

**The American University of Beirut
Final Examination**

Optical Mineralogy (Geol 212)
Department of Geology
Dr. A. Abdel-Rahman

February 1, 2006
Time: 2 hours
Exam rules apply

1. (a) What are the degrees of stage rotation needed to cause the isogyres to split and leave the field of view, indicative for each of the four main types of biaxial interference figures? (5 marks).

(b) Briefly explain how one can determine the thickness of a thin section, given that the thin section contains a known mineral (as quartz) of a known numerical birefringence (use a diagram to illustrate your answer)? (5 marks).

(c) The diagram (Fig. 1, see below) shows in part the determination of indices of refraction, vibration directions, and ray directions (given a wave normal direction) within a biaxial mineral. Fully label this diagram. Describe the procedure to determine these parameters. (5 marks).

2. a) The diagram given below (Fig. 2) shows an orthorhombic crystal. Label the vibration directions of crystal faces (i) and (ii). Based on the labeled diagram, interpret the sign of elongation (+) or (-) for each face. (4 marks).

b) Describe in detail the fundamental operations for _____ method of determining the optic angle ($2V$) of a mineral (use diagrams and text to illustrate your answer). (11 marks).

3. Concisely define or describe the following terms (15 marks) :

a) Brewster's angle	b) Indicatrix
c) BXA	d) Snell's law
e) Apparent optic angle	f) Retardation
g) Fraunhofer lines	

4. a) Describe in detail the method of determining the refractive index of the gamma ray of an unknown biaxial mineral. (6 marks).

b) Using the diagram of figure 3 (see below), Determine the optic sign of the mineral. Label the refractive indices directly on this diagram. Explain why the optic sign of this mineral is interpreted to be (+) or (-). (9 marks).

5. a) Neatly sketch a fully labelled ZX plane (or principal section) of a biaxial, negative indicatrix. (5 marks).
- b) Describe in detail the Carlsbad-Albite method to determine plagioclase composition (or the An content). Use the necessary diagrams to illustrate your answer. (10 marks).