Subject Description Form

Subject Code	ABCT4743
Subject Title	Advanced Analytical Techniques
Credit Value	3
Level	4
Pre-requisite	Analytical Chemistry II or Analytical Spectroscopy
Objectives	This subject provides students with background theory and applications of selected and current topics in advanced analytical techniques for chemical and biological analysis. These techniques are applicable to inorganic, organic, biological, industrial and environmental analysis.
Intended Learning Outcomes	Upon completion of this subject, students will be able to: a. demonstrate a good understanding on the working principles and applications of advanced chromatographic techniques, mass spectrometry, x-ray fluorescence spectroscopy, and selected rapid analytical techniques; b. recognise deeply the advantages and limitations of each analytical technique; c. integrate the knowledge gained to solve practical problems.
Subject Synopsis/ Indicative Syllabus	Mass Spectrometry Basic concepts: isotope, mass, resolution, mass accuracy, nitrogen rule, etc.; ionization techniques: electron ionization, chemical ionization, fast atom bombardment, electrospray, MALDI, etc.; mass analysers: magnetic sector, TOF, quadrupole, quadrupole ion trap, FT-ICR, etc.; MS/MS; GC/MS and LC/MS; ICP-MS; qualitative and quantitative applications. X-ray Fluorescence Spectrometry Absorption and emission of X-ray by matter; wavelength and energy dispersive instruments. Quantitative analysis methodology: sample preparation, matrix effects, methodology for computer-aided qualitative and quantitative analysis, applications. Advanced Separation Techniques Principles and applications of supercritical fluid chromatography, capillary electrophoresis, etc. Advanced Imaging Techniques Working principles and applications of scanning microscopy and atomic force microscopy. Rapid Analytical Techniques Structural and binding properties of antibodies; structural and catalytic properties of enzymes; antibody-antigen and enzyme-substrate interactions; enzyme linked immunosorbent assay (ELISA); radioimmunoassy (RIA); immunosensors; biosensors; fundamental principles and instrumentation of the systems; measurement techniques and result interpretations

<table>
<tr><td>Teaching/Learning Methodology</td><td>Lecture: basic principles will be introduced and discussed. Examples will be used to illustrate the applications of various techniques.

Tutorials: a set of tutorial problems will be given to allow students to apply the knowledge acquired from the lecture. Students are encouraged to solve the problems before seeking assistance. These will help students consolidate what they have learned and develop a deeper understanding of the subject.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Exam</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Test</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Test and examination are used to evaluate how much students have learned in principles and applications of various techniques.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>33 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self study</td><td>72 Hrs.</td></tr>
<tr><td>▪ Homework assignment</td><td>10 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>121 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td><u>Essential:</u>
Skoog D. A.; Holler F. J. and Nieman, T. A.
Principles of Instrumental Analysis (6th ed.) Brooks/Cole, 2007.

<u>Supplementary:</u>
De Hoffmann, E.; Stroobant, V.
Mass Spectrometry: Principles and Applications (3rd ed.) John Wiley & Sons 2007.

Jenkins, R.
X-ray Fluorescence Spectrometry (2nd ed.) Wiley-Interscience, 1999.

Manz, A.; Iossifidis, D. and Pamme, N.
Bioanalytical Chemistry. Imperial College Press 2004.</td></tr>
</table>

	Gault, V.A. and McClenaghan, N.H. Understanding Bioanalytical Chemistry: Principles and Applications Wiley-Blackwell 2009.