REMOTE SENSING B - OBSERVABLE EARTH

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Participants will demonstrate an understanding of the basic principles of remote sensing and interpret imagery, data, and maps related to Earth observation.

   A TEAM OF UP TO: 2

   APPROXIMATE TIME: 50 minutes

   CALCULATOR: Class II

2. **EVENT PARAMETERS:**
   a. Each team may bring writing utensils.
   b. Each team may bring two Class II Calculators
   c. Each team may bring two protractors and two rulers.
   d. Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. If the event features a rotation through a series of laboratory stations where the participants interact with samples, specimens, or displays; no paper may be removed from the binder throughout the event.
3. **THE COMPETITION:** Participants will be given one or more tasks presented as an exam and/or timed stations. The event will consist of questions and activities testing concepts related to the collection and use of remote sensing data to observe the Earth. Questions should emphasize conceptual understanding and interpretation (e.g., qualitative patterns/trends, proportions, and relative comparisons) rather than advanced mathematical or physical derivations. Questions will address the following topics:
   a. Remote sensing concepts (25-35% of total points) Equations should be limited to those listed below. Only equations marked with an asterisk (*) may be tested quantitatively; all others must be assessed qualitatively.
      i. Properties of light: electromagnetic spectrum, reflection, refraction, absorption, scattering, polarization, irradiance/radiance
         (1) Equations, limited to: Wien's Displacement Law ($\lambda_{max} = b/T$)*, wave equation ($c = \lambda\nu$)*, Snell's Law, inverse square law for irradiance, Stefan-Boltzmann Law
      ii. Types of sensors, limited to:
         (1) Passive: optical and thermal sensing in the ultraviolet, visible, near-infrared, shortwave infrared, and thermal infrared ranges
         (2) Active: radar backscatter, synthetic aperture radar (SAR), interferometric SAR (InSAR) at a basic interpretive level, radar altimetry, and radar-derived elevation products
            (a) Equations, limited to: Radar altimetry range*
      iii. Types of satellite orbits and their purposes, limited to: low earth, medium earth, high earth, polar/non-polar, geostationary, geosynchronous
         (1) Equations, limited to: Kepler's Third Law
      iv. Image characteristics: spatial, temporal, radiometric (limited to signal-to-noise ratio/ sensitivity), and spectral resolution
      v. Instrumentation, limited to: scanning systems, multispectral imaging systems, optical and infrared imagers, radiometers, radar altimeters, thermal infrared imagers, synthetic aperture radar (SAR) instruments, and digital elevation models
   b. Interpretation and analysis of remote sensing images and data sets (65-75% of total points), limited to the types of sensors listed in 3.a.ii., from the following satellites only: different spectral combinations from Landsat 5-9 (TM, ETM, OLI), Sentinel-1A/1B, Sentinel 2A/2B, Terra (limited to: MODIS, ASTER), Shuttle Radar Topography Mission (SRTM), ECOSTRESS, GOES. Questions will focus on the following:
      i. Fundamentals of mapping as applied to topographic maps, satellite images, aerial photographs, and other maps generated by remotely sensed data
         (1) Marginal information: location, date, scale, orientation, legend, labels, etc.
         (2) Image display and interpretation: natural color, false color, grayscale, thermal, radar, elevation, contours, classified map displays
         (3) Measurements and scaling estimates, limited to: distance between features, perimeter, area, altitude, elevation, slope/gradient

ii. Earth observation and monitoring
  (1) Physical phenomena, including but not limited to:
    (a) Absorption and scattering by aerosols and their effect on data collection
    (b) Albedo, surface temperature, reflectance, and other properties of natural and engineered materials and their uses for classifying land areas
    (c) Elevation or subsidence changes
    (d) Vegetation changes (e.g., forests, agriculture)
    (e) Geohazards: volcanoes, landslides, flooding, wildfires
    (f) Earth processes: glacial movement, fluvial processes, stream patterns
  (2) Land Cover Classification Systems
    (a) Supervised and unsupervised classification maps
    (b) National Land Cover Database (NLCD/CONUS) Land Cover Change Index
  (3) Human and environmental implications: habitat loss, land cover change, urbanization, deforestation, damage assessment and monitoring

4. **SCORING:**
  a. High Score wins.
  b. Points will be awarded for the quality and accuracy of responses.
  c. Preselected questions will be used as tiebreakers.

This event is sponsored by the IEEE Geoscience and Remote Sensing Society (GRSS).

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