

**CORK INSTITUTE OF TECHNOLOGY**  
**INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Autumn Examinations 2012**

**Module Title:     Applied Separation Technology**

**Module Code:        BIOM8001**

**School:                Biological Sciences**

**Programme Title:**    Bachelor of Science (Honours) in Herbal Science – Year 3  
                                 Bachelor of Science (Honours) Nutrition and Health Science – Year 4

**Programme Code:**    **SHERB\_8\_Y3**  
                                 **SNHSC\_8\_Y4**

**External Examiner(s):**    Dr A. Gallagher, Dr J. Green  
**Internal Examiner(s):**    Mr Germain Levieille

**Instructions:**            **Answer any 4 of the 6 questions asked. Each question carries a equal mark weighing of 25%. Please state clearly the questions addressed in your paper.**

**Duration:**            2 Hours

**Sitting:**                Autumn 2012

**Requirements for this examination:**            Calculator

**Note to Candidates:** Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.  
If in doubt please contact an Invigilator.

- Q1. (a) What are the methods available to achieve separation of cells and biomass debris from a liquid maceration? (10 Marks)
- (b) Give an outline of the main principles guiding the separation for each of the available methods. (8 Marks)
- (c) Comment on the advantages and limitations of the methods mentioned in b). (7 Marks)
- Q2. (a) Detail the process of reverse osmosis. How does it work and what are its applications and limitations? (8 Marks)
- (b) Separations by reverse osmosis and by nanofiltration can be considered to achieve similar level of separation. Discuss the differences, similarities and relative advantages of these two methods. (10 Marks)
- (c) Which method would you choose to remove salt from seawater to obtain drinking water? Why? (7 Marks)
- Q3. (a) Explain the principle of gas chromatography? (8 Marks)
- (b) Give a description of main stationary phase used in gas chromatography. (7 Marks)
- (c) Discuss the applications of GC combined with Mass Spectrometry as analytical method to identify the chemical nature of natural products? (10 Marks)
- Q4. What is a supercritical fluid? (8 Marks)
- Supercritical fluid extraction can be use to extract volatile compounds such as essential oils. How does it work? Why would you choose to apply it instead of distillation? (12 Marks)
- Supercritical fluid can also be applied as mobile in supercritical fluid chromatography (SFC). How does it compare with HPLC and GC. (10 Marks)

- Q5. (a) How would you choose a HPLC method of quantification of a known natural compound in an extract? (5 Marks)
- (b) Indicate the factors to consider to optimise the method and detail the steps you would take to proceed in your optimisation. (10 Marks)
- (c) Discuss the plate theory of chromatographic separation. How does it help to understand and improve the quality of chromatographic separation of compounds in liquid column chromatography? (10 Marks)

- Q6. You have 1L of an aqueous solution containing 100.0 mM of compound C. This solution is extracted with 250.0 mL of diethyl ether and the aqueous phase is assayed and it is found that the concentration of compound C that remains is now at 20.0 mM.
- a) What is the equilibrium constant for this extraction system? (10 Marks)
- b) How much compound C will remain in aqueous solution after four extractions? (15 Marks)