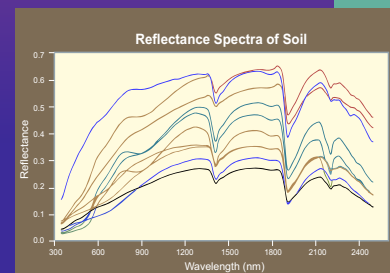




ICAR Sponsored Short Course on Soil Spectroscopy and Machine Learning for Precision Agriculture

Date : 17-26 February 2026



Organized by

Division of Remote Sensing Applications

ICAR-National Bureau of Soil Survey and Land Use Planning

Amravati Road, Nagpur-440 033

<https://icar-nbsslup.org.in/>

About the Training Program

Conventional soil analysis using wet chemistry is precise yet laborious, costly, destructive, and frequently detrimental to the environment owing to reagent usage. These constraints restrict analysis to a limited number of composite samples, leading to suboptimal spatial resolution and insufficient data for precision agriculture, environmental monitoring, and large-scale soil mapping. Given the increasing global demands for sustainable land management and food security, there exists an urgent need for rapid, economical, and non-invasive soil analysis techniques. The electromagnetic spectrum includes a variety of wavelengths, spanning from gamma rays (less than 1 nm) to radio waves (more than 1 m). In soil spectroscopy, the visible (VIS, 400-700 nm), near-infrared (NIR, 700-2500 nm), and mid-infrared (MIR, 2500-25000 nm) spectral regions are most useful. When radiation interacts with soil, it is absorbed, transmitted, or reflected depending on the soil's chemical and physical properties. Diffuse reflectance spectroscopy quantifies the radiation reflected from the soil surface. Distinct chemical bonds (e.g., O-H, C-H, N-H, Fe-O) absorb energy at certain wavelengths, producing unique spectral fingerprints. These signatures encapsulate information about soil organic matter, mineralogy, texture, moisture, carbonates, and other properties. So, Vis-NIR and MIR spectroscopy have emerged as effective alternatives to wet chemistry, offering quick, non-destructive analysis that may concurrently predict multiple soil parameters from a single spectral scan. Multivariate calibration methods, including partial least squares regression (PLSR), principal component regression (PCR), and machine learning approaches (e.g., random forest, neural networks), have been employed to correlate spectral data with soil parameters.

This ten-day training will include interactive lectures, demonstrations, assignments, and live coding sessions led by experienced faculty and domain experts. It aims to develop the capability of participants to conduct advanced soil spectral data analysis, enabling them to contribute to data driven decision-making in soil health monitoring, land resource inventory, and agricultural planning.

About ICAR-NBSS&LUP

ICAR-National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP) was established in the year 1976. It undertakes research, training, soil correlation, classification, mapping and interpretation.

Mission: To conduct and promote research in the National Agriculture Research System in the areas of Soil Survey, Pedology, Geomorphology, Remote Sensing, Geographic Information System, Cartography, Land Evaluation and Land Use Planning.

Mandate

- To conduct soil survey and mapping of the soils of the country to promote scientific and optimal land use programmes in collaboration with relevant institutions and agencies.
- To conduct and promote research in the National Agricultural Research System in the areas of pedology, soil survey, remote sensing applications, land degradation, land evaluation and land use planning.
- To impart training and education to create awareness on soil and land resources and their state of health.

Course Content

- Introduction to Remote Sensing, GIS, open-source tools, hyperspectral instruments, and satellite data availability
- Basics of R programming, statistical concepts, and essential R packages for soil spectroscopy
- R-based remote sensing data analysis, digital image processing, and hyperspectral remote sensing fundamentals
- Soil spectral data preprocessing, visualization, and development of soil spectral libraries
- Introduction to machine learning algorithms and their application in soil spectroscopy
- Spectral modelling of soil properties using R and ML techniques
- Model performance assessment, validation, and interpretation
- Concepts and methods of Digital Soil Mapping (DSM)
- Spatial prediction of soil properties using hyperspectral images and GIS tools
- Field visits for soil profile studies, sampling strategies, daily hands-on practice, and problem-solving sessions

Eligibility Criteria

The applicant should be working in a position not below the rank of Scientist/Assistant Professor/Subject Matter Specialists or Equivalent with specialization of Agriculture, Horticulture, Agricultural Engineering, Animal/Fisheries Sciences and allied disciplines (ICAR, SAUs, KVK, Universities/Institutes, etc). A maximum of 25 participants will be selected for this course based on their qualification, experience, area of work and as per ICAR guidelines.

Travelling Allowance, Boarding and Lodging

All the participants will be reimbursed to and fro travel fare for the journey to ICAR-NBSS&LUP, Nagpur by the shortest route. The payment will be restricted to maximum of AC-II tier train fare/ bus fare (on producing proof of travel). Tickets must be booked from IRCTC or Balmer & Lawrie or Ashoka Travels for reimbursement. Boarding and lodging will be provided free of cost to the outside participants at the institute's guest house on sharing basis and local participants will be provided lunch, inter session tea and course materials only free of cost. Participants are requested not to bring family members with them, as the Institute has limited guest house facilities. No DA will be paid to the participants.

How to Apply

- There is no course fee. However, registration fee of Rs 50/- should be paid using the following QR Code :



Interested candidate may send the scanned copies of their applications along with a brief CV duly signed by the candidates and their higher authority to nirmalnbss@gmail.com . Participants are suggested to bring their personal laptop for practical. For any query write mail to the Course Director.

Important Dates

Receipt of applications: January 15, 2025

Intimation to selected candidates: January 23, 2026

Confirmation by selected candidates: January 31, 2026

Location, Weather Conditions and How to Reach

Nagpur has a pleasant weather and is well connected by road, rail, and air. The ICAR-NBSS&LUP is located at Amravati Road, Nagpur - 440 033 and is 15.9 km from Nagpur Airport, 7 km away from Nagpur railway station. The temperature during the training period will be around 25-30°C (day) and 15-20°C (night). Buses and pre-paid taxi can be availed from railway station and Airport to reach to the guest house/Institute.

Contact

Chief Patron

Dr. N. G. Patil, Director
ICAR-National Bureau of Soil Survey and Land Use Planning
Amravati Road, Nagpur-440 033

Patron

Dr. G.P. Obi Reddy, Principal Scientist & Head, Division of RSA
ICAR-National Bureau of Soil Survey and Land Use Planning
Amravati Road, Nagpur-440 033

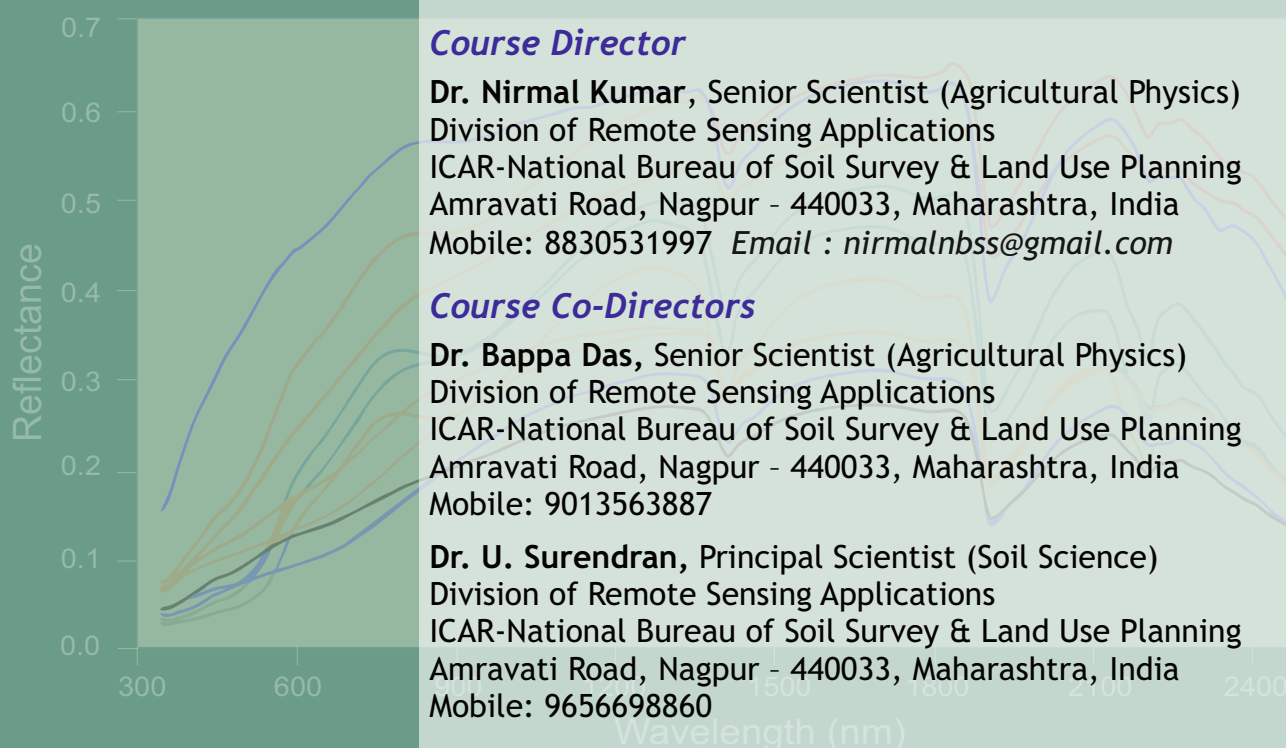
Course Director

Dr. Nirmal Kumar, Senior Scientist (Agricultural Physics)
Division of Remote Sensing Applications
ICAR-National Bureau of Soil Survey & Land Use Planning
Amravati Road, Nagpur - 440033, Maharashtra, India
Mobile: 8830531997 Email : nirmalnbss@gmail.com

Course Co-Directors

Dr. Bappa Das, Senior Scientist (Agricultural Physics)
Division of Remote Sensing Applications
ICAR-National Bureau of Soil Survey & Land Use Planning
Amravati Road, Nagpur - 440033, Maharashtra, India
Mobile: 9013563887

Dr. U. Surendran, Principal Scientist (Soil Science)
Division of Remote Sensing Applications
ICAR-National Bureau of Soil Survey & Land Use Planning
Amravati Road, Nagpur - 440033, Maharashtra, India
Mobile: 9656698860



APPLICATION FORM

Affix recent
colour
passport size
photograph

1. Full name (in block letters) :
2. Designation :
3. Present employer and address :
.....
.....
4. Address for communication :
.....
.....
5. Mobile no. with WhatsApp :
facility/email ID :
6. Permanent address :
.....
.....
7. Date of birth (DD/MM/YYYY) :
8. Gender (Male / Female / Other) :
9. Marital status (Married/Unmarried) :
10. Experience in relevant field :
11. Academic qualification :
.....

Date :

Place :

Signature of Applicant

Recommendation of the higher authority :

Signature of the higher authority with designation and seal

