



RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B. Sc (Joint Major Chemistry-Physics/Applied Science) Degree

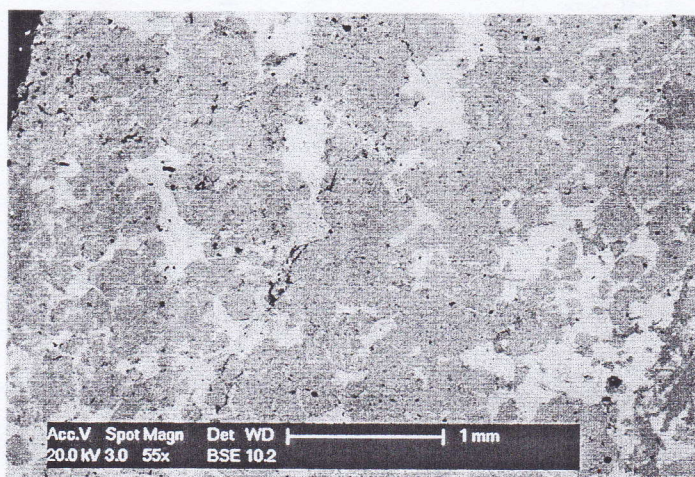
Fourth Year Semester I Examination – Oct / Nov 2015

PHY 4208 CHARACTERIZATION TECHNIQUES

Answer **all** questions

Time: 02 hours

1. (a) State and explain the *Rayleigh Criterion* for the resolution of two point sources.
- (b) Magnetic lenses are used in diverse applications such as cathode ray tubes, electron microscopy and particle accelerators. Explain briefly the focusing action of a magnetic lens.
- (c) “Divergent magnetic lenses do not exist”
Explain the above statement.
- (d) The Backscattered scanning electron micrograph of a polished cross section of a mixed chalcopyrite (CuFeS_2) / pyrite (FeS_2) composite is shown in the figure. Comment on the phase distribution and the porosity of the composite. [Atomic Numbers are: Cu (29), Fe (26) and S (16)].

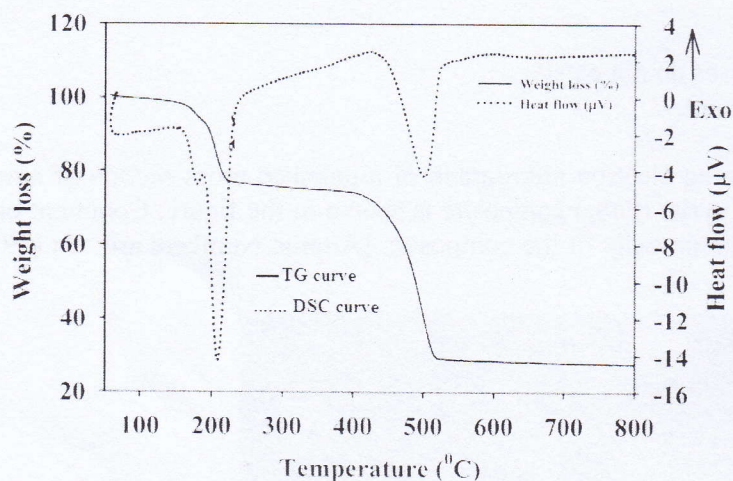


2. (a) With the aid of a labeled diagram illustrate the components of a MALDI-TOF.
- (b) Explain what is meant by desorption ionization and list 3 examples.
- (c) Explain the principle behind electro spray ionization (ESI).
- (d) Describe how post translational modifications (PTMs) could be identified using tandem MS.

3. (a) (i) Describe briefly how the TG technique is performed and sketch a typical TG and DTG plots for the decomposition of a mixture of MgCO_3 and $\text{CaMg}(\text{CO}_3)_2$ as given in the following scheme.



- (ii) Identify X and Y
 (iii) What are the advantages of DTG over TG?
 (iv) State the importance of TG in gravimetric analysis
- (b) Describe briefly how DSC differs from DTA and sketch a typical DTA plot for the melting of a pure metal.
- (c) Given below shows the thermal profile of the Magnesium oxalate dihydrate. Explain the profile completely with appropriate chemical reactions.

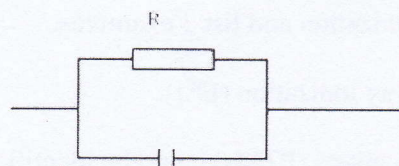


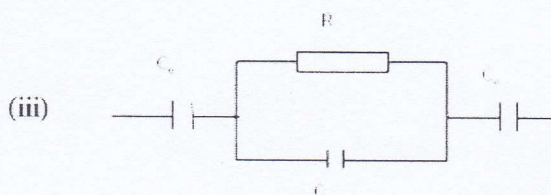
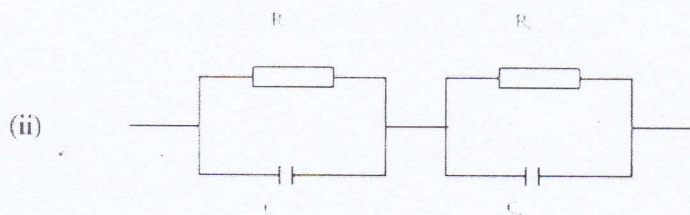
4. (a) Write short notes on:

(i) Dipole relaxation (ii) Ionic relaxation

- (b) Equivalent circuits that could be used in impedance analysis are shown in Figures *i*, *ii* and *iii*. Derive equations for the real and imaginary parts of the impedance for each circuit in terms of R , C and C_e .

(i)





- (c) What is the equivalent circuit suitable to represent electrolyte in non-blocking electrodes?
- (d) Show that complex impedance of the circuit in Fig (i) represent a semicircle in the complex impedance plot.