2.12 COURSE OUTLINE

2.12.1 PHM 3241: INTRODUCTION TO ANALYTICAL CHEMISTRY

Pre-requisites: CHE 2302; CHE 2303; PHY 2333; CHE 2304

Credit Units: 3

2.12.2 Purpose of the course;

This course introduces the student to the common techniques used in contemporary analytical chemistry and covers the science of chemical separation, identification, and measurement. The student will learn the principles and applications of analytical methods, with emphasis on advanced separation science, dynamic electrochemistry, spectroscopy and mass spectrometry.

2.12.3 Expected Learning Outcomes of the Course;

At the end of the course, the student should be able to:

- Describe the theory of sampling, sample preparation and the preparation techniques
- Describe the application of different methods in biochemical analysis,
- Describe how to identify unknown compounds by spectroscopic and mass spectrometric methods and measure their concentrations in pharmaceutical samples
- Evaluate and discuss analytical chemical data from the literature,
- Solve problems using data acquired from chromatographic techniques.

2.12.4 Course Content;

Analytical approach: principles of quantitative analysis, errors, sampling; preparation, digestion, solvent extraction, ion exchange, matrix elimination/suppression, quality assurance, evaluating analytical data. **Classical methods**: acid-base, oxidation-reduction, precipitation, and complexion reactions; gravimetric analysis, titrametric analysis. **Spectroscopic**; principles of atomic and molecular absorption methods; atomic emission, molecular fluorescence. Chemiluminescence, bioluminescence. FIA Analysis; introduction to FIA Analysis. **Chromatographic;** introduction to chromatographic separations methods; gas chromatography, liquid chromatography, ion exchange chromatography, capillary zone electrophoresis. **Electrochemical;** introduction to oxidation/reduction reactions and methods electrochemical methods, electrochemical cells, potentiometric methods, electrogravimetric methods, voltametry and electrochemical sensors. **Miscellaneous**; introduction to chemical sensors, biosensors, ELISA's methods. Mass spectrometry (GC-MS, LC-MS, ICP-MS).

2.12.5 Mode of Delivery;

Lectures, power point presentations, and class discussions. These will take a participatory approach. **Laboratory learning and Experiments:** The lecturer, together with the laboratory technical staff, will take the students through practical sessions, beginning with **demonstrations**. The students will thereafter be expected to use pre formulated laboratory manuals to carry out various practical

exercises then write out their findings in their laboratory workbooks. **Video demonstrations and/or CD-Roms** on Analytical Chemistry when available, after the relevant topic has been covered. **Assignment criteria:** Students will be given several individual or group research assignments on topics relevant to the course. These could include lectures, discovery learning, problem-based learning, experimental learning, group-based learning, independent studies and e-learning.

2.12.6 Instructional Materials and/or Equipment;

Lecture notes or power points for presentation; Tutorials; Video demonstrations; CD-Roms; Text books; Laboratory demonstrations; analytical equipment and apparatus; Standard Operating Procedures for each equipment; chemical charts and atlases. Laboratory Manual.

2.12.7 Course Assessment;

2.12.7.1 Distribution of Marks

Attendance & Participation	5%
Continuous Assessment Tests /Quizzes	5%
Term Paper	10%
Oral examination	10%
Mid-Quarter Exam	15%
Final Exam	25%
Laboratory exercises	30%
Total	**100%**

2.12.7.2 Grading

90 - 100	A
87 - 89	A^-
84 - 86	B^+
80 - 83	B
77 - 79	B^-
74 - 76	C^+
70 - 73	C
67 - 69	C^-
64 - 66	D+
62 - 63	D
60 - 61	D-
00 - 59	F

2.12.8 Core Reading Materials for the Course

Hage, D. S., Carr, J. R. (2010). Analytical Chemistry and Quantitative Analysis: international edition. 1st Edition. Pearson Education, Upper Saddle River, New Jersey, USA

Harris, D. C. (2010). Quantitative Chemical Analysis. 8th Edition. Freeman, W. H. & Company, New York

2.12.9 Recommended Reference Materials;

Bard, A. J. (2011). Electrochemical Methods: Fundamentals and Applications. 2nd Edition. Wiley Science, Hoboken, NJ, USA

Katz, E. (2009). Quantitative Analysis Using Chromatographic Techniques. 2nd Edition. CBS Publishers & Distributors, New Delhi, India

Lambert, L., Gronert, S., Shurvell, H., Lightner, D., Cooks, R. G. (2010). Organic Structural Spectroscopy: International Edition. 2nd Edition. Pearson Higher Ed., USA

Mohrig, J. R., Hammond, C. N., Schatz, P. F. (2010). Techniques in Organic Chemistry. 3rd Edition. W. H. Freeman, New York

Scholz, F. (Ed. 2010). Electroanalytical Methods: Guide to Experiments and Applications. 2nd Edition. Springer, Berlin, Germany

Skoog, D. A., West, D. M., Holler, F. J., Crouch, S. R. (2013). Fundamentals of Analytical Chemistry. 9th Edition. Cengage Learning, Belmont, CA