

Prerequisite status: -	Unit Type: Theoretical	The number of units: 2	Name of the lesson: Principles and physics of remote sensing
Type of additional practical training: Has it <input type="checkbox"/> does not have <input checked="" type="checkbox"/> Science travel <input type="checkbox"/> Laboratory <input type="checkbox"/> Workshop <input type="checkbox"/> Seminar <input type="checkbox"/>		The number of hours: 34	Expert professor to teach: Remote Sensing
Goals: Acquaintance with the basics of remote sensing, including the physics of remote sensing, various platforms, and sensors			
Headlines 1- Definition, history, and applications of remote sensing 2- Light and its interaction with the environment (The nature of light, Planck's laws, Vian, Stefan-Boltzmann, particle theory, The interaction of light with different surfaces, The combination of light and aerosol, Laws governing reflection, diffraction, failure, absorption, polarization, Defining the absorption and emission spectrum of materials, Radar waves, radio waves) 3- Mechanics of satellites (Definition of satellite orbits, speed of orbits, energy of orbits, The angles of the surfaces of the orbits, The rules governing the placement of satellites in orbit, correcting the satellites' path, Error caused by circuit disturbances, Polar satellites, and Earth track) 4- Physics of remote sensing sensors (Classification of types of gauges, detectors, physics that governs sensors, noise, and smell, The effect of noise on the collected data. The power of spatial, radiometric, temporal, and spectral separation of sensors, The output of sensors, pixel definition, and sensor coverage in different widths) 5- Spectroscopy (Spectroscopy tools, history of spectroscopy, application of spectroscopy in remote sensing, Factors affecting spectroscopy, types of spectroscopy, how to interpret the spectrum and determine the important absorption points, spectroscopy of minerals, spectroscopy of soils, spectroscopy of plants, spectroscopy of water environments, terrestrial and satellite spectroscopy, Using terrestrial spectrum for satellite data calibration) 6- Communication satellites (How to collect and send sensor data to the ground station, Estimating the amount of information in different gauges, how ground stations work, How to relay information by interface satellites) 7- How to interpret information (Visual interpretation and information extraction from images in different bands. Algorithms to extract information from satellite images. How to determine the study site and how to order images, How to optimally choose the right platform and measuring device for research work, respecting the cost aspect, Volume of information, and quality of data) 8- Technology and applications of drones (History of drones, Classification of types of drones in terms of construction, Operational flight height and maximum payload, small drones (Micro Aerial Vehicles: MAVs) and their applications, Hardware and software specifications of drones, UAV guidance systems, UAV positioning methods using internal satellites and GPS, Types of energy sources in the movement of drones (solar cells, fossil fuel, batteries and hybrid systems) types of sensors (electrooptical, radio), familiarization with the software used in processing aerial images, How to design a flight project, reference ground for aerial images and orthophotography, The characteristics of point clouds obtained from aerial images of drones, UAV data classification methods, integration of			

images from several UAVs, Some applications of drones in natural resource management (Wildlife, forests, meadows, lakes and wetlands) The role of drones in urban environments (such as traffic control), non-urban (agriculture, horticulture), Using UAVs in Decision Support Systems (DSS)

Reference

- 1- Rangzan, Kazem. , Mostafa Kabulizadeh, Donya Karimi, Azim Saberi, 2019 Applied Spectroscopy of Minerals, Shahid Chamran University Publications, Ahvaz
- 2- Mobasheri Mohammad Reza, 2007, Fundamentals of Remote Sensing Physics and Satellite Technology, Khaje Nasiruddin Tusi University Publications
- 3- Elachi Charles, Jakob J. van Zyl, 2006, Introduction To The Physics and Techniques of Remote Sensing, Wiley-Interscience.
- 4- Jensen John R., 2015, Remote Sensing of the Environment,
- 5- Clark, R.N., and Roush, T.L., (1984): Reflectance spectroscopy: Quantitative analysis techniques for remote sensing applications, J. Geophys. Res., 89: 6329- 6340.
- 6- Gupta, R. P. (2002): Remote sensing geology. Second edition, Springer.
- 7- Gupta R.P. (2018): Imaging Spectroscopy. In: Remote Sensing Geology. Springer, Berlin, Heidelberg
- 8- Dekoulis, G. (2018). *Drones-Applications*. London: IntechOpen.
- 9- Fahlstrom, P. & Gleason, T. (2012). *Introduction to UAV systems*. Chichester: Wiley.
- 10- Valavanis, K. & Vachtsevanos, G. (2015). *Handbook of unmanned aerial vehicles*. Dordrecht: Springer