PhD Topics - CSRE PhD Admissions - Autumn 2023-24			
Name	**Topic**	**Description**	**Written Test**
Prof. Biplab Banerjee	Self supervised learning in multi-modal remote sensing image analysis	The project will deal with the application of self-supervised learning to remote sensing images, which is a broadly open area.	No
Prof. Biplab Banerjee	Vision language models for remote sensing images	Explore the vision language foundation models for remote sensing images	No
Prof. Gulab Singh	Design and Development of low cost snow dielectric constant & moisture sensors		Yes
Prof. Avik Bhattacharya	Time series analysis of polarimetric SAR data for Agriculture Monitoring	Time series Synthetic Aperture Radar (SAR) data are of paramount importance as it records temporal variations of the crops at their various phenological advancements. The objective will be to analyze the multi-temporal SAR data from different modalities, viz., dual-pol, compact-pol, and fully polarimetric SAR data for various agricultural applications. It comprises developing new algorithms/novel descriptors for crop type identification, crop classification, soil moisture retrieval, and estimation of biophysical parameters for different crop types.	Yes
Prof. Avik Bhattacharya	GNSS-Reflectometry for Estimation of Geophysical Parameters	Soil moisture, snow depth and water levels are essential elements of the terrestrial water cycle and affect various hydrological, biological and agricultural processes. GNSS-Reflectometry (GNSS-R) and GNSS-IR makes use of GNSS signal reflections from the Earth's surface to estimate geophysical parameters. With the development of GNSS as a satellite microwave (L-band) technique that can penetrate through vegetation and ice, new potentials are being explored including soil moisture content, water level, wind speed, water vapour content and snow-depth estimation. GNSS-R is highly advantageous over traditional remote sensing techniques with low cost, multi-constellation and frequency data availability, high spatial and temporal coverage, space-borne and ground-based options and all-weather, near real-time availability.	Yes
Prof. Surya Durbha	Spatio-temporal data and neural cubes for large-scale geospatial analysis	Research and Development of fusion and data cube approaches using multi-Source Remote sensing and ancillary data. Further, develop Neural cubes for compact representations and predictions for aggregate queries.	No
Prof. Karthikeyan Lanka	Novel methods to improve soil moisture and vegetation characterization using passive microwave sensors	Satellite remote sensing using passive microwave sensors (radiometers) has become an important source to monitor both SM and vegetation at global scales over the past four decades. A retrieval algorithm generally involves inverting a physics-based radiative transfer model (RTM), which simulates brightness temperature as a function of soil and vegetation properties. Vegetation properties are represented in RTM by Vegetation Optical Depth (VOD). Soil moisture and VOD together have key information to assess land-atmosphere interactions and extreme events. Goal of the project is to develop high quality soil moisture and vegetation information using passive microwave sensors SMAP and SMOS. In this process, synergies between microwave and optical/thermal sensors shall be explored. The candidate will also have opportunity to explore applications of soil moisture and VOD in the areas of hydrology, ecology, and land-atmosphere interactions.	Yes
Prof. Karthikeyan Lanka	High resolution soil moisture and vegetation estimation using synergy between passive microwave, active microwave, and optical/thermal sensors	Monitoring soil moisture (SM) and vegetation is essential in agriculture water management, monitoring extreme events, and understanding land-biosphere-atmosphere interactions. Low-frequency passive microwave remote sensing (PMRS) has enabled SM and vegetation dynamics estimation at global scales. The goal of this project is estimate high resolution soil moisture and vegetation optical depth by synergistically merging brightness temperatures (TB) data from PMRS with radar and optical/thermal sensors using physics-based schemes. Candidate will have opportunity to explore physics guided machine learning algorithms in this project.	Yes
Prof. Alok Porwal	Spectral unmixing of hyperspectral data: From Laboratory images to real-world data	This research involves developing physics-based and empirical models for microscopic level spectral mixing	No