Centre of Studies in Resources Engineering Ph.D. Topics for Spring Semester (Jan. – Apr. 2023) For Enquiries, Contact: phdadmissions@csre.iitb.ac.in

Faculty Name	Topic	Details	Pre-requisites
Prof. Surya Durbha	**Sparse LiDAR data processing techniques**		
Prof. Surya Durbha	**IoT edge analytics for Urban areas**		
Prof. Biplab Benerjee	**Low shot learning for remote sensing image classification**		
Prof. Karthikeyan Lanka	**Sub-Seasonal to Seasonal Integrated Agricultural Drought Prediction over India**	Agricultural drought occurs due to a decline in soil moisture, which subsequently leads to the failure of crops. The lack of water in the soil can be attributed to a deficit in rainfall or lack of irrigation along with a greater evapotranspiration. Therefore, agricultural drought monitoring is carried out primarily by analysing the patterns of soil and vegetation along with meteorological conditions. This project deals with research problems related to drought propagation, development of novel drought indices, and sub-seasonal to seasonal (S2S) drought prediction in India. Drought prediction generally refers to the prediction of severity in terms of drought indices. The predictability of soil moisture is driven primarily by precipitation and temperature. Furthermore, the predictability of meteorological conditions is affected by large scale atmospheric circulation patterns driven by SST (Sea Surface Temperature), and, to an extent, local scale feedbacks from the land surface. Drought prediction could be carried out using statistical and dynamical models.	Candidate is required to have basic understanding about hydrology. Candidate is required to have good programming knowledge in any of the platforms such as MATLAB/R/Python etc. Some background on AI/ML is desirable.
Prof. Karthikeyan Lanka	**Monitoring Soil Moisture and Vegetation using Passive Microwave Satellite Radiometry**	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. Radiometers measure electromagnetic radiations emitted from the Earth's surface as brightness temperature. These radiations in low frequencies (< 11 GHz) are sensitive to soil and vegetation's dielectric and geometric properties. 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). Vegetation Optical Depth (VOD) depicts the total water content present in leaf and woody biomass components above the ground surface. 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.	Candidate is required to have good programming knowledge in any of the platforms such as MATLAB/R/Python etc. Some background on remote sensing (ideally microwave remote sensing) and AI/ML is desirable.
Prof. Gulab Singh	**Spaceborne Geodesy for Glacier Dynamics: uncertainty, corrections, and evaluation**		
Prof. Gulab Singh & Prof. Raaj Ramasankaran, Civil Engg.	**Integrated space geodesy for land deformation: modeling and prediction (TAP from project)**		
Prof. Gulab Singh	**Polarimetric Ground Based SAR for Snowpack study (TA through Project Category)**		