YELLOWHEAD REGION EDUCATIONAL CONSORTIUM

GEOGRAPHY 1310

INTRODUCTORY PHYSICAL GEOGRAPHY

FALL TERM, 1992
INSTRUCTOR: Jack Park

LECTURES: FRIDAY 9:00 - 12:00
LABS: FRIDAY 1:00 - 4:00

TEXT: Strahler, Alan and Arthur. Modern Physical Geography. Fourth Edition. Toronto: John Wiley and Sons, Inc. 1992. 638 p.

APPROACH: Introduction to the atmosphere and biosphere - Physical elements of weather and climate - Causes, changes and patterns of weather - Climatic classification - Interrelationship of climate, soils and vegetation. Laboratory work required.

EXAMS:
Lab Exam 1 - October 9
Midterm - October 23 (format: m/c, T/F, definition, essay)
Lab Exam 2 - November 20
Final - December 4 (format: m/c, T/F, definition, essay)

COURSE MARK:
Lab 1 - 15%
Midterm - 30%
Lab 2 - 15%
Final - 40%

MARKING SCHEME:

Final Course %	Final Mark
90 - 100	9
82 - 89	8
74 - 81	7
66 - 73	6
58 - 65	5
50 - 57	4
30 - 49	3
< 30	2

LAB SCHEDULE:
LAB 1 - SEPT. 4 - SOLAR RADIATION (EARTH/SUN RELATIONSHIPS)
LAB 2 - SEPT. 11 - INSOLATION
LAB 3 - SEPT. 18 - ATMOSPHERIC PRESSURE, PRESSURE SYSTEMS, WINDS
LAB 4 - SEPT. 25 - MOISTURE IN THE ATMOSPHERE
LAB 5 - OCT. 23 - MIDLATITUDE CYCLONIC WEATHER SYSTEMS
LAB 7 - OCT. 30 - WORLD CLIMATES
LAB 8 - NOV. 6 - VEGETATION AND CLIMATE

COURSE OUTLINE

TOPIC

1 ENERGY AND TEMPERATURE

Readings: pp. 10-16, 23, 25-28, 62-71, chapt. 3.

A. Methods of heat transfer
   1. Conduction
   2. Convection
   3. Radiation
      a. Wavelength
      b. Frequency
      c. Electromagnetic spectrum

B. Solar energy input to the top of the earth's atmosphere
   1. Earth-sun relationships
      a. The earth's tilted axis
      b. Sun angle
      c. Daylength
   2. Seasonality
      a. June solstice
      b. December solstice
      c. Autumnal equinox
      d. Vernal equinox

C. Composition and effects on radiation of the earth's atmosphere
   1. Non-varient gasses
      a. Nitrogen
      b. Oxygen
      c. Argon
   2. Varient gasses
      a. Carbon dioxide
      b. Water vapor
      c. Ozone
      d. Methane
   3. Aerosols

D. Vertical energy structure of the atmosphere
   1. Troposphere
   2. Stratosphere
   3. Mesosphere
   4. Thermosphere

E. Energy balance at the earth's surface
   1. Albedo
   2. Specific heat differences of land and water
   3. Local energy budget
   4. Latitudinal imbalance of solar radiation

TOPIC

2 GENERAL ATMOSPHERIC AND OCEANIC CIRCULATION

Readings: pp. 23-24, chapt. 5, 129-130, 137-139.

A. Atmospheric pressure
   1. Units of measurement
   2. Isobars and weather maps
   3. Formation of a simple convection cell

B. Advection
   1. Forces acting to produce winds
      a. Pressure gradient force
      b. Coriolis force
      c. Centrifugal force
      d. Friction
   2. Winds
      a. Geostrophic wind
      b. Gradient wind
      c. Surface winds

C. General circulation of the atmosphere
   1. Hypothetical circulation (rotating but homogeneous surface)
      a. Pressure cells
         1) Equatorial Low
         2) Subtropical High
         3) Subpolar Low
         4) Polar High
      b. Winds
         1) Trade Winds
         2) Westerlies
         3) Polar Easterlies
      c. Areas of calm
         1) Doldrums
         2) Horse Latitudes
      d. Convection cells
   2. Actual circulation (rotating and non-uniform surface)
      a. Seasonal reversal of pressure cells in northern hemisphere
         1) Siberian High
         2) Laurentian High
         3) Aleutian Low
         4) Icelandic Low
         5) Hawaiian High
         6) Bermuda High
      b. Monsoons

D. Circulation in the Midlatitudes
   1. Rossby Wave
   2. Jet Stream
   3. Polar Front

E. Local winds
   1. Land Breeze/ Sea Breeze
   2. Mountain Wind/ Valley Wind
   3. Anabatic Wind/ Katabatic Wind

F. Oceanic circulation
   1. Gyres
   2. Upwelling
   3. El Nino

TOPIC

3 MOISTURE IN THE ATMOSPHERE
Readings: Chapts. 6 and 7.

A. Transfer of water to the atmosphere
   1. Rules for evaporation
   2. Evapotranspiration

B. Measurement of humidity
   1. Barometers
   2. Absolute humidity
   3. Specific humidity
   4. Relative humidity

C. Condensation
   1. Requirements
      a. Relative humidity
      b. Condensation nuclei

   2. Clouds
      a. High family
      b. Middle family
      c. Low family
      d. Clouds with vertical development
   3. Fog
      a. Radiation
      b. Advection

D. Formation of precipitation
   1. Bergeron process
   2. Coalescence model

E. Temperature lapse rates
   1. Environmental lapse rate
   2. Dry adiabatic lapse rate
   3. Wet adiabatic lapse rate

F. Atmospheric stability and instability
   1. Absolute stability
   2. Absolute instability
   3. Conditional instability

G. Uplift mechanisms
   1. Orographic
      a. Windward precipitation
      b. Leeward rainshadow effect
      c. Mountain and valley breezes
      d. Anabatic and katabatic winds
   2. Convectional
      a. Land and sea breezes
      b. Thunderstorms
      c. Tropical cyclones
   3. Cyclonic
      a. Air masses and source regions
      b. Midlatitude cyclones and fronts
      c. Tornados
   4. Convergence

TOPIC

4 GLOBAL CLIMATES

Readings: Chapts. 8, 10, 11 and 12.

A. Climatic classification - examples
   1. Based on annual temperature
   2. Based on annual precipitation
   3. Based on monthly temperature and precipitation

B. Strahler Climates
   1. Low Latitude
      a. Wet Equatorial
      b. Monsoon and trade wind littoral
      c. Wet-dry tropical
      d. Dry tropical
   2. Midlatitude
      a. Dry subtropical
      b. Moist subtropical
      c. Mediterranean
      d. Marine west coast
      e. Dry midlatitude
      f. Moist continental
   3. High Latitude
      a. Boreal forest
      b. Tundra
      c. Ice sheet

C. Koppen climatic classification system
   1. Explanation of system
   2. Definition of climates
   3. Method of climatic determination

TOPIC

5 VEGETATION AND CLIMATE
Readings: pp. 484-488, 508-512, 519-540.

A. Ecological Energetics
1. Ecosystems and biomes
2. Ecological niches
3. Food chains and energy flow
4. Photosynthesis and plant respiration
5. Plant communities
6. Plant succession and climax

B. The Major Biomes
1. Forest
a. Low latitude rainforest
b. Broadleaf evergreen forest
c. Midlatitude deciduous forest
d. Cold needleleaf forest
e. Sclerophyll forest
2. Savanna
3. Grassland
a. Short-grass prairie
b. Tall-grass prairie
4. Desert
a. Semidesert, thorn forest, scrub
b. Desert shrub and desert
5. Tundra

TOPIC

6 SOILS
Readings: Chapts. 23 and 24.

A. Soil-forming processes
1. Weathering: the disintegration of rock
a. Physical
1) Thermal expansion
2) Unloading
3) Crystal growth
4) Biotic
5) Hydration
b. Chemical
1) Hydrolysis
2) Acid reactions
3) Oxidation
2. Translocation
a. Eluviation
b. Illuviation
c. Leaching
3. Organic activity
a. Nutrient recycling
b. Nitrogen fixation
c. Aeration

B. Properties of soils
   1. Texture
      a. Drainage and aeration
      b. Colloidal activity
   2. Structure
      a. Peds
      b. Flocculation
   3. Acidity
      a. pH
      b. CEC
   4. Color
      a. Causes
      b. Intensity
   5. Horizons
      a. O
      b. A
      c. B
      d. C
      e. R

C. Factors affecting soil development
   1. Parent material
   2. Climate
   3. Site
   4. Organisms
   5. Time

D. Canadian System of Soil Classification
   1. Brunisolic
   2. Chernozemic
   3. Cryosolic
   4. Gleysolic
   5. Luvisolic
   6. Organic
   7. Podzolic
   8. Regololic
   9. Solonetzic

TOPIC

7 THE HYDROLOGIC CYCLE AND LOCAL WATER BUDGET

Readings: Chapt. 9.

A. The global water budget
   1. Evapotranspiration
   2. Precipitation
   3. Runoff and streamflow
   4. Infiltration and soil moisture storage
   5. Groundwater

B. The local water budget
   1. Definition of variables
      a. Actual evapotranspiration
      b. Potential evapotranspiration
      c. Change in soil moisture storage

2. Calculation of water budget
   a. Water balance equation
   b. Calculation
      1) Surplus
      2) Deficit