

## Examination Department

146TH EXAMINATION

## SPHERIC TRIGONOMETRY

Tuesday, June 15, 1897 — 1:15 to 4:15 p. m., only

100 credits, necessary to pass, 75

Answer 10 questions but no more. If more than 10 questions are answered only the first 10 of these answers will be considered. Division of groups is not allowed. In a spheric triangle  $A$ ,  $B$  and  $C$  represent the angles and  $a$ ,  $b$  and  $c$  the opposite sides. In a right triangle  $C$  represents the right angle and  $c$  the hypotenuse. Each complete answer will receive 10 credits.

1 Define *quadrantal triangle*, *polar triangle*, *pole of an arc*, *spheric excess*, *spheric polygon*.

2 Prove that in any spheric right triangle an angle and its opposite side are always in the same quadrant.

3 Derive formulas giving the value of  $\sin A$ ,  $\cos A$ ,  $\tan A$ ,  $\cos c$ , in terms of functions of  $a$ ,  $b$ , and  $c$ .

4 Mention in order Napier's circular parts and state the two principal rules for their use.

5 Prove that in any spheric triangle  
 $\cos A = \sin B \sin C \cos a - \cos B \cos C$ .

6 Given  $A$ ,  $B$  and  $C$ ; show how to find the remaining parts, writing the formulas to be used.

7-8 Given  $A$ ,  $B$  and  $a$ ; discuss the question of one solution, two solutions or no solution.

9-10 Given  $A$  and  $b$  of a spheric right triangle; derive formulas for computing each of the parts  $B$ ,  $a$  and  $c$  in terms of  $A$  and  $b$  only; also the check formula  $\cos B = \tan a \cot c$ .

11-12 Given the latitude and the longitude of each of two places; show how to find the shortest distance between these places, and the direction of one place from the other.

13-14 A triangle, whose sides are  $40^\circ$ ,  $90^\circ$  and  $125^\circ$  respectively, is drawn on the surface of a sphere whose radius is 8 feet; find in feet the length of each side of this triangle, and also the angles of the polar triangle. Write the formula for finding either angle in terms of functions of the sides.

15 A vessel sails along the parallel of  $60^\circ$  south latitude a distance of  $15^\circ$  of longitude; how many statute miles does she sail? ( $1^\circ$  of a great circle = 69.16 miles.)