 | 7 | | Methods of precipitation titrations. |
| | 8 | | Principles of complexometric titrations. |
| 5 | 9 | | Titration curves of complexometric titrations |
| | 10 | | **Oxidation-Reduction Titrations**<br>Theories and definitions for of oxidation- |

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| | | | reduction reactions |
| 6 | 11 | | Nernst equation and oxidation potential of redox system. |
| | 12 | | Redox titration curves. |
| 7 | 13 | | Detection of end point in redox titrations. |
| | 14 | | **Ultraviolet-visible spectrophotometry** The electromagnetic spectrum |
| 8 | 15 | | Laws of light absorption |
| | 16 | | Molecular absorption spectra |
| 9 | 17 | | Instrumentation of spectrophotometry |
| | 18 | | Spectrophotometric method development |
| 10 | 19 | | Application of spectrophotometry in quantitative analysis |
| | 20 | | Application of spectrophotometry in quantitative analysis |
| 11 | 21 | | **Introduction to high performance liquid chromatography (HPLC)** General description and types of chromatography |
| | 22 | | Principles of HPLC |
| 12 | 23 | | Instrumentation of HPLC. |
| | 24 | | Chromatogarphic parameters |
| 13 | 25 | | Selection and optimization of HPLC method |
| | 26 | | Validation of HPLC method |
| 14 | 27 | | Qualitative analysis by HPLC |
| | 28 | | Quantitative analysis by HPLC |

**PHC 213 Laboratory Project's Outline**

| Week | Topic | Project |
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| 1 | Acid-Base titrations | ▪ Preparation and standardization of 0.1 N HCl.<br>▪ Determination of borax.<br>▪ Determination of boric acid. |
| 2 | Acid-Base titrations | ▪ Determination of aspirin.<br>▪ Determination of ammonium salts.<br>▪ Non-aqueous titration of papaverine HCl. |
| 3 | Precipitation Titrations | ▪ Determination of chloride by Mohr's method.<br>▪ Determination of bromride by Volhard's method.<br>▪ Determination of iodide by Fajan's method. |

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| 4 | Complexometric Titrations | ▪ Determination of zinc sulphate.<br>▪ Determination of calcium and magnesium in a mixture.<br>▪ Determination of iodide by mercuric ions. |
| 5 | Oxidation-Reduction titrations | ▪ Preparation and standardization of 0.1 M potassium permanganate.<br>▪ Assay of hydrogen-peroxide.<br>▪ Assay of Ferrous sulphate in tablets.<br>▪ Bromometric determination of aspirin |
| 6 | Oxidation-Reduction titrations | ▪ Bromometric determination of phenol.<br>▪ Bromometric determination of isoniazide.<br>▪ Analysis of tincture iodine.<br>▪ Determination of calcium lactate. |
| 7 | Practical Exam-1 | |
| 8 | Spectrophotometric Analysis. | ▪ Absorption spectra of aniline and phenol and effect of pH. |
| 9 | Spectrophotometric Analysis | ▪ Absorption spectrum of potassium dichromate.<br>▪ Verification of Beer's Law and calculation of $A_{1\,cm}^{1\%}$ and molar absorptivity.<br>▪ Absorption spectrum of sulphacetamide in 0.1 M HCl. |
| 10 | Spectrophotometric analysis | ▪ Analysis of two-components mixtures.<br>▪ Analysis of vitamin $\beta_1$ and vitamin $\beta_6$ in ampoules.<br>▪ Analysis of caffeine and paracetamol in tablets. |
| 11 | HPLC | ▪ Inspection of typical chromatograph and calculation of the resolution, NTP and HETP. |
| 12 | HPLC | ▪ Separation of multi-component mixture. |
| 13 | HPLC | ▪ Quantitative analysis of multi-component mixture |
| 14 | Practical Exam-2 | |

| 2 Course components (total contact hours per semester): | | | |
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| Lecture: 28 | Tutorial: NA | Practical/Fieldwork/Internship: NA | Other: 14 Lab. |

| 3. Additional private study/learning hours expected for students per week. NA |
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| 4. Development of Learning Outcomes in Domains of Learning. NA |
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| **a. Knowledge** |
| (i) Description of the knowledge to be acquired |
| (ii) Teaching strategies to be used to develop that knowledge<br>1- Lectures<br>2- Labs<br>3- Assignments |
| (iii) Methods of assessment of knowledge acquired<br>1- Exams<br>2- Quizzes<br>3- Assignments |
| **b. Cognitive Skills:** NA |
| **c. Interpersonal Skills and Responsibility:** NA |
| **d. Communication, Information Technology and Numerical Skills:** NA |
| **e. Psychomotor Skills (if applicable):** NA |

5. Schedule of Assessment Tasks for Students During the Semester

**COURSE EVALUATION:**

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| Continuous Assessment: | |
| First Assessment Test | 15% |
| Second Assessment Test | 10% |
| Term Activity* | 10% |
| Laboratory Test | 10% |
| Final Laboratory Test | 15% |
| Total | 60% |
| Final Examination: | |
| Final Paper test | 40% |
| Total Marks | 100% |

## D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

1- Faculty web-page with communication tolls.
2- 2 office hours
3- Lab assistance (Lab technician)

## E. Learning Resources

1. Required Text(s): NA

2. Essential References: NA

3- Recommended Books and Reference Material:

- Fundamentals of Analytical Chemistry, Douglas A. Skoog and Donald M. West. Fourth edition. Sanders College Publishing, Philadelphia (2005).
- Analytical Chemistry, Douglas A. Skoog; Donald M. West, F. James Holter, Standey R. Crouch, 7th ed. Harcourt College Publishers (2000).
- Principles of Quantitative Chemical Analysis, Robert de Levie. McGraw Hill, New York (1997).
- Vogel's Textbook of Quantitative Inorganic Analysis, 4th ed. J. Baisett, R.C. Denney, G.H. Jefferg and J. Mendham, Longman, Essex (1978).

4-.Electronic Materials, Web Sites etc. NA

5- Other learning material such as computer-based programs/CD, professional standards/regulations NA

## F. Facilities Required

| Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.) |
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| 1. Accommodation (Lecture rooms, laboratories, etc.)<br><br>1- Lecture room<br>2- Lab |
| 3. Other resources NA |

## G Course Evaluation and Improvement Processes

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| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br><br>1- Students evaluation in each semester<br>2- Meeting with students<br>3- e-suggestions<br>4- Open door policy |
| 2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department<br><br>1- Self evaluation<br>2- Peer review<br>3- Annual outsider review<br>4- Conducting research |
| 3 Processes for Improvement of Teaching<br><br>1- Studying reports<br>2- Training of faculty.<br>3- Exchanging faculty between different institutions |
| 4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)<br><br>1- Taking a sample of assignments and exams to determine validity and reliability |
| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.<br><br>1- Collecting all reports and evaluations at the end of the year for a reviewing purpose.<br>2- Conducting a workshop to presents finding of reports and evaluation to share knowledge.<br>3- Reviewing results of reports and evaluations with outside reviewers |