GEORGIA INSTITUTE OF TECHNOLOGY

The George W. Woodruff
School of Mechanical Engineering

Ph.D. Qualifiers Exam - Fall Semester 2002

Tribology
EXAM AREA

Assigned Number (DO NOT SIGN YOUR NAME)

- Please sign your name on the back of this page—

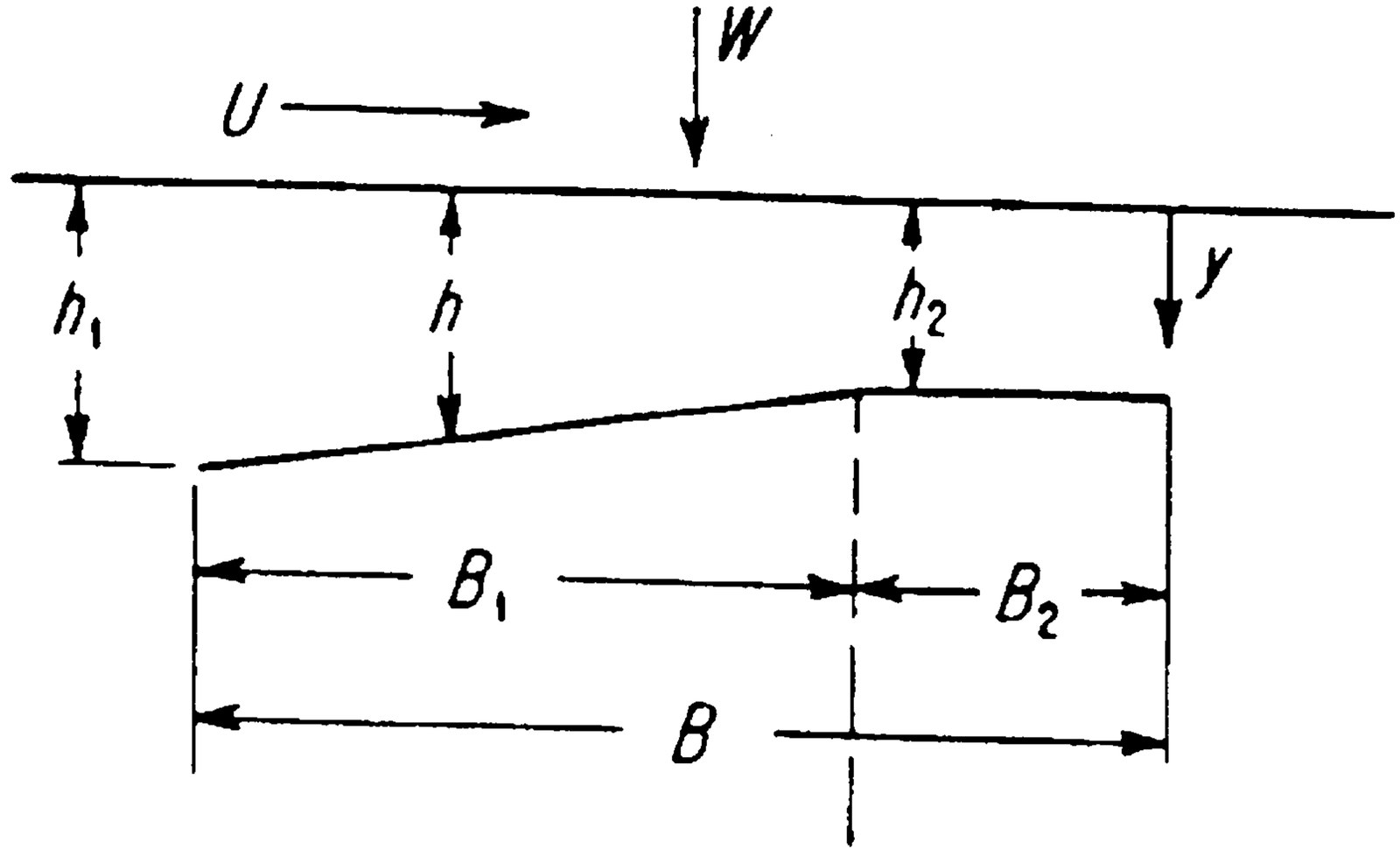
Please **p r i n t** your name here.

The Exam Committee will get a copy of this exam and will not be notified whose paper it is until it is graded.

Question 1

The bearing termed "composite" is shown in the figure below. It is made up of a combination of tapered-land and a flat-land. The bearing is "long" such that side flow is negligible. Determine the pressure distribution, and plot it schematically along the bearing.

NOTE: Concentrate on setting up the correct formulation for the problem, and justify assumptions if necessary. Only if you have sufficient time, work the math (which is not complex) to completion.



Question 2

a) In Hertzian contact, a sphere is modeled as a paraboloid in the vicinity of the contact region. Justify this approximation, mathematically.

b) Describe, in detail, how the Greenwood-Williamson model of rough surface contact utilizes Hertzian contact theory.

c) Describe a method to determine the average radius of curvature of the asperities on rough surface.

Question 3

Consider a system such as a disk brake on an automobile as essentially two nominally flat blocks with a flat circular disk clamped between them. Suppose the brakes are applied and held at a constant clamping force until the car comes to rest.

a) Draw a schematic of the system. Suppose you were required to predict the mean surface temperature of the pad as a function of time during the braking process.

   i) List the parameters you would need to know.

   ii) List the assumptions you would make.

   iii) Consider a point attached to the disk surface. Sketch the trend of the temperature of this point as function of time during the braking process.

b) Consider the following a case in which the elastic modulus of one pad is ten times as big as the other brake pad. On which brake pad will we find the higher temperature hot spots? Or will there be no difference in the peak temperatures? Justify your answer.