

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

**Semester 1 Examinations 2011/12**

**Module Title:     Applied Separation Technology**

**Module Code:**        BIOM8001

**School:**                School of Science

**Programme Title:**    BSc (Honours) in Herbal Science  
                              BSc (Honours) Nutrition and Health Science

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

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

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

**Duration:**            2 Hours

**Sitting:**                Winter-Spring 2011/12

**Requirements for this examination:**

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

**Q1.** What are the methods available to achieve separation of cells and biomass debris from a liquid maceration? (10 marks)

Give an outline of the main principles guiding the separation for each of the available methods and comment on the advantages and limitations of each of these methods.

(15 marks)

**Q2.** (a) Details the process of reverse osmosis. How does it work and what are its applications and limitations? (10 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. (15 marks)

**Q3.** (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)

- Q4. (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)

Q5. Two substances A and B are separated by column chromatography. Their retention times are A: 5 min and B: 15 min, on a 20 cm column. The widths of the peak bases were 0.25 and 0.58 min respectively.

Calculate:

- (a.) column resolution; (5 marks)
- (b.) the average number of plates in the column; (5 marks)
- (c.) the average plate height; (5 marks)
- (d.) the resolution of these peaks; (5 marks)
- (e.) the minimum length of column sufficient to achieve a resolution of 2. (5 marks)

Q6. You have 2L of an aqueous solution containing 200.0 mM of compound C. This solution is extracted with 500.0 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 40.0 mM.

- (a) What is the equilibrium constant for this extraction system? (10 marks)
- (b) How much compound C will remain in aqueous solution after three extractions? (10 marks)
- (c) What will be the percentage of recovery of the compound C after the three extractions? (5 marks)